#	Date taken	Taken by
165		
162	FMC } for Reproduction	4 Oct 56.
163	FMC }	

161

Vsesoiuznoe gosudarstvennoe ob'edinenie po bor'be s vrediteliami i bolezniami v sel'skom i lesnom khoziaistve. Sektor Sluzhby ucheta. Instruktsii dlia nabliudatel'nykh puñktov. no. 1-2, 5-6, 13. 1932-33. 464.9 V96

Translated in part from the Russian by R. G. Dembo

TABLE OF CONTENTS No. 2

TABLE OF CONTENTS No. 6

TABLE OF CONTENTS No. 13

END

4 June 1951

Translated from the Russian by
R. G. Dembo

162

Fridrikhson, G. A.
The virus diseases of crop plants
in Saratov region. Zashch. Rast. 14:
105-107. 1937. 421 P942

Virus diseases of agricultural plants in the Saratov region have recently attracted the attention of phytopathologists. Not until 1931 did we notice in the oblast the first indication of their spreading on plants like tomatoes and squash (Vertogradova).

The systematic work of the Saratov fruit-vegetable zone station on the disclosing of the viruses of fruit-berries and vegetables, which started in 1935, found them in large variety, widespreading and damaging; therefore, this group of diseases requires our special attention.

The present work aims to give a short survey of the viruses in this oblast'.

The virus diseases of the potato. The potato is a plant which suffers considerably from viruses. The average percentage of infestation reaches sometimes up to 50-75.

Among the diseases of this group, the wrinkled mosaic is always found, the percentage of which often reaches 30 and even more. The disease manifests itself often in a complicated form - the form of striped mosaic. According to the data at Petrovsk, selection station of Saratov Oblast', the loss of crops due to wrinkled mosaic is shown as follows:

Table 1

Species	Losses of Crops in %		
	1929	1930	1931
Early rose	57	61	58.0
Kriuger	49	61	20.5

Among other diseases, there are in Saratov oblast' "krapchatost", rolling of leaves, Witchès Broom and "aukuba". The latter three are found quite rarely.

Witches' Brooms is mostly spread in the Volga region. The number of stems during this disease reaches up to 100; tubers are of the size of a pea or are missing entirely.

Diseases of tomatoes. The tomato in Saratov oblast' is infested by mosaic and by "stolbur". The percentage of mosaic infestation reaches up to 100, stolbur - up to 50.

Damage caused by stolbur is extremely great, since the diseased plants usually carry single fruits or do not have any fruits. "Stolbur" appears more frequently upon saliferous soil, and also under the conditions with insufficient moisture in the ground. In Western parts of the oblast', it is found rarely and in a less harmful manner.

In 1936 "strik" upon tomato plants has been disclosed. A close observation indicated a wide spreading of this virus. Thus, out of 14 raions, it has been disclosed in 10. Yet the percentage of its infestation is insignificant. An early infestation by "strik" (the first and second week in July) causes the loss of plants. The Mexican tomato suffers considerably from "strik". The incubation period is 15 to 17 days.

During the bushiness of the top (the diagnosis is conditional), the plant is depressed; it gives a small amount of sprouts. The lower leaves of normal size are slightly rolled up. With young growing parts of the stem, the development of the internode is delayed and the leaves are drawn together. The additional top sprouts have a tendency toward an intensified development; the leaves have crushed lobules; their fibers are underdeveloped, hence the leaf blade wrinkles and, besides, rolls along the central fiber.

Diseases of squash. On melon, squash and turnip, the cucumber mosaic is widely spread in Saratov oblast'.

Diseases of fruit-berry crops and of grapes. Out of this group of plants, and underskin spottiness on the apple tree has been observed, on grapes - striped chlorose, quite similar to the infectious chlorose. Yet its etiology has not been determined up to date.

Upon raspberry, the goffering of leaves and Witch's Broom have been disclosed in the state farm "Sadvintrest" of Bek raion. The observation made in the state farm indicated a wide spread of diseases on the plantation of 60 hectares.

During the goffering, the leaves are of dark green color, rolled upwards. The tissue between the nerves are swollen upwards. On the stems, there are elongated spots from brown to balck. There are on the plantations some fields where the infestation equals 100 o/o, in some others, it fluctuates in the boundaries between 10 to 20 o/o.

During the disease of Witch's Broom, the plants have up to 200 and even more thin stems, in comparison to sound plants. The height of the plant is 3-4 times smaller than the normal one. The leaves are crushed and have many necrotic spots. They fall prematurely, the diseased plants do not bear any fruits; on the field, they are unevenly distributed; there are rows where the infestation reached 22 o/o. "Usanka" is the species which suffers the most.

In summing up the above, it might be said that the Saratov oblast' is a raion of wide spreading of various virus diseases of agricultural plants and requires the development of scientific research in this direction.

END OF ARTICLE

4 June 1951

Stepanov, K. M.
The prognosis of plant diseases.
Zashch. Rast. 15: 3-14. 1937.
421 P 942

Translated from the Russian
by R. G. Dembo

163

The practical significance of forecasting plant diseases is beyond any doubt; it is important to foresee in advance the timing of infestation and of manifestation of the diseases and also the intensity of their seasonal development, because this helps in precise planning of the amount of measures in controlling them and in fixing the timing of carrying out the control.

The forecast of plant diseases is determined mainly in the following manner; 1) by the availability of the regular dependency of the development of the diseases upon the factors of environment, and 2) the possibility of foreseeing the latter. The history of epiphytism and daily practice indicate that the principal factors, which regulate the development of plant diseases is the economic activity of man and the weather. The role of man is varied in this respect and sums up to the following: 1) the development of the plant-host; 2) the spreading of infections (with seeds, with planting material, etc.); 3) the active elimination of the infection (immunization by chemical and thermic means, derooting, etc.); 4) cultivation of immune species and 5) initiating such conditions of the environment, under which the immunity of plants is manifested in the highest degree, and the viability of the parasite, in the lowest degree (agrotechnique).

The first four requirements may be met comparatively easily, and the success of the forecast of plant diseases practically depends little on them. More complicated is the control of the environment. It is true that man is able to change the environment by measures such as the time of sowing, the density of grass, cultivation of the soil, the location of the field, etc. Nevertheless, it is closely related to the weather which cannot be controlled by man. Therefore, for the forecast of plant diseases, it is most important to know the regularity of its development in relation to the weather. The role of the latter is manifested not only directly (increase and decrease of the aggressiveness and of virulence of the parasite and the distribution of the infection), but indirectly as well through the plant-host (increase and decrease of its immunity). Hence, the forecast of the weather is in this respect of great significance.

Investigations carried out in the field of plant disease forecasting should lead practically to the fixing of definite meteorological indexes of the developments of the diseases. It seems there can be no universal index; there must be various indexes according to the stage of development of the parasite and of the disease. In connection with this, the investigations on forecasting and also the practical approach should follow specific bioschemes which reflect those states of the parasite and of the disease and those factors, the regular relationship with which, would ensure the formulation of the forecast. These schemes should vary depending on the form of the forecast (short and long forecasts).

The short forecast is that of timing of separate infestations and of manifestations of the disease. This forecast is made many times during the season and is significant mainly for warning of the time of spraying or of pollination. As a classic example of such a prognosis is the warning of the spraying of vine against mildew, of the apple tree against scab, and of the potato against phytophthora.

The scheme in drawing 1 should be used as the basis of a short forecast.

The starting point in the formulation of a shortforecast is the primary infection (its sources, schedule and conditions); it determines the original manifestation of the disease, then the secondary infection, etc. Although the general phenological acclimatization of the parasite to the plant-host has been disclosed, the separate timing of infection, including also the first infections, vary usually in relation to the conditions of moisture which fluctuate in various seasons. In cases when those instances are sufficiently examined, it is relatively easy to foresee the first infection or, at least, the origin of the disease. The scab of the apple tree has been taken as an example. It is known that the primary infection of the apple tree by scab occurs mainly with the assistance of ascospores. As long as the discarding is possible only during a great amount of moisture, mainly during rain, and this is necessary also for the infection, the short forecast of rain is in some degree also the forecast of the primary infection of the apple tree by scab, under the conditions of definite temperature with the availability of mature spores and the organs of the apple tree which are susceptible to infestation. On this is based the famous North American method of spraying (Stepanov, 1934).

This is related to a considerable degree to mildew of grapes and to phytophthora of potatoes. As is known, the source of the primary infection of mildew are the oospores. As indexes of primary infection are: 1) the availability on the soil of oospores capable for sprouting; 2) temperature higher than 11° C; 3) abundant rain causing the sprouting of oospores and simultaneously moistening the lower surface of young leaves, and 4) availability of small leaves susceptible to infestation; their size should be not less than 2-3 cm (Mueller and Sleumer, 1934).

Stepanov, K. M.

In practice, the warning for the first spraying of the vine against mildew starts when, with the availability of the given conditions, the average day temperature of the air reaches 13° C. and higher (Prints, 1937). Based on the forecast of the first abundant rain, when suitable temperature has established itself and the vine is covered with foliage, then one could make the forecast of the first infection according to the example of the apple tree scab and carry out the first protective spraying accordingly. Unfortunately, in the practice of controlling vine mildew, the primary infection is fixed post factum and the first spraying is carried out only at the end of the first incubation period, that is, before the secondary infection.

More complicated is the problem of the first infection of haulm of potato by phytophthora. This is explained by the fact that up to now the conditions of the primary infection were not examined completely. The indexes of the primary infection known under the name of Holland signs of weather were determined empirically. According to these signs, the spread of phytophthora could be expected during 15 days after the following weather conditions took place: 1) dew observed at least during four night hours; 2) minimum of temperature higher than 10° C; 3) the average cloudiness of the following day higher than 0.8, and 4) measurable rain during the following 24 hours. Here, as in the case of vine mildew, the primary infection is difficult to foresee. These "signs" seemed to be correct also in England, where some additions were introduced. Investigations which were carried out by VIZRA (ВИЗРА) All Union Institute of Plant Protection) indicated the practical significance of these signs, but they also indicated the necessity of some additional changes (Naumova, 1934, 1935, 1936). Thus, the problem concerning the day of the primary infection of the potato by phytophthora remains still unsolved. Therefore, in some cases, it is considerably more difficult to make the forecast of the primary appearance of the disease than in the case of the apple scab and vine mildew.

In those cases when the instances of primary infection are still not clear, it is quite impossible to make the forecast of the primary infection and the primary manifestation of the disease. This will require the introduction of two first most reliable protective sprayings.

The forecast of the primary and then of the secondary infections will be more precise according to the familiarity with the conditions under which they originate. Besides, this will assist in contsolling the correctness of the forecast, since, after having studied the conditions of infection, one may determine post factum the day of infestation according to the weather. This, as has been indicated, helps in determining the possible time of the appearance of disease and of infestation.

1. initial infection

2. second infection

5. Dispersion of the infection

6. viability of the infection

4. the appearance of the infection   3. incubation

Indexes: 1-the initial infection and 2-second infection[moisture, temperature (light)]; 3-incubation [temperature, moisture(light)]; 4-appearance of the infection [temperature, moisture9light)]; 5-dispersion of infection[aerial streams(moisture)]; 6-viability of the infection[moisture, temperature (light)] origin

The conditions of the sprouting of spores of fungi which are the most abundantly spread sources of infection furnish quite a clear idea of the conditions of infection. Nevertheless, the sprouting of spores, especially under those conditions under which laboratory experiments are made, are not identical with the instance of infection. The latter is the starting moment for the struggle between the sprouting of the spore and the plant host, which resists the penetration of the parasite whose strength varies according to weather conditions. Therefore, the real notion about the moment of infection furnishes the knowledge of those conditions under which the latter occurs.

Moisture and temperature are here of preeminent significance. Drop-liquid moisture is required for the infection of plants by the majority of fungi. The latter is able to be stored on plants after rain, dew, etc. for various periods, depending on the temperature, wind, etc. Therefore, even under favorable conditions of temperature, the infestation might not occur if the water drops dry fast enough, as a definite length of time, depending on temperature, is required for the formation of a sprout and of its penetration, which occurs in most cases. It has been indicated, for instance, that the infestation of the apple tree by ascospores Venturia inaequalis occurs with 6° after 13-18 hours, with 9° after 9-11 hours, with 20-24° after 4-6 hours, and so forth (Keitt and Jones, 1926).

Similar indications are available in relation to vine mildew, crown rust of oats and other diseases. Thus, the infection of oats by ecydio- and uredospores Puccinia coronifera under the conditions of moisture of leaves occurs under 4.5-5.5° after 24 hours, with 6° after 2- hours, with 7-12° after 10 hours, with 17-27° after 5 hours and so forth (Marland, 1937).

The fact that the duration of storage of water drops is of great significance for the infestation is seen in the peculiarities of development of vine mildew in Kirovabad raion (Azerbaidzhan) and in Ialta (Crimea). With almost the same amount of rainfall during the period of May9July in both raion(s)(in Ialta there is even more rainfall) in Ialta mildew rarely develops, but in Kirovabad raion it occurs yearly. The absence of mildew in Ialta is explained by winds which blow at night and cause the leaves to dry; in Kirovabad, there are no winds during the night (Prints, 1936). Therefore, it is quite natural that for determining the days of the primary and secondary infections by similar diseases is important to consider the duration of moistening of the plant. In this respect, the registration of dew is most important. Therefore, it is necessary to examine the speed of the infestation during various temperatures.

When the availability of drop-liquid moisture is not required for infestation (for instnace, the infestation by conydia of mildew fungi), it is necessary to register the duration of those conditions under which the infection occurs in general (the correspondence of temperature with the definite relative moisture of air, soil. In each case, there should be a corresponding approach, resulting from ecological peculiarities of the parasite and of the disease caused by it.

For a successful completion of infestation, light is significant in some cases,(for instance, against mildew (Hammarlund, 1925). Therefore, the registration of conditions necessary for infestation during corresponding periods of the day is required.

The moment of fixing the day of infestation helps to determine in advance the end of incubation which causes the manifestation of infectional origin and the next infestation. The basic dominating factor is the dependency of the duration of the incubation period on temperature. As the classic example in this respect, we may consider the scheme of Miuller, which has been used in our country widely and successfully in controlling vine mildew, the origin of which was started by the work of Prints (1924).

A practical application of the Miuller scheme is specified, when, based on meteorological data of many years standing, the graphs of the incubation period are worked out. The graphs assist in determining quickly, according to any day of infestation for the given locality, the possible day of the manifestation of mildew; then, this preliminarily determined day is specified by means of daily registration in percentage of the amount of passage of incubation period based on factual average daily temperature, and as the result of systematic summary of the percentage, the amount of the incubation from the moment of infestation is determined. The nearest percentage to 100 is the warning of an approaching manifestation of the disease (Shatskii, 1935).

The Miuller scheme has been worked out in application to more or less constant temperatures and is most correct for them. Thus, it has been indicated that with fluctuating temperatures the incubation period occurs 1 or 2 days slower than under constant temperature, especially when the latter is critical (Müller and Sleumer, 1934). Therefore, during the registration of the length of the incubation period, it is necessary to register daily fluctuations of temperature, especially in raions where the latter are high (Olgarzhevskii, 1933). In respect to mildew of grapes, there are indications that the average temperature during half a day, namely of the average day and night temperatures, furnishes a more correct idea of the length of the incubation period for 24 hours as a whole than the average 24 hour temperature does. Thereby, it has been indicated that the sum of percentage of incubation during a series of days from the moment of incubation, equal to 90-93, indicates the readiness of the fungus to bear spores (Popov, 1936).

In this respect, the nomographs of incubation periods, worked out on the basis of three elements of temperature, minimal, average, and maximal, are an important step forward. Such nomographs were first worked out for Phytophthora of potatoes, brown and yellow rust of wheat (Naumova, 1935, 1937). According to the scheme of Miuller, it is possible to work out from these nomagraphs charts of incubation periods for each locality and then count according to factual temperature the size of daily incubation passage.

The aerial moisture should be of less significance than the temperature during incubation, because the parasite is at this time sufficiently well protected by the tissue of the plant-host. During the experiments of Naumova, carried out under natural fluctuations of moisture (1934, 1935), there was no correlation between the length of incubation period of phytophthora of potatoes and of brown rust of wheat and relative moisture of air. Yet the absence of correlation could be observed, possibly, only within certain limits. Thus, for Puccinia Glumarum, the reverse correlation between the duration of incubation period and of minimal relative moisture of air has been recorded (Naumova 1937). For vine mildew, it has been indicated that permanent 100 % Moisture of air speeds up the incubation period sometimes by 1-3 days (Müller and Sleumer, 1934).

For some diseases, the influence of light is important during the incubation period. Thus, during the infestation of wheat by uredospores Puccinia graminis, the incubation period is extended if the plants remain under poor light (Melander, 1935). This fact may have practical significance for work carried out under conservatory conditions during the winter.

Finally, the age immunity of the plant-host plays some role. It has been determined for Puccinia coronifera that during the infestation of oats in the phase of sprouts, the incubation period appeared to be shorter, on the average, by 1-2 days, than during the infestation in the phase of blooming (Marland, 1937).

During the forecast of alternate infection, it is imperative to register the conditions of appearance of the infectional origin (for instance, spores) upon the surface of the infested organ, its disappearance and viability. Temperature is a very important factor during the spore bearing. The speed of the formation of spores depends on temperature after the manifestation of the first signs of the disease, oily or chloride spots, and so forth. In some cases, moisture is important; thus, the formation of conidia bearers Plasmopara viticola occurs at the end of incubation under the temperature not lower than 12-13° C. and with the moisture of leaves, whereby the moisture of the air should not be less than 80 o/o (Müller and Sleumer, 1934). The formation of conidial film Phytophthora infestans has been noticed only upon leaves which were moistened during 5-6 hours (Naumova, 1935).

The diffusion of the infectional origin (primarily of fungi spores) depends mainly on air streams. It is possible to say for most of the diseases, that the infestation starts to diffuse immediately after its manifestation. With some species, the diffusion of the infection is related to moisture, for instance, of conidia Fusciadium dentriticum, the conidia of the species Gloesporium, and so forth. (Stepanov, 1935). This has to be taken into consideration during the fixing of usual infestation.

Stepanov, K. M.

Of great importance is the viability of the infection, namely, the period during which it may preserve its virulence. Often there are cases when the infection, for instance, the bearing of fungi spores, is manifested, but the conditions necessary for infection are absent at the given moment. Viable spores, for instance, uredospores of rust, chlamydospores of smut, etc., are able to endure relatively easily unfavorable conditions and with the return of favorable conditions are able to infest plants. There are also ephemeral bearing of spores, for instance, basidiospores of rust, conidia of perennial spores, biability of which could be measured only by hours. All this depends, of course, on conditions which should be studied as to the viability of infectional origin in each separate case.

In conclusion, we must say a few words concerning secondary infections. Basically, they require the same conditions as for the primary infection (moisture, temperature). Nevertheless, as long as secondary infections are usually caused by so called summer spores, and the primary, by winter spores, there is between them some kind of a difference. The differences pertain not only to the infection itself, but also to its diffusion. Thus, the ascospores Venturia inaequalis which cause the original infection of apple trees, diffuse mainly during a rain and therefore, rains are of greatest significance in primary infections. The diffusion of conidia of this fungus is due to moistening, that is why the secondary infections occur also during dews. For the primary infection of vine mildew, as has been indicated before, abundant rain is necessary (in the vineyard should be little pools), while the secondary infection requires only abundant dew. Such differences are often observed in relation to the sprouting of spores of the infection itself. All this has to be studied and recorded accordingly.

These are the basic instances which are fundamental during the carrying out of a short forecast of plant diseases. Every stage of the development of the pest and of diseases requires separate indexes (drawing 1). The scheme given here is quite clear, and the carrying out of the short forecast is easy. The most difficult point is the weather forecast, expecially of temperature for a series of days which determine the length of the incubation period. Technical difficulties represent also the registration of time of preservation of raindrops and dew, which, in many cases, is quite decisive during the fixing of the infestation day.

Basically, it is necessary to utilize data of many years and then introduce the corresponding corrections concerning the factual temperatures. For the definition of a long incubation period, one may make use, in some degree, of the average temperature for 3-4 days after the fixation of the infestation day, as has been applied for vine mildew and phytophthora of potato. Popov (1936) assumes that the climatological method could be used during the working out of a system of forecast of temperature. It consists of the fact that for the given climatic zone, the normal movement of temperature during the passage of rainfall, is clarified first; then, having the forecast of the distribution of the days with rainfall, which are based on the normal movement of temperature, the probable temperature for the following days and the assumed end of the incubation period are determined.

For a full picture, it is necessary to mention some possibility of carrying out a short forecast based on the famous bioclimatic law of Hopkins. According to this law, the time of some periodical natural phenomenon, under other equal conditons, is delayed, generally, for 4 days for each degree of latitude(from South to North), for each five degrees of longitude (from West to East) and for each 125 meters of altitude at the beginning of summer and in the reverse order, at the end of summer and in fall. Based on this law, Tehon (1927), compared the factual time of the appearance of Puccinia triticina during a series of years along various points of the State of Illinois (North America) with theoretically fixed time, and as a result, their concurrence has always been noticed. Therefore, taking into consideration the time of the appearance of the disease somewhere in the South, it is possible to determine with a certain probability the time of its appearance in other points in the North, if only the coordinates of all points are known.

Of course, such a method might have some significance during the forecast of the appearance of the disease in some locality as a whole and not for small fields, because the microclimatic conditions play an important role in this respect.

Considerably more complicate now is the problem of a long forecast for a comparatively longer period of the possible intensity of the development of the disease during the season. Its practical significance is the fact that based on it, the amount of measures in the control of plant diseasescould be determined in advance. The long forecast is made once, but with the advance of the critical period, it undergoes certain clarifications based on factual weather conditions. The forecast would be in principle not difficult, if only the weather could be foreseen for a long time in advance, not during the next season, but during specific periods which are critical for infestations and the ensuing development of the disease. The success of a long time forecast depends still more on the long forecast of the weather.

The scheme given in drawing 2 should serve as the basis of the long forecast.

Stepanov, K. M.

Drawing 2

1. Infection of the preceding season

2. Wintering of supply of infestation

4. Importation of a disease from afar

3. The frequency of the original infection

Figure 2. The scheme of research along the long forecast
Indexes: 1-infestation of the preceding season [moisture, temperature]; 2-wintering [low temperature, melting, moistening, the depth of snow cover]; 3-the frequency of the initial infestations [moisure, temperature]; 4-importation of infection from afar [aerial streams].

During a long forecast, the amount of infection which has been formed in the preceding season is of some significance. For some diseases, the original infection of which is preserved in living organisms of plants which are not exposed to the unfavorable influence of winter, the intensity of infestation of the preceding season is of great significance. As much as the latter depends on weather conditions during a critical period, it is evident that a long forecast of the conditions of weather during infestation would be made with some probability. The dusty smut of wheat might be taken as an example. As a result of experiments, Tarke (1931) determined the following: during the resistance of plants at the time of infestation at 56-85 o/o of aerial moisture and 19.4-29.0°C., the manifestation of dustry smut for the next year reached 93.7 o/o of smut spikes, and with the resistance of the plants under 11-30 o/o of moisture and 21-33°C (approximately), the manifestation of smut reached 21.9 o/o. In another experiment with 45-92 o/o of moisture and 14.4-31;5°, the manifestation of smut reached 68.3 o/o of smut spikes, while with 13-48 o/o of moisture and 11.7-35.0° during the infestation, the manifestation of the disease reached 14.4 o/o. Investigations carried out in this direction by VIZR (ВИЗР) indicate a similar relationship (Tropova, 1937).

As to those diseases whose infectional origin winters in the living tissue of plant-host or in plant waste, whereby they experience unfavorable influence of winter, the carrying out of a long forecast, for instance, in the fall, according to the supply of infestation which took place in many cases, is absolutely impossible.

In those cases when mass loss of infestation takes place, as it appears according to the scheme of weather indexes, it seems a long forecast might be carried out. A similar attempt is known. Thus, as a result of statistical data, Stevens (1934) fixes some indexes according to which it is possible to carry out a forecast of the intensity of development of bacterial wilting of corn caused by Aplanobacter Stewarti. The indexes are the sum of an average monthly temperature for three winter months (December-February). According to the index, higher than 100° Fahrenheit, an intensive development of wilting could be expected, and, according to the index, lower than 90°, its very poor development can be expected. The experiment in some degree proved the significance of these indexes of the forecast of the development of wilting in various states. (Stevens, 1934, 1935, 1936). It is possible to expect such relationship with other diseases, including also those whose infectional origin winters in the living tissue of the plant-host, for instance, uredomycelia of rust on winter crops. The work carried out on the wintering of rust indicates the possibility of mass loss of infection under certain conditions.

In case of favorable wintering of infectional origin, it is impossible to fix a long forecast if the weather during specific critical periods of the coming season remains unknown.

In separate cases, probably an extended forecast according to summer weather conditions is possible. During that period, the infectional origin which causes the first infestation of plants in spring of the following year is preserved. Some assumptions were made that the development of curliness of leaves of peach trees, caused by Exoascus deformant, depends in some degree on summer temperature. Such assumption is the result of the fact determined by Mix that the conidial crops of fungus perish completely after a few days under 3-° C. This explains the absence of the disease in Texas and in the Southwest part of North America (Heald, 1933). The observations of Mehta(1931) in the hills of Himalaya, who found that starting with the hot dry weather, the rust in the valleys dies completely, and then, after the unfavorable conditions are over, it again appears, due to the diffusion of spores from the plateau, point out that unfavorable summer conditions in some cases cause loss of infection.

A more reliable long forecast could be made according to weather conditions under which the spring reappearance of the disease occurs. The spring weather might cause a breach between the parasite and the plant-host during the reappearance of the activity of the infectional origin which winters in the living tissue of the plant or in plant waste. In such cases, a slight development of the disease or its entire absence could be expected. In other cases, on the contrary, the spring weather could increase the activity of the parasite, and, on the other hand, extend the period of the most susceptibility of the plant-host and thus increase the activity of the parasite and, on the other hand, considerably extend the intensity of the infections. Then, consequently, the intensive development of the disease could be expected. As examples might serve dust and hard smut, fusarioses of wheat sprouts and apple tree scab.

It has been ascertained that the sprouting of wheat grains which were infested by dust smut under low temperature considerably decreases its manifestation. Thus, in the experiments of Gassner and Kirchoff (1934) the grain, which sprouts under the temperature of + 5° C., yield plants which had 7.4 o/o of smut spikes, while the sprouting under + 20° C. yielded 11.6 o/o of smut. In another experiment, grain which aprouted under 1-0° yielded afterwards 2.4 o/o, and those sprouted under + 20° yielded 12.7 o/o of smut. The work of VIZR (ВИЗР) indicated that the sprouting of grain under + 1° C. yielded the spreading of dust smut, equal to o.4 o/o of smut spikes, while the grain sprouting under + 5° and over (up to 30°) yielded the spreading of smut in the limits of 2.1-4.1 o/o (Tropova, 1937). It is evident that it is impossible to make the forecast of the presumed appearance of smut based on the temperature of the soil during the period of grain sprouts.

A similar forecast on the temperature of the soil could possibly be made also in relation to fusariosa of wheat sprouts; when during the period of sprouting, the decrease of soil temperature occurred then the decrease of the disease manifestation could not be expected (Tupenevich,1936). For the hard smut of wheat reverse relationship takes place; in this case under the decrease of temperature during the time of grain sprouts, an increased manifestation of the disease could be expected (Muraviev, 1928).

It has been known that a humid, cool spring causes an intensive development of the scab of the apple tree. Bremer (1924) discovered for Proskau (Germany), that the intensity of seasonal development of scab is in direct relation to rainfall for a decade previous to the blooming of the apple tree. The working out of statistical data in various raion(s) of the Union carried out in our country indicated that the universal index (the sum of rainfall during some period) for all raion(s), evidently, could not be determined. The relation between the seasonal development of scab and the definite kind of weather during the month of apple blossoming has been determined, namely, it became clear that the more the weather is humid and cooler during that period, the more intensive development of scab may occur, and, inversely, the warmer and more dry the weather is during the same period, the lower development of scab is probable (Stepanov, 1936). With more precise weather indexes, especially after registering generally the summer weather, a similar extended forecast could be made. Its significance is preserved as long as the amount of further measures on spraying could be clarified.

Finally, during an extended forecast, it is necessary to take into consideration the possibility of importation of infection by air streams from aside. The work of VIZR (Stepanov, 1935), carried out in this direction, indicated that the opinion concerning the possibility of simultaneous distant drifting of the infection by aerial streams from afar in such degree to cause local epiphytism was exaggerated, especially in cases of diffusion of infection by aerial streams in latitude sense (from West to East). Yet under certain conditions, the drifting should be taken into consideration, especially when it occurs in altitude direction (from South to North), since during this motion, a considerable delay in the time of plant development is observed. This may cause a successive drift of the infection, if not a simultaneous one, from the location where the original infection already accumulated to another location. Such a circumstance, of course, may change the picture of development of the disease in raion(s) where the local infections are absent, due to certain reasons, or died at the beginning of the season.

This is, generally, the situation with an extended forecast of plant diseases. And in this case, of course, the forecast could be significant only for an entire field, and not for separate fields, since the conditions of microclimate and the distribution of the nests of infection are important for the intensity of the seasonal development of the disease. The work of VIZR (ВИЗР)All Union Institute for Plant Protection indicated a great difference in the dynamics of development of brown rust of wheat on different ecological stations within the borders of one field. Thus, about July 27, the average amount of uredopustule reached 480 in low places, and 39 on elevations. Similar differences were determined also for other fields (Fedorinchik,1937). This, of course, takes place also in cases of development of other diseases.

In general, in the field of forecasting plant diseases, expecially in relation to an extended forecast, deep, serious investigations are necessary. Clear, detailed indexes concerning separate stages of the disease are imperative.

A serious study of the plant host itself is necessary, because the influence of the environment, especially of meteorological factors, is noticeable not only on the virulence of the parasite, but also and in larger degree, on the resistance of the plant, and on the final result of the development of the disease. The problem of species, the stages of plant development and of the parasite should be discussed in further work. The conformities in the development of the diseases in realtion to the factors of the environment are significant,not only for the forecast; they assist in determining the frequency of epiphytism in the past and in the future for each locality separately (raioning), and also assist in forecasting the possibility of development of the disease in those raion(s) where it is absent at the given moment (questions of quarantine). Finally, it is necessary to mark their undoubted significance for agrotechniques: by selecting the corresponding time of sowing, distributing the plants in a specific way during crop rotation, applying a corresponding tillage, etc., we are able to create such conditions which will be detrimental to the development of the disease.

END OF ARTICLE

5 June 1951

Vostochno-Sibirskaia kraevaia stantsiia zashchity rastenii. Trudy po zashchite rastenii Vostochnoi Sibiri. No. 25. 1935-37.
464.9
V.93

Trans. 164: Plant Protection

Translated in part from Russian by R. G. Dombo

164

TABLE OF CONTENTS NO. 2

TABLE OF CONTENTS NO. 5

END

5 June 1951

Muralov, A. I.
Not to be backward from life.
Zashch. Rast. 4: 5-8. 1935.
421 P942

Translated from the Russian by
S. N. Monson

166

TO KEEP IN STEP WITH LIFE*

Socialist agriculture opened a wealth of possibilities before agricultural science, leading to daring creative thought and innovations.

The Party and Government created conditions for fruitful work at scientific research institutes, laboratories, experiment stations, of a type not to be found in any capitalist country. With certain accomplishments to its credit, agricultural science is nevertheless lagging behind actual needs at state and collective farm levels and does not fulfill the tasks placed upon it by our country.

The Party and comrade Stalin established an enormous army consisting of collective farm brigade leaders, chairmen of collective farms, tractor operators, drivers of combine machinery, mechanics, machinists. This army of organizers of a vast agriculture is equipped with first-class machinery. It energetically and persistently engages in a struggle with nature, conquering it step by step. These peasants, only recently backward and today transformed into collective farmers, are fighting to double and triple agricultural outputs and to establish better standards of living for themselves; they are greedily stretching out for scientific knowledge and technical means, placing ever greater demands.

But one may as well admit that these demands frequently remain unfulfilled. Literally dozens of examples may be cited pointing to the lagging of agricultural science behind contemporary requirements, indicative of the gulf existing between theory and practice. Thus instructions of the XVI Party Convention concerning the redistribution of agricultural crops

* Translation of Title by SNM.

and varieties in the country remain still unsolved. This despite the fact that they represent a major problem. It is true that attempts were made to solve them. The All-Union Institute of Plant Protection has recently published series of papers dealing with this particular problem ("Plant Industry in USSR", for instance). The Lenin Academy of Agricultural Sciences has, however, not developed or confirmed the plan for a redistribution of agricultural crops. Stalin's statement made at the XVII Party Convention concerning the confusion in the seed industry did not evoke the necessary response among scientific institutions. Major shortcomings in the organization of scientific research with respect to selection and seed growing have not yet been overcome. Nor has the development of individual technical crops within the framework of established crop rotations been given adequate attention. To preserve sowings and increase yields in many regions, especially in the Volga (Zavolzhie) region (left bank of Volga river in its central and lower course), irrigation techniques for cereal crops are of particular significance. The problem has been studied for about three years and sufficient data been accumulated to pass pertinent information on to industry. Scientific observations were, however, never generalized, nor were practical instructions developed for introduction into Soviet practice. Theoretical ideas concerning irrigation have not gone beyond the walls of laboratories and limited experimental observations. This despite the fact that the Party and comrade Stalin directed the attention of the entire country to this problem of greatest economic significance. Sprinkling methods have equally been studied for several years, but agriculture has not obtained practical assistance from science on the technique of sprinkling.

Muralov, A. I.

Or let us take such "individual" problems as the control of the damage caused to cultivated plants, (unfavorable conditions for wintering, for instance). These have not been studied to date. We still lack adequate methods ensuring plant protection from pests and diseases. Collective and state farms develop their methods and measures of pest control of agricultural plants, but scientific institutions do not generalize the information and thus do not aid farmers.

It is sufficient to refer to a subject such as the control of smut and rust, practically overlooked by the All-Union Institute of Plant Protection (VIZRa). This despite the fact that triple yields may not be achieved without decisive control of pests and plant diseases.

Would it be that our agricultural science lacks observation and investigation? No, quite the contrary. Scientific workers are simply afraid to go into the fields of collective and state farms, to put up experiments on a wide scale, test their own observations. Unexplained timidity, fear of risks are, moreover, observed not alone at the Institute of Plant Protection. Similar situations prevail at institutes dealing with cotton crops. As a rule, scientific experiments on fertilizers, technical methods concerning soil science are conducted at "vegetative" cottages. People engaged in this work do not visualize the wide spaces of collective and state farms while they experiment at their "vegetative" pavillions. Collective farms are therefore frequently ahead of institutions in scientific tests. Narkomzem of USSR suggested to take experimentation out into the fields. One hopes this measure will reduce timid fears among many scientific workers and bring them in closer touch with agricultural production. We at present are harvesting 25 million poods of cotton annually and shall have to attain 37 to 43 million poods in 1937. It will be difficult to reach this amount without the aid of many scientific methods. Science has been lagging in this instance.

The problem of determining the maximal efficacy in the use of chemical fertilizers has not been solved. Agricultural practices and the use of fertilizers on cotton crops have not been studied to date.

Nor is the situation any better with regard to flax, sugar beet and other technical crops. Specifically, scientific institutes have not succeeded in producing new sugar beet varieties of high sugar content.

Science faces concrete and therefore operative tasks in the field of plant industry, which are claimed by the nation and expected by millions of collective farmers. The answer lies in practical action, concentration of effort on the most important points, closer contact between agricultural science and industry.

The Odessa Institute of Selection and Genetics shows a concrete example of operative work, of close contact with practical collective farm labor. Thousands of collective farms and tens of thousands of farmers know today about vernalization and are familiar with its practical procedure.

It is essential to reach a stage where every scientific discovery and scientific paper will receive wide acknowledgement among millions of collective farmers. The ground is prepared for it. We possess a wealth of creative forces at state and collective farms. These creative forces turn for direction towards leaders in agricultural science. We must learn how to use and organize these forces.

We know of the role played by the machine in agricultural production.

Muralov, A. I.

We also know that this role will steadily be increased. The Party and and Government have equipped and continue to provide agriculture with first-class machinery. One cannot deny that scientific research institutions have studied the subject. But this was done on a limited scale, inadequately and unsatisfactorily. Hundreds of thousands of machines were delivered to agriculture but utilization of the machine tractor remains on a low level. The nation has approximately 350.000 tractors. Scientific institutions have, however, failed to develop even general methods concerning the use of tractors and the cultivation of soil. The technical care of field equipment, its repair, the operation of tractor units, the establishment of types of repair shops, and the organization of technical repair shops, these problems have all remained unsolved to date.

At present our tractor plants (Cheliabinsk) put out powerful machines. But trailer equipment of corresponding power is lacking. Science has done hardly anything in this direction. And we need these trailer (parts) attachments since they would speed the operation of tractors immensely.

The Party and Government attribute enormous significance to the control of losses in yields. Science has long ago been given the assignment to develop new types of harvesting machinery, particularly for moist regions. This order has remained unfulfilled. So has the order for mechanized equipment for grain drying. Mechanized harvesting of technical crops is still practiced on a low level. In the field of mechanized atriculture there is, as noted, a vast field open to scientific endeavor. The Government, state and collective farms have placed their orders and agricultural science should feel honored in fulfilling these obligations.

Muralov, A. I.

Of no lesser importance are tasks in the field of husbandry. It suffices to enumerate the individual problems demanding theoretical development in order to appreciate the gigantic effort demanded of science.

Sterility among domestic animals, breeding of young livestock, the organization of pedigree cattle production, the adjustment of imported breeds of cattle in the USSR, etc. These problems of major economic importance have not been studied yet by science, except in individual instances. Nor have selection-pedigree cross breeding and multi-fertility (?) found their reflection in scientific studies. The situation may be explained primarily by the fact that our scientific institutions dealing with livestock are not engaged in centralized, systematic, planned work which would permit them to consider all the demands placed by agriculture, but are proceeding in different directions, without any connection between them.

Full grown development in the field of husbandry may not be achieved without raising veterinary science upon a necessary height. This field is in an equally neglected state. One may frankly admit that all scientific institutions, headed by the All-Union Veterinary Institute, are not equipped to solve practical problems on the control of diseases of livestock. In the field of veterinary science, as in no other, the lack of people of superior knowledge is severely felt.

The tasks confronting agricultural science are vast, varied and honorable indeed. But the demands placed before it by socialist agriculture, Party, Government and the country are equally great. So far agricultural science has not succeeded in meeting these demands. We suffer from a vast abyss between theory and practice. The gulf between science and collective farm practices, the lagging behind actuality are at the roots of this abyss. Lack of definite leadership in science, the seclusion of institutions and their personnel behind four walls, the clinging to "gruppovshchina" [domination of individual, secluded groups in any field of science], and ineffective self-criticism all interfere with progress. One may add that Narkomzem organizations on location have also not supported agricultural science and been of little aid to scientific workers in tying theory to practice and establishing closer contact with agricultural production. All this has hindered the process of agriculture from moving into broader paths. The Lenin All-Union Academy of Agricultural Sciences, called upon to direct the work of agricultural institutions, has not succeeded in this task. A sturdy collective of highly qualified scientific personnel is now grouped around the Academy. Active members of the Academy have been confirmed. Their united efforts should cause a radical transformation in the activity of the Academy. Every academician, every scientific worker should now become an organizer in the field of science, lead the thousands of people employed in scientific institutions, united under the Academy, and organize and lead the millions of collective farmers-experimenters. If we accept the words of comrade Stalin "Cadres determine all", if we learn how to organize these cadres, to build scientific work on a planned foundation, we shall master the tasks placed before us by the Party, Government and our entire practical agriculture.

Recently the first wide session of the Lenin Academy of Agricultural Sciences convened, attended by the foremost scientists of our country. It commented on the unsatisfactory performance of the Academy and pointed to ways of improving it. Scientific agricultural workers should unite in their efforts to achieve high yields, raise soil fertility, increase the affluence of collective farms, effect the proper organization of procedures in scientific research, establish supervision of main institutes over the entire network of scientific research units, down to the level of cottage laboratories.

Agricultural science should serve socialist agriculture.

End of Article

* * * * * * * *

(Publ. in "Izvestia" No. 151,
June 29, 1935.)

Miscellaneous.

Aviation in agriculture. In Sel'skokhoziaist-vennaia entsiklopediia. Ed. 3. vol. 1. Moscow, 1949. p 5-7. 30.1 Se42 Ed.3

Translated from the Russian by S. N. Monson

Aviation in agriculture has a wide and varied application.

PEST AND DISEASE CONTROL OF PLANTS. Attempts were made to use airplanes in many countries of Western Europe for the control of pests of agricultural plants but nowhere did aviation find wide and practical application; airplanes engaged in the work were few in number. Following the first experimental attempts made in the USSR in 1925, agricultural aviation became firmly established. In 1940 pest control was applied on an area of 1.1 million hectares with the aid of airplanes. During the period 1931 to 1940, pest control exercised by air, covered an area close to 5-1/2 million hectares.

The Law of the Five-year plan, concerning the reconstruction and development of the domestic economy of the USSR between 1946 and 1950, states: "To develop special mass aviation for the control of pests in agriculture and forests, as well as for the benefit of air photography."

Airplanes were equally used to control larvae of malaria mosquitoes by treatment with poisons (chiefly Paris green) of infested reservoirs (wells); (between 1931 and 1940 control of mosquito larvae was applied on an area of 20 million hectares and in the last pre-war years, close to 3-1/2 million hectares were treated annually. The technique of using airplanes in pest and disease control of plants consists in having a low flying airplane (5 to 10 m. above ground) broadcast various poisonous substances over infested plots and wells. Air-dusters dust with powderlike poisons and poisoned attractants. Air-sprayers spray liquid poisons (concentrated solutions, emulsions and pure mineral oils). See ill. 1, 2, and 3 on p. 5. Chart showing expenditure of poisons by the aviation method applied in the control of pests and diseases of agricultural plants printed on pages 5 and 6 (Omitted temporarily).

The advantages of the aviation method over above ground methods consist in its high productive capacity, limited labor consumption, accessibility in treating infested plots, and reduced costs.

The capacity (output) of an airplane per hour is: when dusting locusts-up to 200 hectares; using attractants-about 60 hectares; when spraying-about 40 hectares; when dusting to control cotton and orchard pests-about 60 hectares, when spraying-about 5 to 20 hectares; when dusting pests of sugar beets - about 80 Hectares; when spraying-about 20 to 30 hectares; when dusting mosquito larvae-about 300 hectares; spraying-about 40 hectares.

BROADCASTING FERTILIZERS. A special feature in broadcasting fertilizers is their dispersal during the period of the plant's vegetation. The most prevalent treatment by air consists in additional feedings with nitrogenous fertilizers of rice and flax plantings, as well as principal grain crops.

The advantages in using the aviation method to introduce fertilizers to these crops, as compared to above ground methods, consists in : 1. greater regularity in dispersion; 2. opportunity to broadcast fertilizers during periods and on plots which are difficult or impossible to reach otherwise, (i.e. rice plantings on inundated fields, winter wheat in early spring, etc.) The standard norms for introducing mineral fertilizers by broadcasting equal those of above ground methods.

CONTROL OF STEPPE FIRES. It is possible to establish a shelter belt in front of a line of fire by spraying with liquid solutions of caustic soda and calcium chloride (20 and 30 o/o in dosages of 0.3 liter per 1 m^2) and of potash (20 and 30 o/o in dosages of 0.5 liter per 1 m^2). The boundary belt of a widtth of 3 to 4 m. is completely effective for controlling steppe fires. Airplanes are equally used to control forest fires. The advantage of the avia-chemical method lies in the fact that the location of the fire is discovered and extinguished earlier.

TRANSFER OF AGRICULTURAL FREIGHT, demanding speedy delivery, (preparations for artificial insemination of livestock, live fish and caviar, the latter to organize fish industries in new basins, etc.)

AIR-PHOTOGRAPHY OF LOCATIONS and individual objects for various agricultural and forestry needs (see air-photo-geodesy).

ORGANIZATION IN THE USE OF AIRPLANES] For the purpose of conducting the above work in agriculture and forests in republic, krai and oblast centers, special aviation detachments were organized which have become part of the system of the Civilian Air Fleet (Aeroflot)[ ]. These detachments perform work by contract which is concluded with agricultural organizations and determines the dates and volume of the work, gives estimates and specifies the quality of the procedure.

End of Article

Reference: Korotkikh, G. Use of airplanes in the control of agricultural and forest pests. M.-L 1932

Korotkikh, G. and Starostin, S. Avia-chemical protection of yields. M. 1945

Lavrov, L. and Davii, K. Organization of pest control in agriculture by avia-chemical method. M. 1939

Popov, S. Review of development of designs of agricultural aviation equipment. M. 1945

Funikov, A. Use of airplane in the control of steppe and peat (turf) fires. M. 1939

Funikov, A. Instruction for using avia-chemical method in forest pest control. M. 1941

Funikov, A. Zbornik of instructions on work of special applications. M. 1941

6 June 1951

Virus diseases. In Selskokhoziaistvennaia Entsiklopediia. Ed. 3, vol. 1. Moscow, 1949. p. 328-329. 30.1 Se42 Ed.3

Translated from the Russian by S. N. Monson

Virus diseases of plants are specific infectious diseases, of which the inducers are special so-called virus albumen, or viruses capable to reproduce themselves in living cells of susceptible plants (the organism viruses do not accumulate, nor do they show activity). On the basis of this characteristic and by chemical composition, viruses resemble structural albumen of protoplasms from which they undoubtedly originate. Viruses contain nucleinic acid and belong to nucleoprotides. The possibility of new formations of viruses, as the result of pathological reconstruction of structural albumen under unfavorable conditions of an external environment, is not precluded. Viruses are rather easily segregated from the plants they affect and can be cleaned of admixtures with the aid of physical-chemical methods. Pure preparations of difference viruses have been obtained in the form of crystals. Separate particles of viruses can be seen through an electronic microscope and may be photographed. The size of these particles varies from tens to hundreds of millimicrons. The particles of the majority of viruses pass through small-porous bacterial filters which retain microbes. Hence, the frequently used name of filterable viruses. Some viruses are very resistant, such as the mosaic tobacco virus which may remain in dry leaves for dozens of years without losing its viability.

Virus diseases affect flowering plants of wild and cultivated flora of a multitude of families. Among cultivated plants particularly affected by the virus diseases are: tobacco, tomatoes, potatoes, peppers, eggplants, sugar beet, cotton, beans, soya, cucumbers, wheat and oats. Ferns, club moss (Lycopodium), horsetail (Equisetum), and conifers are not affected by virus diseases.

By their external and physiological characteristics, virus diseases are divided into two groups: mosaic and yellows("zheltukha"). Mosaic is evidenced in the injury of chlorophyll tissues of leaves, light colored parts of leaves alternating with dark colored; degeneration and dropping of plastids is also observed. The photosynthesis is reduced and the cells of leaves contain a smaller amount of carbohydrates. Disfigurement of foliage is frequent and in some instances the affected tissues die off. To this group of virus diseases belong: tobacco mosaic, sugar beet mosaic, crinkled mosaic, striped mosaic, mosaic of potatoes, raspberries, plums, cherries,etc. Ragwort is characterised by general chlorosis of leaves and severe depression of plant growth; the conducting activity of "sieve-like tubes" is interfered with, which leads to the filling of leaves with carbohydrates, despite the fact that photosynthesis is also reduced. Cases of "shortknotting" ("korotkouzlia"), of accelerated tillering and branching are frequent; occasionally flowers get green. To Yellows belong: "zakuklivanie" of oats, "stolbur" of Solanaceae, leaf roll of potatoes, "kurchavost", top curl of sugar beets, leaf curl of cotton, mosaic of winter wheat.

During vegetative propagation of plants affected by virus diseases, the virus is frequently transferred to the progeny. Thus, potato tubers affected by crinkled mosaic are infected by the virus, as a rule, and when growing produce mosaic plants. The "stolbur" virus of Solanaceae is poorly retained in potato tubers and cases of its transmittance to tubers are very infrequent, although the physiological after-effect of "stolbur" is considerable (appearing in the form of threadlike shoots).

The geographical distribution of virus diseases is connected with virus circulation in nature. Viruses that are highly infectious are cosmopolitan. To these belong, for instance, the inducers of tobacco and cucumber mosaic. These viruses are easily transmitted by juice inoculation; this is explained by their established resistance to external factors. Other viruses, destroyed during their extraction from the cells, are not transmitted by the above method. Their distribution depends upon insects of one kind or another, acting as hosts. These viruses preserve their viability in the insect organism. The area of such viruses is limited and depends upon the area of the insect-host. Thus "stolbur" of Solanaceae prevails only in southern regions, in habitats of the insect cicada (Hyalesthes obsoletus) while it is not found in central and northern regions. Occasionally, the spread of virus diseases depends upon the area of the plant on which the virus settles for the winter (i.e. mosaic virus of winter wheat); most frequently, virus diseases are spread by sucking insects, thus aphids transmit crinkled mosaic of potatoes and mosaic of cucumbers; the dark cicada is vector to "zakuklivanie" of oats. These insects get infected by viruses which settled on diseased weeds, the principal focus of viruses in nature. Some virus diseases are easily transmitted by contact; specifically, the most infectious tobacco viruses are transmitted by the juice of plants and in thinning or the "breaking" of tobacco plants, etc. Viruses of "zakuklivanie" and "stolbur" are not transmitted by inoculation. Some virus diseases, such as bean mosaic, "pestritsa" of tobacco (variegation?), is transmitted by seeds. The virus of tobacco mosaic is present in the epidermis of seeds of mosaic-infected tomato plants and may during their growth infect the shoots. The virus of the infectious chlorosis of pepper is transmitted by pollen; a large number of virus diseases prevailing abroad are not found in the USSR.

Sukhov, K.

The development of virus diseases depends to a large extent upon the surrounding environment. Thus, streak of tomatoes causing parts of tissues on stems, leaves and fruits to die, is stimulated by high temperatures and appears only underground ("zakryty grunt"). The tobacco plant obtained from the crossing of N. glutinosa X N. tabacum forms small local necroses when infected by the mosaic virus which "block" the virus and in this manner protect the plant from complete destruction. Growth of this hybrid plant at high temperatures neutralizes the protective reaction and causes it to perish, following the general infection of the stem.

Virus diseases cause large damage to agriculture. They reduce yields and spoil their quality. When infected by stolbur, tomato yields, though approaching normal, are unfit for consumption becuase of a wooden tastelessness of the fruit. Grain yield is radically reduced by "zakuklivanie" and so is its germination. Stolbur (or "wet montar") of tobacco interferes with the drying of leaves and causes them to rot. On many varieties of peppers and eggplants, stolbur produces foliage and fruit wilt. Tobacco mosaic reduces yields 20 to 40 o/o.

The diagnostic of virus diseases is based on the totality of external symptoms and indicators of pathological physiology. Diagnostics is helped in cases when the virus produces characteristic intra-cellular inclusions well observed through the microscope. These ("vkluichenia"), inclusions have been ascribed to tobacco mosaic, "zakuklivanie" of cereals and several other virus diseases. Virus infection of some plant—indicators also serves as diagnosis. Viruses possess antigenic qualities which permit their diagnosis by serological method. A decisive influence in controlling virus disease is occasionally achieved by special methods of agricultural techniques.

sukhov, K.

Thus summer plantings of potatoes reduce the spread of virus diseases, while simultaneously eliminating the physiological causes of degeneration. Potato plantings in the south made after July 10 are completely free from stolbur. Dusting of tomato plants, peppers and eggplants with the preparation DDT during the period of migration of the insect-vector reduces the spread of stolbur two or three times. Similar results are produced by dense plantings of these crops. Heating of dried tobacco seeds (moisture 6 o/o) for one hour at a temperature of 85-90° reduces the transmittance of the virus "pestritsa" (variegation ?) by two. Of considerable significance in the control of virus diseases is the production of resistant plant varieties. The above mentioned tobacco hybrid, possessing superior smoking qualities, is resistant to mosaic. Varieties of tree tomatoes are relatively resistant to stolbur. The potato varieties "Lorkh" and "Korehevskii" are highly resistant to crinkled mosaic. For plants of vegetative propagation, the selection of healthy seed stock is of decisive importance in controlling virus diseases. Regular destruction of weeds also contributes to reduction in virus diseases.

END OF ARTICLE

Bibliography: Virus diseases of plants and methods for controlling them. Moscow-Leningrad, Academy of Science of USSR, 1941 (Work of Conferences on virus diseases of plants) Moscow, 4-July 7, 194-

Kuprevich, V. Physiology of diseased plants in connection with general problems of parasitism. Moscow-Leningrad, 1947

Ryzhkov, V. Phytopathogenic viruses, M.-L., 1946

Sukhov, K. Viruses of plants and insects-hosts, M.-L., 1942

Khudyna, I. Virus diseases of tobacco in the USSR. Krasnodar, 1936.

6 June 1951

Buchheim, A.
Plant diseases. In Selskokhoziaistvennaia Entsiklopediia. Ed. 3. vol. 1. Moscow, 1949. p. 219-222. 30.1 Se42 Ed.3

Translated from the Russian by S. N. Monson

Plant diseases are disruptions in life functions of plants connected with infringements upon the normal structure of their cells and tissues, and produced by parasitic organisms, unfavorable environmental conditions, mechanical injuries, and other reasons. Plant diseases reduce the quality and amount of yields of agricultural plants or lead to their complete destruction.

It is customary to divide plant diseases into non-parasitic, parasitic, and VIRUS DISEASES. Non-parasitic diseases of plants are caused by conditions of external environment: unfavorable meteorological factors, excessive or insufficient moisture of the soil, deficient mineral nutrition, etc. These causes frequently lead to the disruption of the metabolism of plants and produce such diseases as chlorosis and gummosis. To non-parasitic diseases of plants belong also changes that occur in plant tissues as a result of mechanical injuries.

Parasitic plant diseases are caused by parasites of flowering plants, parasitic fungi, ray fungi (actinomyces), i.e. potato scab, bacteria, nematodes, aphids, and other parasites. Parasitic and virus diseases of plants occasionally assume a mass character and cover large areas. Among non-parasitic diseases, those produced as a result of variations in temperature are widely spread. At low temperatures (below 0°), the tissues of individual parts of a plant or an entire plant may freeze. Delicate flowers of large moisture content, young, growing runners, unfolding leaves, are particularly susceptible to low temperatures. In freezing, because of the intra-cellular formation and the resulting water deficiency in the cell plasma and its mechanical contraction, cell colloids congeal and the plasma "dies". Extremely high temperatures, accompanied by considerable dryness of soil and air, may produce disease symptoms in plants, so-called "zakhvat" of cereals. Drastic variations in temperature may cause serious injuries to plants, such as scald and frost injury to woody plants. Frost injury (splits in trunks and branches of trees) is the result of irregular contraction of different layers of wood cellulose during a sudden severe frost. Frost injuries and other disturbances of (all) tissues of branches and trunks lead frequently to canker growth. Plants react to the deficiency or abundance of any elements of mineral nutrition in the soil. For instance, when iron is present in the soil in non-soluble condition, as is the case under an over abundant content of calcium carbonate or in instances of iron deficiency, plants develop chlorosis. Symptoms are yellowing of leaves, especially of young runners. Chlorosis is in some cases determined by the alkaline reaction of the cellular fluid or may develop as a result of virus infection. Diseases may also be caused by the lack of boron, manganese, copper and other micro-elements in the soil.

Among parasitic flowering plants ("poviliki"), dodder, [Cuscuta europaea] on clover and flax and ("zarazikha"), broom rape, [Orobanche] on sunflowers, hemp, tobacco, etc. cause major damage. They are practically devoid of chlorophyll and feed exclusively at the expense of the plant-host. Some plant semi-parasites, though containing chlorophyll and absorbing hydrogen from carbon acid in the air, feed on plant-hosts, depriving them of water and salts dissolved in it. Among semi-parasites "omela", [Viscum album] injuries particularly apple trees and less frequently pear trees.

Among the principal inducers of infectious plant diseases are parasitic and non-parasitic fungi. Fungous plant diseases, i.e. rust and smut of cereals, phytophthora of potatoes, fusarium of cereals and other plants are spread by spores carried by wind or rain. Seeds of agricultural plants infected by fungi within or contaminated by spores, packing (tare) and agricultural equipment, also serve as transmitters of infection.

Some fungi plant diseases, such as the majority of potato diseases, are transmitted through seed stock. "Gribnitsa", mycelium or the spores of some parasitic fungi are preserved in the soil in viable condition. By penetrating into the root or "root collar" of a healthy plant [Pythium DeBaryanum Hesse] they produce injury (i.e. fusarium of cereals, flax, diseases of seedlings of various legumes). Club root of cabbage, for instance, is also spread through soil. Different ways are known in which a parasitic fungus penetrates into plant cells. Spores grow, develop in a drop of water or in moist air and produce hyphae ("gifa") which may penetrate into the plant through the pollen aperature and other openings of the vegetative tissue, as well as through the cellular wall of the epidermis of the plant-host. Fungi multiply within the plant and spread primarily intracellularly.

Any fungus is an inducer of disease and affects definite species of plants. This adjustment to plant-hosts may be limited (affecting only one or several plant species) or large (affecting many plant species, occasionally entire genera or even families). The adjustment of rust fungi to plant-hosts has been particularly well established.

Externally plant diseases are distinguished by different symptoms and characterized by a certain type of injury.

Fungi produce localized diseases, apparent in separate small parts of the plant, or general diseases which encompass the entire plant. Among localized infections are: spottiness, pistules and fungi films ("nalet")....

As an example, spottiness may appear in spots on pear tree leaves. Genuine or pseudo-mildew [Erysiphe communis Grev. f. fagopyris or Botrytis cinerea Pers.] produce film ("nalet"). Whenever above-ground organisms (branches, foliage, fruits) are covered by black, smoky film, this condition is referred to as "Chern'", [Cladosporium]. This disease is observed primarily on shrubs and trees, specifically citrus plants [Aithaloderma colchicum, Woronich]. Occasionally a localized infection may acquire the shape of more or less deep ulcers on various parts of plants (anthracnosis), the rims of sores being frequently colored.

Localized infection is also observed in the form of brightly colored spots (fungus "burn" of foliage of plums), while in some instances growth of tissue is noted, club root of cabbage; "karmashki", [Exoascus pruni Sadeb], and potato canker. Living and dead vegetative tissue containing an abundance of moisture ~~is~~ are frequently affected by rot.

Among the most vivid examples of general infection are diseases of wilt caused by fungi, bacteria or viruses which penetrate into the vascular system of plants. Another example of general infection is the so-called diffuse infection causes by some rust fungi. It appears when the fungus penetrates into the point of growth and is distributed throughout the plant.

Intense development of plant diseases caused by parasitic fungi and bacteria depends to a large extent upon the environment affecting the plant and the inducer of the disease. The condition of the plant changes under an environment and along with this changes its susceptibility to disease. Thus sugar beets are affected more easily by "serdtsevinnaia gnil'", caused by the fungus Phoma betae, [Phoma Cetae, Frank] when boron is lacking in the soil. Under an abundance of hydrogen fertilizer, cereals are more susceptible to infection by rust, while potassium phosphate fertilizers are known to increase the resistance of cereals to this disease. The influence an environment exerts upon the inducer of disease stems from the fact that it contributes to or interferes with the development of either favorable or unfavorable conditions, detrimental to the formation of spores, their growth, the penetration of the inducer into the organism of the plant-host. Thus rainy or warm weather at the beginning of the vegetative period of the grape vine (up to the end of its bloom), contribute to the development of mildew; the same weather conditions during definite stages of development of plant-hosts contribute to rust of cereals and phytophthora of potatoes. By changing conditions of the external environment, i.e. applying agricultural techniques, it is always possible to increase the resistance of plants to diseases. Soviet scientists have developed methods to protect plants from diseases and thus have stimulated yields. To these methods belong vernalization, summer plantings of potatoes, growing and application of healthy certified seed stock in planting, etc.

The degree of injury caused by parasitic fungi and bacteria, aside from the destruction of the individual parts of the plant (spikes by smut), is also evident in changes in the metabolism of affected plants. Assimilation is changed, breathing is accelerated and so is evaporation. Thus wilt upsets the supply of water (and soluble salt contained in it) for plant organisms. Some parasitic fungi exude in addition elements poisonous to plants. Many fungi diseases spread by air (rust, mildew) over large areas which increases during the vegetative period. Diseases caused by parasitic fungi lead to enormous losses in yields. Thus, in the period from 1916 to 1926 the loss in wheat from rust, Puccinia graminis f. tritici, ~~ddn~~ in twelve states of the USA, located around the basin of the Mississippi River, amounted to close to 21 million ...

Potato losses from disease are equally large, as are losses in flax and other crops. Between 1894 and 1926 there were 11 outbreaks of most severe phytophtora in the central belt of European Russia which caused enormous losses in potato crops. If the average loss in potatoes from various diseases is estimated at approximately 10 percent, in years of epiphite outbreaks losses amount to 50 percent and more. Potato canker, caused by the fungus inducer Synthytrium endobioticum, affects all non-resistant potato varieties. By causing deformities in growth and tuber rot during the period of the plant's development, the inducer of canker also infects the soil for a long time. Potato canker is widely spread in Western Europe; it was carried in by German occupation forces during the war years into many regions. Improved agricultural techniques and the application of mass measures in disease control have drastically reduced losses in the USSR, which should, nevertheless, not cause us to relax our determination to eliminate the disease completely.

Methods for controlling plant diseases are divided into prophylactic measures, destined to prevent disease, i.e. protection of plants from diseases, and destructive measures. To prophylactic measures of control belong primarily agricultural methods, among which the most important are: 1. application of proper agricultural techniques which take into consideration biological and varietal peculiaries, characteristics of plants and those of inducers of plant diseases. 2. Proper crop rotation,(i.e. during repeated plantings of flax some disease-bearing fungi accumulate in the soil causing so-called "l'no-utomlenie", ("flax tiredness")), which points to the desirability of avoiding frequent planting of flax and the return of this crop every 7 to 8 years. 3. Proper distribution of crops under a crop rotation system; to control brown rust of summer wheat the fields should not closely adjoin those planted with winter wheat; brown ruse of foliage frequently winters on winter wheat and is likely to cause early and severe infection of summer wheat when this is planted next to winter wheat. 4. To observe proper periods in planting in order to control the spread of plant disease (early plantings of oats and summer wheat are less frequently affected by rust). In an area of abundant moisture wheat matured earlier in favorable weather, which reduces the threat of infection by fusarium. Planting in close periods is very important for controlling rye ergot. In this case all blooming of rye takes place at the same time, preventing disease from spreading. 5. Vernalization of seeds of cereal crops and pre-sowing vernalization of potato tubers contribute to the more rapid development of these crops, as a result of which they manage to complete their vegetative growth before the diseases (rust and phytophtora) get well established. 6. Timely and speedy harvesting. Delay in harvesting of cereal crops leads to accelerated growth of saprophyte fungi on stalks of cereals in areas of abundant moisture (blackening of stalks caused by fungi of the genus Cladosporium) and Fusarium. 7. Destruction of focuses of infection, i.e. barberry and buckthorn [Rhamnus cathartica], upon which the intermediary stage of rust fungi develops. 8. Disking of stubble with successive deep plowing is of major importance in the control of rust of cereals since it destroys spores of rust along with stubble residues. 9. Removal from the fields of post-harvest residues are particularly important in the control of diseases of sunflowers, flax, cotton, legumes, and some agricultural plants. 10. Fertilization reacts favorably upon plants, increasing their resistance to many diseases. 11. Quarantine measures. In addition to preventive measures

Buchheim, A.

directed to control plant diseases, the introduction of varieties resistant against diseases into agricultural practice is of considerable importance. Soviet selectors have produced varieties of wheat resistant to brown rust of foliage and varieties of potatoes resistant to phytophthora.

Plant resistance to any parasite is not permanent throughout the period of its development. Sometimes plants are more severely infected when young and grow resistant when mature. In other instances the picture is reversed. These peculiarities of plants and plant varieties were considered in plant disease control, as they were in producing varieties resistant to disease.

Among direct (destructive) methods of control, conducted for the direct destruction of inducers of plant diseases and the protection of growing organisms from infection by parasitic fungi, chemical methods are of major importance. They consist in spraying and dusting of plants with compounds (fungicides) poisonous to parasitic fungi, and treating plantings, seed stock and soil with disinfectants. Among these physical methods of control the thermic reaction applied for the disinfection of seed stock and soil is of primary significance.

See also articles on plant diseases: [Orabanche]; club root of cabbage [Cuscuta europaea], canker, ergot, phytophthora, fusaium.

End of Article

* * * * * * * *

Literature: Briantsev B., and Dobrozrakova, T. "Plant Protection from Pests and Diseases", 2nd ed. M.-L. 1948.

Efimov, A. "Handbook on application of poisons in the control of pests and diseases of agricultural plants", 3rd ed. M. 1948.

"Plant Protection" Zborniki, M. NIZR, 1935 - 1941, (beg. 1940 they appear under the title "Vestnik of Plant Protection");

Buchheim, A.

Kuprevich, V. "Physiology of diseased plants in connection with general problems of parasitism". M.-L. 1947.

Kursanov, L. "Micology," 2nd ed. M. 1940.

Hanumov, N. "Diseases of agricultural plants," M.-L. 1940.

" "Handbook on the control of pests and diseases of agricultural Crops." 6th ed. M. 1948.

" "Zbornik of work of All-Union Institute of Plant Protection"(VIZR), issue 1-M. 1948

" "Spravochnik (reference book) of an agronomist on Plant Protection." edited by N. A. Naumov and V. N. Shchegolev. M.-L.1948.

* * * * * *

Nikitin.
Agroforest-melioration. In Sel'skokhoziaistvennaia Entsiklopediia. Ed. 3, vol. 1. Moscow, 1949. p.77-78. 30.1 Se42 Ed.3

Translated from the Russian
by S. N. Monson

Agro-forest melioration is a system of forestry measures directed towards the improvement of steppe climate, the elimination of the threat of drought and dry winds, ("sukhovei"), the protection of soil from erosion and blowing off. In the grass-field agricultural system agro-forest melioration serves the purpose of increasing soil fertility, the creation of better conditions for plant growth and the production of large and resistant yields.

Agro-forest melioration is based on properties of the forest and their influence upon the surrounding environment. Forests temper climates, condense vapors of the air, transform the soil. Forest plantings prevent the snow from blowing into ravines and gullies, change surface flows into inner flows, reduce the evaporation of moisture in the soil, and thus contribute to the retention of water in it. The influence of the forest upon the territory it occupies and protects consists in the reconstruction of the conditions familiar to the forest steppe, ~~and~~ that approximate the natural conditions of the steppe and forest. This is achieved by 1. the reconstruction in steppe and forest steppe regions of natural forest plantings; 2. the growth of artificial plantings that conform to the demands of a grass-field system of agriculture.

Agro-forest melioration consists in the following types of plantings: 1. forest belts near watersheds on "syrts" (bogs, quicksand) and mountain passes, to change ~~changing~~ the climate, accumulate snow, and provide moisture for adjoining slopes. 2. forest shelter belts on wide, flat watersheds and

170

slanting non-washed off slopes to reduce the force of winds, retain snow on fields, and reduce evaporation of moisture in the soil. 3. forest and forest-orchard belts and strips on watersheds off slopes, along river banks, to transform the surface flow into an internal flow and prevent washing-off of the soil and the formation of denuded hills. 4. forest belts on sandy soils and "moving" soils to aid their "fixation" for greater agricultural use. 5. plantings along irrigation canals, around watersheds and on swampy land. 6. forest belts around orchards and vegetable gardens. 7. plantings of shrubs and trees at collective and state farms. In intersections (especially mountainous regions)forestry is supplemented by grass planting and the simplest technical measures (terracing, pond forming), while on sandy territory grass planting and "decayed" material of brushwood (dead-wood)is used. (See articles on Erosion and Sands.)

Plantings on watersheds, slopes, along river banks and in ravines, together with local environment affect the steppe area to a considerable degree. Tree shelter belts of particularly local significance (in that they improve the conditions under which cultivated plants directly bordered by them grow) simultaneously affect distances (ranges) which increase as the steppe gets overgrown with trees. When forest planting is completed (the steppe transformed into a forest-steppe) this together with the influence exercised by the plantings on watersheds, slopes, river banks and ravines present powerful agronomic factors.

"The principal aims achieved by such plantings", wrote Dokuchaev, "consist in the following: protection of steppe plantings from storms and winds which beat and mix grain crops; prevention of losses of grain and the burning of steppe fields; reduction in the evaporation of moisture of the soil; proper distribution of the snow cover, and the accumulation of snow

Nikitin.

masses in desirable places as stores of moisture; a resulting rise in the level of ground waters; possible reduction in temperature variation and moisture in the air and soil; aid in transforming vapor-like moisture into drop-liquid condition(to attract rains)....".

V. R. Williams wrote: "An utterly absolute requirement in the grass-field system is for all elevated locations to be afforested, where grass yields both,perennial and annual, may not be stable. Watersheds should be covered with forests of local significance. The latter automatically regulate the moisture of adjoining agricultural land. Forests together with tree belts, which should surround all our steppes, are of exceptional significance in controlling drought and dry winds ("sukhoveii"). They will aid the farmers to conquer droughts once and for all."

In addition to representing decisive means for transforming the nature of the steppes and eliminating the threat to agricultural plantings caused by droughts and dry winds, tree shelter belts also serve as a substantial source of lumber. Productive and technically valuable plantings are found along river banks, in ravines, and on sandy sails where cultivation of agricultural crops presents considerable difficulty or is practically impossible. The experience of planting trees in ravines and on sands proves that shelter plantings grown in these places frequently prove superior in quality and technical value to natural plantings in the forest zone. Agro-melioration measures are planned simultaneously with the "organization" of agricultural territory, consideration being given to the configuration (contour) of fields, soils, relief, and other characteristics; on already "organized" territory. prevailing land formation is taken into account.

Nikitin.

The first attempts to use the advantages offered by tree shelter belts in steppe regions, in the form of forest massives in the South and South-East of European Russia, date back to the first half of the nineteenth century. By the end of the nineteenth century an attempt was made to build a "forest shield" in the South-East ("ribbon" plantings) to separate the European part of Russia from Asiatic Russia. But neither "ribbon shields", nor mass forest planting were completed, nor did they attain appreciable degrees in development. Forests planted in some locations in the 19th century were hardly developed at all. The current stage in agro-melioration, the theoretical study of its foundations and its practical application are directly connected with the Dokuchaev Expedition of 1892 and his personal organization of experimental sections at Kamenno-steppe, Mariupol, Starobelskii. On these plots were obtained principal data concerning the positive influence tree plantings exert upon micro-climate, soil, hydrological conditions, yields of agricultural plants and the improvement of methods and technique in plantings. This data formed the basis of contemporary agro-melioration, founded in the Soviet period, ~~and which had grown into~~ which has become a powerful agronomic factor. It is the Soviet period, which refuted the previously prevailing opinion concerning the drying out of plains as a result of forest growth and the impossibility of producing tree shelter belts in the dry stepps. Agro-melioration received its widest development and practical application first in the period following the Great October socialist revolution, especially after the collectivization of agriculture and its provision with contemporary modern machinery, which actually opened the widest possibilities for the effective control of drought, soil erosion, and other unfavorable

Nikitin.

natural conditions. Agro-melioration became widely introduced to agriculture following the All-Union Conference on Drought Control in 1931 and particularly that of the XVII convention of VKP(b), at which time comrade Stalin stated that "the planting of forests and tree shelter belts in the eastern parts of Zavolzhie (left bank of the Volga) is of enormous significance." In the years of the second Five-Year plan the following planting took place: tree shelter belts, 278.5 thousand hectares, soil shelter plantings, 121 thousand hectares, and forest plantings on sands, 125.5 thousand hectares, an increase by eight over the entire pre-revolutionary period. The volume of work and its quality continue to rise, aided by the improvement in the technique of growing plants and the mechanization of the work. Forest planting machinery was designed and produced by our industry and special cultivators manufactured for the care of plantings. Processes in growing seed material at tree nurseries were also mechanized.

Agro-melioration is most effective in agronomic measures intended to raise agricultural levels, as recommended by V. R. Williams, V. V. Dokuchaev, P. A. Kostychev, i.e. under conditions of a grass field system of agriculture. A planned and wide introduction into agriculture of the grass-field system of agriculture and the application of advanced agro-biology, conforming to the teachings of I. V. Michurin and T. D. Lysenko, will raise the level of agriculture upon a higher step, equip practicioners with powerful weapons and means in guiding plant life, stimulate cultivated agriculture, and the productivity (output) of its branches.

In October 1948 the Council of Ministers of the USSR and the Central Committee of VKP(b) issued the decree concerning the "Plan on Tree Shelter

Nikitin.

Belts, the Introduction of Grass Crop Rotation, the Construction of Ponds and Watersheds to ensure high and stable yields in the steppe and forest-steppe regions of European USSR." This decree presents a grandiose plan of attack upon drought which aims at completely combating it, obtaining high yields of agricultural crops, and creating stable forage bases for the development of husbandry. The decree envisaged the establishment of a system of large vast government tree shelter belts between 1950 and 1965 in watersheds and along banks of rivers in the South and South-East of European USSR, of a total spread of 5.320 km on an area of 117.9 thousand hectares. These belts were to serve the purpose of overcoming the destructive influence of dry winds upon yields of agricultural crops, prevent the blowing off of fertile soils in the Povolzhie, Northern Caucasus, and the central-black earth oblasts and improve the water regime and climatic conditions of these regions. The same decree establishes a plan (1950-1965) to create free shelter plantings on fields of collective and state farms, on an area of 5.709 thousand hectares, and it also proposes to plant an area of 322 thousand hectares on sandy lands between 1949 and 1955.

The variation of natural conditions in steppe and forest-steppe regions of the USSR requires a careful selection of woody and shrub genera for plantings and high technique in growing them to obtain successful results. Only genera adapted to the environment in which they grow, will in their proper mixtures and given careful care produce stable and long lasting shelter plantings. The latter should be mixed-composite and consist of the principal and suitable genera and shrubs. In steppe regions these plantings are more stable, long lived and productive; among the most important genera are:

Nikitin.

the summer oak (best adapted to steppe conditions), ash, English elm, Siberian larch, poplars, etc.; among those tolerant to shades: maples, small-leaved linden, common elm, etc. In order to increase the economic value of shelter plantings, it is recommended to grow fruit varieties (10 to 15 percent) along with them.

For successful shelter plantings local seeds or those from adjoining regions (or more severe climates) should best be used. Seeds of trees from old artificial tree plantings which went through lengthy selection and training are particularly valuable. According to Michurin's teaching, the training of plantings should begin with the preparation of seeds. Growing of seedlings for planting and that of plantings form a single process, of which each successive stage is predetermined by the preceding one. In forestry it is preferable to use high grade, fresh seeds and seedlings; the latter should be grown under conditions identical to those they meet in their permanent home. Of particular significance for the successful growth of plantings (especially in the first few years) are also deep and careful cultivation of the soil and technically correct sowing and planting, which help future care and weed control, and generally reduce costs. From the economical point of view the growth of tree shelter plantings is most effective if seeds are planted in the permanent location and row culture (?) of trees is replaced by nest culture. As confirmed by the experience of steppe-forest, plantings grown directly from seed are of higher stability and productivity. Particularly effective are plantings from seed of summer oak, white acacia, ash, maples and of many shrubs.

Agro-melioration on a high agricultural level contributes to wide mechanization. In the years 1949 to 1950 a total of 570 tree shelter

Nikitin.

stations were organized. The most important role, aside from the role played by the latter, belongs to MTS (Machine Tractor Stations), state farms and special agro-melioration detachments.

A network of agro-melioration institutes, experiment stations and bases are engaged in developing scientific methods and techniques in agro-melioration under the supervision of the All-Union Scientific Research Institute of Agro-Melioration.

End of Article
* * * * * * * *

References: Williams, V. Principles of Agriculture, 6th ed. M. 1948;

" Grass-field System of Agriculture on Irrigated Lands, M. 1935

Vysotskii, G. On the hydrological and meteorological influence of forests, M. 1938.

D'yatchenko, A. Forest Belts in the part-steppe zone, M. 1949.

Demidov, S. Development of Agriculture in the post-War Five Year Plan, M. 1946.

Dokuchaev, V. Our Steppes, Past and Present, 2nd ed. M.-L. 1936

" and Sibirtsev, N. Introduction to the Work of the Expedition arranged by the Department of Forestry under the leadership of Professor Dokuchaev, St. Petersburg, 1894.

Kozmenko, A. Control of Soil Erosion; 2nd ed. M.-L. 1949.

Krylov, A. Grass Field System of Agriculture in Controlling Drought, Voronezh, 1947

Nikitin...

Labunskii, I. Mechanization in Tree Melioration Nurseries, Kharkov, 1940.

Lysenko, T. Experimental Sowings of Forest Belts by Nest Method, M. 1949.

Nikitin, P. and Minin, D. Tree Shelter Growing, M. 1949

Decree of Council of Ministers of USSR, dated October 20, 1948 Plan of Tree Shelter Belts...., M. 1948

Orlov, M. Astrakhan Part-Desert Sands, and methods for their stabilization and economic utilization, M. 1940

Eitingen G. Forestry, 4th ed. M. 1949.

* * * * *

Markin, A. K.
The cotton-plant quarantine in the Tadjik Soviet Socialist Republic (1930-1939), Vestnik Zashch. Rast. 1940(4):38-42. 421 P942

Translated from the Russian
R. G. Dembo

The pink worm is known to the entire world as a very dangerous and serious quarantine pest of the cotton plant. During a short period of time (25-30 years) this pest spread widely on the earth, penetrating into cotton fields of almost all capitalistic countries.

As the result of the daily care of the party and of the government concerning the development of cotton crops in our country and of timely carrying out of quarantine measures - the cotton raion(s) of USSR are freed from the pink worm.

The main cotton committee imported 820 thousands of cotton seeds bought in Egypt in 1929-1930 with the purpose of introducing cotton species with long fibres.

As is known, the pink worm which has been presumably imported from India with poorly cleaned fibres has been discovered in Egypt in 1910. The pink worm causes serious damage to cotton in Egypt, the losses being from 20-30 percent and with the retarded species even up to 80 percent. In spite of its yearly control the general infestation by the pink worm of cotton bolls reaches 91 percent in late fall. Thus, the import of a great party of cotton seeds from Egypt represents a considerable danger for the cotton fields of the Soviet Union.

The state entomologist, director of the entomological division of the Ministerium of Agriculture in Egypt, wrote in 1919: "It is humanly impossible to guarantee that all the species of the pink worm would be killed through

171

fumigation of a great amount of seeds. Fifty specimens of those still alive are sufficient to infest the entire cotton land."

The world scientists of the capitalistic countries who were consulted by the Principal Cotton Committee considered the infestation of the raion(s) unavoidable. Some of them, for instance the Director of Plant Quarantine of USA, Dr. Marlatt, who was consulted at that time by the interoffice quarantine commission with our Trade Delegation concerning the control of the pink worm, recommended the application of vacuumless fumigation of the cotton seeds with bisulphide of carbon, with the doses of 10 English pounds (4.54 kg) for 1000 cubic feet, with the exposure of 24 hours, under the condition that the amount of the seeds is not over 2 English pounds (0.908 kg). Marlatt recommended carrying out the fumigation of seeds with bisulphide of carbonin in a vacuum room when a great amount is involved. After fumigation the seeds should undergo a heating with dry steam up to 60° C. during 2-1/2 hours, followed by sulphuric acid. The application of this method might have caused the complete loss of seed sprouts if our specialists had not applied necessary preventive measures.

Not having the possibility of rendering the cotton seeds harmless in vacuum rooms (because of their absence), the Egyptian Government rendered them harmless only in thermic disinfestation rooms established in that country on each cotton factory. At that time it was known that the thermic disinfestation does not kill the pink worm entirely. This has been confirmed by our specialists after having analyzed the first group of seeds received from Egypt to Odessa in 1930. During the unloading K. E. Demokidov discovered pink worms in the boat hold.

The subsequent work in the appraisal of these seeds indicated that all consignments contained a great amount of the pink worm.

Markin, A. K.

It has therefore been determined that the thermic disinfestation eradicated the pink worm only to 99.52 percent, and the remaining (as it has been theoretically counted) 213,000 living caterpillars represented a great danger for the cotton crops of the Union. The general infestation of seeds by the pink worm was at 5.34 percent, and in individual cases 9.84 percent.

In the practice of other countries there was a case, when in 1916 a former German steamboat, acquired by England as a war prize, arrived in USA. In the ship hold there were 189 tons of cotton seeds originated in East Africa. It was discovered that these seeds were infested by the living pink worm. Not having the methods of fumigation of a great amount of cotton seeds, the Americans treated them with sulphuric acid; then the seeds were used in ground form for the fertilization of the soil in South Carolina. The ship holds were fumigated by hydrogen cyanide.

Taking into consideration the exceptional danger of the pink worm for the cotton growing in the country of socialism and the government importance of the introduction of the long fiber species of cotton, the Soviet specialists were not lost in face of the amount of work and of the difficulties ahead.

The government ~~government~~ assigned the task of freeing the entire seed consignment from the pink worm and using the seeds in sowing. K. E. Demokidov, V. V. Nikol'skii, agronomist I. A. Kazas, engineer V. F. Stepanov, and the chemist Petrov were entrusted with the execution of this responsible task. The fumigation of the seeds was carried out day and night in a vacuum room of a Russian museum in Leningrad which was reconstructed for this purpose, and in Odessa in a newly remodeled vacuum room bought in USA.

Markin, A. K.

The specialists who carried out this work did not succeed immediately in finding an effective process of fumigation. The American method recommended along with the vacuum room did not give a hundred percentage of eradication of the pink worm in the cotton seeds. This instruction had in mind stacks of cotton and not bags with seeds, each weighing 125 kg.

After having determined the effective conditions of disinfestation, V. V. Nikolskii tested a few doses of sodium cyanide: 4000, 5000, 6000 g. for a vacuum room of the capacity of 28 cubic meters, with the load of 28 bags and exposure of 2 hours.

With these doses the pink worm remained alive and only with the dose of sodium cyanide of 7000 g. for the room all caterpillars died after an exposure of 2 hours. During the disinfestation it has been determined that hydrocyanic acid is adsorbed in considerable degree by the cotton seeds and that the pink worms die after fumigation in the bags outside of the room. This has been confirmed with more precision by the succeeding work which was carried out by a group of specialists of the VIZR, All-Union Plant Protection Institute (V. V. Nikolskii, A. M. Il'inskii, D. M. Paikin, A. K. Markin) in 1933.

The given persons achieved the full loss even of such a resistable pest like the granary weevil which was placed inside the bag of cotton seeds applying in the vacuum-room a smaller dose of sodium cyanide, but under the same exposition. This indicates how great the concentration of hydrocyanic acid could be in all layers of bags of cotton seeds exposed to fumigation.

The problem of adsorption of hydrocyanic acid by cotton seeds has been solved already in 1930 in Odessa and finally confirmed and clarified in 1933, which the Americans achieved much later according to their work published in 1938.

Applying the laws of adsorption of hydrocyanic acid during the fumigation of cotton seeds carried out in Odessa and in Leningrad in 1930, and simultaneously taking into consideration all the other conditions (dosage of sodium cyanide, exposure, temperature), it becomes evident that the destruction of the pink worm occurred during the fumigation itself and during the unloading of cotton seeds from the vacuum room during their storage in storehouses and even on their route for investigation.

The fumigated bag of cotton seeds is used for a long time as a "mordant bag", and the pink worm dies afterwards if it has not been killed directly by the process of fumigation. The death of the pink worm confirmed the entomological control, carried out with 3500 kg of seeds, divided from the general consignment as an objective test.

In the entomological control in Odessa alone, 170 persons worked. Despite the obvious lucidity of the given data for the effective fumigation, the chemists applies at that time especially great discretion because they were not sure of the possible destruction of the pink worm in the cotton seeds after fumigation.

When the first consignment of cotton seeds arrived in Termez, the enemies of the people urged the burning of the seeds and the disinfestation of the tares and of the cars. They published wrong information in the papers. Thus, for instance, the newspaper "Uzbek Truth" published an article in February, 1930, which said that Plotnikov discovered pink worms still alive in the consignment of seeds imported from Egypt and which underwent disinfestation in the Union in vacuum room, while Plotnikov really did not carry out any analysis of these seeds.

The second analysis of 2 million cotton seeds made in Uzbek SSR indicated the absence of the living pink worm. Only after a long and persistent control by specialists who followed the national point of view, the seeds were sown in Tadzhik SSR, in former Kurgan-Tiubinsk, Shaartuskii, Dzhilikul'skii raion(s). These raion(s) isolated by natural borders from all other raion(s) of cotton production (mountains, desert steppe) were suitable as far as quarantine is concerned.

For a definite testing of the effectiveness of disinfestation and of checking the spreading of the pink worm beyond the borders of the quarantine zone, in case of its appearance the sowing of cotton was declared under quarantine according to the resolutions of Central Asiatic Economic Soviet and of the Soviet People's Commissariat of the Tadzhik SSR for 1930. During all these years the export of sowing cotton seeds beyond the borders of the quarantine zone was prohibited.

And only according to the data concerning the absence of the pink worm, the export of technical cotton seeds beyond the quarantine zone was admitted after a corresponding quarantine inspection and during the least dangerous seasons (from October to May).

The export of cotton fibers was admitted the first year only after fumigation in vacuum rooms. In the following years the cotton fibers were exported without fumigation but under quarantine inspection beyond the quarantine zone to textile factories located in non-cotton raion(s).

Simultaneously with the carrying out of the quarantine measures, according to the decisions of the government, during all the past years (1930-1939) the inspection of the cotton sowing was also carried out. The work on inspection was most responsible since it had to solve the problem of whether there was a pink worm on the cotton fields of the quarantine zone. Aiming towards the solution of this problem, the Quarantine Sector accomplished the plan of inspection of cotton by various methods. During the first two years (1930-1931) field investigations were carried out. K. E. Demokidov, V. V. Nikol'skii, N. N. Filip'ev and others were invited for this work. During recent years the field inspection was supplemented with other more perfect methods which are known only in science, namely, mechanical worm traps, analysis of cotton seeds by cutting them with special cutting machines, light traps established in cotton fields which worked from June until October in catching moths. Specialists and the control of the Quarantine Sector carried out the supervision of these inspections.

During all these years 115,260 hectares, with the average yearly field of 20,000 hectares, on which Egyptian species were sown were inspected by the field method. On the indicated field 11,162,600 sexual organs of cotton plants which were characteristically damaged were isolated and analyzed. 262,000 kg of gin waste have been analyzed with two mechanical wormtraps. 16,000 kg of cotton seeds of inferior quality were analyzed by means of cutting them by hand (with scissors), and 16,000 kg with a cutting machine.

For a definite decision of the problem concerning the absence of the pink worm on cotton fields of the quarantine zone and in connection with the state decree concerning the elimination of quarantine from the cotton fields, the harvest of cotton in 1938 might be of special interest.

This yield was the fifth after the cotton seeds were sown in the quarantine zone without fumigation. If the pink worm would have been really imported to the cotton fields and it would acclimatize in the raion(s) of the quarantine zone, then during the nine-year existence of the zone and during the five-year propagation, without any control on the part of man, it would have propagated in 1938 to a great amount, especially since the climatic raion(s) of the quarantine zone were not the controlling factor in its propagation.

The temperature of the raion(s) of the quarantine zone in major cases was not below zero. If in 1933 the average monthly temperature in Kurgan-Tiubin raion decreased to 5.9° (January), it did not decrease below 0.3° (February) in Dzhilikul' raion during the same year.

Besides, the unlimited propagation of the pink worm was furthered by the following condition. Having been closely and directly related biologically to cotton seeds (diapausing in them up to 2.5 years), it could easily winter in the bundles of cotton raw material, which had always a positive temperature, and in cotton seeds, stored in storage houses where there are no low temperatures.

It has been known in the practice of capitalistic countries that the pink worm was disclosed in the second, third and fourth year after its infestation of cotton plants (Greece, Brasile, Iran). Thereby the inspections in the indicated countries were carried out entirely by the field method and on a limited scale.

Taking into consideration all these data, after a special final investigation by specialists, 54,500 pieces of cotton harvested from fields in late fall, 64,000 kg. of sprouts by mechanical snail catchers, 1200 of cotton seeds by means of cutting them by hand and 3,800 cutting by machine were analyzed in 1938-1939.

If the pink worm would have been in the seeds, one per ton, with this method along it could have been disclosed. A good proof in the decision of the problem of absence of the pink weevil in the quarantine zone is the work of the mechanical worm catchers who work on the cotton cleaning factories during seven years. During this time, as has been indicated, a great number of gin waste has been analyzed. The principle of the analysis of sprouts by this method is based on biological peculiarities of the pink worm.

As it is known, the feeding of caterpillars of the pink worm is connected with cotton fruit elements, and mainly with the cotton pod within which the caterpillars are fed by immature fibre and cotton seeds.

During the harvest of raw cotton from the fields the pink worm caterpillars of a short or long development cycle enter the cotton. When the raw cotton is passing through the cleaning machines at the cotton factories, waste is separated from it. Various insects including the pink worm caterpillars deapausing and undeapausing enter the waste. This waste of cotton was passed through a worm catcher. From the entire mass of waste, 8 to 10 percent (tiny particles of soil and other waste) was separated in which insects penetrate. This separated waste was accumulated in a special vessel, was analyzed, and all insects, dead and alive, were taken out from this waste.

The work of worm catchers in the quarantine zone indicates that the worm catchers separate from the waste a great amount of varied entomological material. During the time of final inspection (season of 1938-1939, eight months of work) 21,165 examples of various insects were separated by worm catchers at the Kurgan-Tiubinsk, Shaartuz cotton plants. The same amount of insects was caught by the worm catcher every season of recent years. All these collections passed through the appraisal of specialists. But in all these great accumulation of insects (including caterpillars), the pink worm has not been found.

The work of worm catchers indicated more than any other method the absence of the pink worm in cotton fields of the quarantine zone, because all the waste after the cotton clearing during each harvest was let through the worm catchers. This method is the most effective and at the same time inexpensive (40-50 kopeks for one hectar).

In places, where during field inspection mallow moth has been found in singular exemplars or not at all, the worm catcher disclosed it at the places of its work in the shortest time (Nakhichevan ASSR).

In the United States the separating machine (similar to our worm catcher) disclosed the pink worm in gin waste during the first days of its work, while the field inspection required about 200 exploring labor days and the results were negative.

Thus, analyzing the results of inspection of cotton sowing in the quarantine zone for the past years and the results of the final inspection according to indicated indexes, the brigade of the quarantine sector, consisting of K. E. Demokidov, V. V. Nikolskii, the supervisor of the quarantine sector of People's Commissariat of Agriculture USSR, A. N. Volkov, of the quarantine inspection of the Tadzhik SSR, L. P. Datchenko, under my supervision came to the conclusion that the pink worm is absent on the cotton fields of the quarantine zone of Tadzhikistan. Now it has been undoubtedly proven that the pink worm has been entirely eradicated by fumigation in vacuum-rooms in Leningrad and in Odessa, which has been carried out when the cotton seeds were imported into the Union from Egypt in 1930.

The further abandoning of the quarantine zone has been found inexpedient and, based on the decree of SNK and TSK VKP(b) the Central Committee of the All-Union Communist Party of the Tadzhik SSR, the quarantine has been eliminated from the cotton sowing raions of the quarantine zone. The abolishment of quarantine from the cotton fields of the quarantine zone permits the import of cotton products into cotton growing raion(s) of the Union. The abolishment of the quarantine zone liquidates entirely the suspicion concerning the pink worm which existed until recently.

Thus, since the Egyptian seeds have been rendered entirely harmless, the whip of the world cotton growing - the pink worm has not been admitted on the fields of our country.

This division of the quarantine work has been evaluated by an All-Union conference which has been held in Tashkent from February 7 until February 11, 1940, under the chairmanship of the late academic N. M. Kulagin and by the VIII meeting of the section of Lenin All-Union Academy of Agricultural Science concerning the control of pest and diseases in crops as a great success achieved by the quarantine work of the Union in the field of cotton protection.

The next task of quarantine service of the People's Commissariat of Agriculture of USSR is to increase still more the cotton quarantine so that under no circumstances would the pink worm and other quarantine pests and diseases enter the fields of socialist cotton industry.

END of Article

* * ** * * * *

Il'inskii, A. M.
The chemical control method against pests and plants [!] diseases in the USSR. Vestnik Zashch. Rast. 1940 (1/2): 15-23. 421 P942

Translated from the Russian
by R. G. Dembo

According to the historical decisions of the XVIII Conference of the All-Union Communist Party, the agriculture of our country must ensure further growth of agricultural crops at the end of the third Five-Year Plan compared with the achievements of the end of the second Five-Year Plan: in grains 27 percent, in cotton 28 percent, in sugar beets 37.2 percent, in flax 49 percent. A considerable growth is planned for a series of other plants.

This advance of our agriculture is ensured by its complex mechanization, the strengthening of agrotechnique, the shifting to grass growing crop rotation, the development of chemization of agriculture, the supply of chemicals and of machines on the part of industry. The chemical control method against pests and plant diseases is of great importance, particularly in the third Five-Year Plan. The chemical method, which is the oldest and the principal control method, has not been applied up to now on the scale required by the socialist agriculture due to a series of causes.

First of all this has been prevented due to the breach between the agricultural demand for compounds and the actual industrial supply. If we indicate the demand of People's Commissariat of Agriculture of USSR for poisons against pests and compare it with actual supply, we obtain an impressive picture (data are given in tons).

172

		1934	1935	1936	1937
Sodium arsenite	Demand	1805	2124	1885	5000
	Supply	1100	1070	1448	2702
Coppor aceto-arsenite	Demand	1047	1847	1500	2865
	Supply	329	594	1112	1696
Sodium fluosilicate	Demand	1033	4821	3600	9500
	Supply	900	976	2512	3624
Ground sulphur	Demand	5066	2640	10000	23953
	Supply	1000	1500	8000	8826
Cupric vitriol	Demand	10766	16793	9000	16000
	Supply	1500	1764	4500	5573
Formalin	Demand	1255	1168	1880	3732
	Supply	600	859	1450	2919
Anabasine-sulfate	Demand	270	440	350	730
	Supply	50	64	206	445
Barium chloride	Demand	11152	11239	18250	18800
	Supply	3143	4832	7890	11249
Calcium arsenate	Demand	1487	4854	4000	10420
	Supply	394	1343	2476	2533

A similar breach between demand and supply takes place concerning other compounds and in various years as well. It is necessary to note that the actual demand for agricultural compounds is considerably higher than it was indicated in the declaration of KHZ USSR which considers the availability of machines and the possibilities of chemical production, and later on the preparation of compounds will increase according to the growth of collective farms. The practice of foreign countries, for instance of such a capitalist country as USA whose agriculture for control of pests and plant diseases spent the following amount of chemicals in 1934: lead arsenate 88,800 tons, calcium arsenate 66,600 tons, copper aceto-arsenite 8,800 tons, sulphur in powder 66,600 tons, pyrethrum 22,200 tons, nicotine-sulphate 4400 tons, cupric vitriol 26,660 tons and corresponding amount of a series of other insecticides and fungicides.

The causes of such a breach between the demand for and supply of poisons are purely historical.

During the prerevolutionary period the supply of chemicals and of equipment for control of agricultural pests and diseases was imported from abroad. There was not much of national industry of insecto-fungicides in prerevolutionary Russia. The scientific research work in the field of chemical method limited itself mainly to incidental experiments with some compound or with some chemical method only aiming to verify the foreign data. The operating measures were based primarily on data furnished by foreign science. Some times those data were verified, some times they were not. In rare cases attempts were made for a systematic research concerning the chemical method (for instance, working out the method with poisoned attractants by Uvarov - in controlling locust, and by Siberian entomologists - in controlling the solitary locust etc.)

The imperialist war 1914-1918, the civil war which followed it and the blockade of the Soviet Union on the part of the capitalist countries deprived our country of the only source of supply of compounds and equipment for control of pests and plant diseases. Nevertheless, surrounded by a circle of enemies, burning in the fires of the civil war, the young Soviet Republic in its struggle for survival did not forget this field of its economy; the searching for various possibilities of protecting crops against pests by means of control. With the absence of supply from abroad, not having our own chemical industry, the Soviet Union during those heroic times aspired to organize as much as possible a supply of chemicals and equipment for pest control. Thus, for instance, 1618 poods of arsenic was given to agriculture in 1919, 1560 poods in 1920, 30,752 in 1921, 46,175 in 1922, 65,505 in 1923. At the same time some attempts were made to organize the production of first compounds (Tula "avtomakov" - 1920-1922 [illegible]

Il'inskii, A. M.

After the end of the Civil War and the end of the economic blocade, during the reconstruction period the demand for compounds and equipment in controlling pests was covered basically by compounds imported from abroad. At the same time OZRA (ОЗРА) NKZ, (НКЗ) the Society of Plant Protection of the People's Commissariat of Agriculture organized the first scientific research organization which aimed toward scientific working out of the problems of the chemical method in controlling pests and plant diseases;- it was called NILOV (НИЛОВ) the Scientific Research Laboratory of Poisoning Substances. Its task was: the working out and the verification of new methods and measures of chemical control, control analyses of insecticides and fungicides, toxicological research, the working out of problems of standardization of insecticides and fungicides, the assistance of industry in organizing the production of insecticides and fungicides and other problems of chemical pest control.

The chemicall industry of the Union was faced at that time with the task to proceed with the organization of production of compounds for pest control so that foreign import would be eliminated. It was hard to achieve that task due to the novelty of the matter, the lack of qualified personnel, the limit of raw materials, the unknown technological processes, and, finally, sabotage in industry. By conquering these obstacles, the chemical industry gradually acquired the production of the basic assortment of compounds for controlling pests, which fact permitted the cutting off of foreign import of some compounds and to transfer agricultural supply to the production of the Union. Thus, at the beginning of the first Five-Year Plan the Union chemical industry supplied agriculture with cupric vitriol and barium chloride, in 1929 the first supplies of sodium fluoride and sodium fluosilicate were produced, in 1931 the compounds of copper-aceto-arsenite, sodium arsenite, calcium arsenite and the mordant AB appeared, in 1933 the compound PD was added, in 1934 calcium arsenate etc. At the end of the second Five-Year Plan the Soviet Union freed itself from foreign import of materials necessary for controlling pests.

It is natural that during such a short length of time, overcoming a series of obstacles, the chemical industry did not succeed in expanding the production of these new compounds in such a degree that it would be able to fulfill the demand of the growing agriculture, especially since the same compounds are acquired by other branches of the country's economy (cupric vitriol, sulphur, formalin, sodium fluoride, ferric vitriol, etc.)

The chemical industry is partly indebted to scientific research institutes for such a speedy mastering of new products. These institutes worked out the technology of acquiring compounds, consulted industry in organizing production, inspected the new compounds, worked out the methods of their analysis, worked out the projects for various sorts, etc. As an example we may indicate the work of NIUIF (НИУИФ) on arsenic and fluorine compounds, the work of GIPKH on cyanide and others. The scientific research organizations of plant protection had the task of assimilating the new compounds produced by chemical industry to determine the scope of application, dosing, the expenditure rate, the working out of the composition prescription, methods and conditions of application.

Simultaneously with the solution of this immediate problem and with the assistance of chemical industry in organization of the production of insecto-fungicides and of appropriating the new compounds, the scientific research organization was faced with a new problem: the ensuring of operative measures in introducing new compounds to replace those which were missing in our country for some reasons (lack of raw materials, demand from other consumers, unadjusted production etc.)

While the problem of eliminating import has been solved comparatively simply - by means of organizing the production of insecto-fungicides in USSR, the production of our own industry of insecticides and fungicides, and the role of scientific research organizations summed up by the approval and the appropriation of the compounds by our national industry and by consultation in connection with their production and application - the solution of the second problem was more complicated. Agriculture could not wait until the chemical industry will completely adjust the production of the basic poisons in the amount necessary for the complete supply of the growing demand and required the quick solution of this problem - the ensuring of measures by sufficiently effective control methods. Therefore, for the solution of the problem the scientific research organizations had to develop their work in various directions simultaneously.

The first research work was confronted with the problem of finding new additional sources of raw material for the production of deficient basic compounds already utilized by chemical industry, and mainly of finding ways of utilizing industrial waste. Here we could mention the work of NIUIF with Cottrell process, poor arsenic ore for obtaining arsenic compounds, work over pyritic bisulfate in order to obtain copper-possessing fungicides, work for catching phtor-containing gases of superphosphate production and melting furnaces to obtain sodium fluoride and sodium fluosilicate, to replace potash soap by soap naphtha, etc. Here also belong some work of VIZR (ВИЗР), for instance the research of natural and artificial pitch instead of the imported ones for the production of caterpillar glue, the obtaining of carbolineum from the products and waste of coal industry etc.

The second course has as its aim the searching and creation of new compounds which could, at least partly, satisfy the demand for basic compounds in controlling pests and plant diseases. Here, on one side, attempts were made to directly utilize raw material as control measures, which was used for the production of insecticides and fungicides and their half products. For instance, SAIZR (САИЗР) tested scorodites and pitticites as intestine insecticide; with the initiative of SAIZR ground sulphur concentrates have been for a long time applied along with sulphur and with its mixtures in controlling the web tick; comparatively recently pastes of sodium arsenite and of copper aceto-arsenite are widely applied. Simultaneously attempts were made to utilize waste and refuse of various kinds as insecticides and fungicides as well as their mixtures. VIZR carried out, for instance, extensive work in testing waste of CK production as mordants, bringing it up to production (raw aldehydes SK, condensate). The Asia station of plant protection widely advertised the application of emulsions of oil industry waste as contact insecticides. SAIZR worked out and introduced into production drain alkali - waste of soap production which appeared to be good acaricides. Instead of the deficient and expensive chargers - talcum, chalk, lime and others - road dust, loam, ground waste of porcelain and ceramic production - oil and naphth humbrina are widely applied. Instead of deficient and expensive holdings in controlling locust and locust-like insects, sawdust, dung and rice peel etc. are used.

But in a still higher degree the work of testing and creating new compounds has been developed, which should be an addition to those already assimilated by production but produced in such quantities which are unsatisfactory for the growing demand of agriculture. Here we may include also the group of new compounds by which has been expected to replace the existing ones, but for various reasons are excluded from the assortment of control measures or which are not desirable for application in separate cases.

Without indicating the huge material of work in research and in creating new compounds accomplished by a series of research organizations and by individual workers, we are able to indicate a few individual cases of such work.

One of the most widely used intestine insecticides is copper aceto arsenite. It is standardized, highly toxic for insects, comparatively harmless for the protected plants and is considered one of the best compounds of the given group. Nevertheless its production is complicated and for its preparation the deficient copper and the deficient acetic acid which used to be imported from abroad are used, therefore the chemical industry is producing copper aceto-arsenite in limited quantities and the operating organizations (Narkomzem, Narkomzdrav) are applying this precious but expensive insecticide in rare cases when the application of other compounds are excluded. Aiming to alleviate the situation in addition to copper aceto-arsenite and to replace it in controlling the caterpillars of malaria mosquito, two new compounds - oil arsenite (Azstazra) and "arsmal'" (NIUIF) were created which during approbation showed their full usefulness as substitutes of copper aceto-arsenite for the given case. Simultaneously some attempts were made (Shchelkovskii plant) to create new compounds of the type of copper aceto-arsenite, but less expensive and less deficient. The first of them is caustic green which is a copper aceto-arsenite diluted by gypsum. For its production, in comparison to copper aceto arsenite much less of white arsenic, cupric victriol and acetic acid has been used. Calcined sodium carbonate is replaced by slaked lime. Besides, the washing of residues is entirely excluded from the process, thus accelerating the process. The second compound - Moscow pigments - is analogous to caustic, but instead of vinegar acid anhydrid - the formic acid anhydrin - is included.

Copper is usually deficient, therefore we try to replace it by other substances or at least to decrease its usage. In plant protection cupric carbonate was utilized with great success. It was applied as a mordant against smut, harmless for sowing qualities of grain even during a prolonged storage of poisoned seeds. To replace cupric carbonic acid, A. I. Borggardt constructed and introduced into plant protection a new compound AB which is a cupric carbonic acid diluted by chalk, which is not less effective than pure cupric carbonic acid. The compound AB replaced the latter at the present time.

Instead of formalin, which once became deficient, sulfurous acid and hydron acid were suggested for seed poisoning.

In connection with the deficiency of sulphur, besides the introduction of caustic soda solution and ISI, attempts were made to create its sorption compounds which ensure sufficient effectiveness with insignificant expense of the active source (sulphur). Thus the chemical industry produced ultra-sulphur which appeared to be unsuccessful despite its high toxicity. Such were the sorption sulphur compounds of NIZR, which was not introduced into production, and the compound PS SAIZR. By successfully replacing the usually applied mixtures of sulphur with lime by these compounds, a considerable economy of sulphur could be achieved, or with the same amount of sulphur there would be the possibility of working over a surface several times larger.

Il'inskii, A. M.

One of the commonly used compounds in controlling pests (web mite [Tetrany-chus urticae Kock] coccidae and coccodea) and plant diseases (scab, spottiness) is ISO (ИСО) (sulphur-lime decoction, Californian liquid). Its defect is the necessity of preparing (stewing) at work, because the compound which has been prepared ahead of time (at the factory) decomposes quickly. Besides, the transport of the liquid ISO is connected with many disadvantages. NIUIF suggested a new compound - barium sulphate constructed after the German barium sulphate - to replace ISO. The acting ingredient in barium sulphate is barium polysulphide. Its advantage in comparison with ISO consists in the fact that barium sulphate is a powder which, for application, is dissolved in water and does not require stewing like ISO. Its transport is more convenient and simpler than ISO. Therefore barium sulphate is able to replace ISO in those cases when the stewing is for some reason impossible (absence of fuel, the poor quality of lime, etc.)

In controlling rodents of fruit crops the majority of presently applied insecticides of intestine effect often causes harm to plants. Even one of the most harmless compounds - copper aceto arsenite - sometimes quite unexpectedly causes serious burns of leaves and of fruit. To replace these compounds under the conditions of orchard growing VIZR introduced sodium fluosilicate, which is considered abroad as the most harmless compound of intestine effect for plants.

In the practice of fumigation dichlorethan has been introduced - a more harmless in case of fire and available compound - to replace the explosive and more deficient bisulphide of carbon which is used in great quantities for other industrial demands. The toxic, chemical and physical qualities of dichlorethan are similar to bisulphide of carbon.

Il'inskii, A. M.

A ~~big~~ great amount of examples could be mentioned in the research and creating of new compounds for controlling pests and plant diseases, with the purpose of creating additional sources for the assortment of chemical measures in controlling pests and plant diseases or with the purpose of full or partial replacing of applied compounds. It is necessary to indicate, as a characteristic peculiarity of this work, that with a few exceptions (drain alkali, barium sulphide, sulphuric concentrates, AB, "protars" etc.) they are not completed despite the evident positive effect.

A separate work is the research of insecticides of botanical origin. This group of compounds attracted research workers by its prospects, since its raw materials, unlike the other compounds, could have been considered unlimited; being the products of plants they were harmless for the protected plants and at the same time possessed high insecticide qualities. As the result of research carried out by some organizations (NILOV (НИЛОВ) Scientific Research Laboratory of Poisoning Substances), VIZR (ВИЗР) All Union Institute of Plant Protection, NIYIP (НИОИФ) and by individual workers, the inspection of a great amount of plants which carry poison or which, according to literature, possess the insecticide qualities, was carried out. Separate types were disclosed which appeared to be highly effective during the first inspection and a thorough investigating work has been carried out with them (pyrethrum, melene, aconite, safforite and some others). But only anabasine could be industrially applied; during preliminary testing by NILOV it has been similar to nicotine and replacing the latter in practice; also pyrethrum is being introduced.

One of the attempts to decrease the consumption of compounds and to ensure the widening of surfaces of plants with the same amount of expenditure of the active source, it is necessary to indicate the work in creating compounds with a decreased contents of the active source. Thus, to replace the standard sodium arsenite with the trioxide arsenic 70-72 percent in controlling locust by aerial method, NIUIF (НИУИФ) suggested the new calcium arsenite worked out by it and which possesses only 38 percent of trioxide arsenic and which represents a planted compound with a nucleus of an inertcharger. The above-mentioned ultra sulphur and other sorbing sulphur compounds, and also other sorbing compounds of formalin on peat, compound AB, mordants worked out by NIUIF and consisting of organic arsenics (talcarsine, nivarsene) and mercury compounds ("meranin, germizin"), are examples of such compounds.

The third course in research work whose task was alleviating the hunger for compounds in plant protection consisted in attempts of applying other forms of the chemical method in controlling individual pests by utilizing new, non deficient substances. The control of granary mite could serve as an example of such shifting. Here instead of fumigation of grain by the deficient and inconvenient chlorpicrin or carbon bisulphide the method of interspersing of grains by chalk, naphtalene, vivianit - indeficient and cheap substances are applied. In controlling the codling moth [Laspeyresia pomonella] along with the methods of spraying and pollination by intestine and contact poisons, the autocide belts were applied; attempts are also made to utilize the attractant method (Astrakhan Zonal Experimental Station). In controlling the gregarious locust there has been worked out the method of surface fumigation of static and dynamic "kuliga" of locust with the assistance of indeficient cyanide process which assists in carrying out the control at any time irrelevant to the behavior and condition of the pest and which ensures the economy of deficient arsenics.

As a separate course in recently carried out work with the chemical method, it is necessary to mention further a series of research for the improvement of the quality of compounds and the increase of the effectiveness of their action by means of improving those compounds which also ensure a considerable economy of deficient compounds.

The improvement of the dustlike compounds by mineral oil (work of VIZR) might be indicated as one of such examples. By using such dustlike compounds, like calcium arsenite, calcium arsenate, sodium fluosilicate, sulphur, only a smaller portion of the compound penetrates into the plant and a considerable part is carried away by the wind. Besides, the part of the compound which settles upon the plant falls from it due to its poor adherence and inability for retention. For instance, in the experiments of cotton pollination, sodium fluosilicate settled down on the plant surface in the amount of 42 percent, after an hour there remained on the plant only 24 percent, and after 24 hours only 15 percent survived. Thus, from the general amount of the used dustlike compound only a small portion is utilized productively; the basic mass is usually wasted without advantage. Applying such improvement of dustlike compounds by mineral oil it is possible to decrease the consumption of the compound due to the adhesion of the smallest particles which would be carried away by the wind if without oil. This decrease of consumption (dosing) as the experiments indicate, may reach 25 percent with calcium arsenite, 34-40 percent with calcium arsenate, 50 percent - ultrasulphur without any loss for the effectiveness. Besides the obtained economy of the compound itself, the improvement by mineral oil often increases the effectiveness due to the improvement of adherence and its ability of retention. For instance, calcium arsenite, not improved during the experiments against locust, produced by aviomethod 88.3 percent of the decrease of locust quantity by using 5.1 kg/ha and 83.4 percent with the consumption of 4.7 kg per ha. The same calcium arsenite after having been improved by oil caused 99.2 percent pest decrease with the dose of 40 kg/ha; with the dose of 3.4-98.3 percent; 2.9 kg/ha -99.1 percent, and with the dose of 2.3 kg/ha - 90.8 percent. The toxicity of pollinating compounds does not change when oil is added, as has been proved by special toxicological research.

We may also indicate the experiments of VIZR by improving cyanic acid during the soil fumigation in controlling the beetle caterpillars, SAIZR experiments with a series of compounds for the improvement of intestine insecticides in controlling moth, the application of soap for the improvement of compounds by plant poisons, etc.

Without having solved the problem of supplying all the necessary measures for controlling pests and diseases, all the indicated courses in scientific research work by the chemical method could easily alleviate the tense condition by ensuring the operating work by a necessary assortment of compounds, in case the organizations for plant protection manifested enough initiative and energy in introducing the results into production.

Under the conditions of planned socialist agriculture, by carrying out work on large surfaces the quality of work is of decisive significance. Even the slightest deviations from the norm with a great amount of work is reflected considerably upon the economic effectiveness of the measures carried out. Hence the scientific research organizations are confronted with a new serious task - the increase of the quality of measures with the purpose of increasing their technical effectiveness and decreasing the expenditure of the work.

The solution of this problem has been realized by various means. The oldest measure of decreasing expenditure consisted in simultaneous application of various compounds for the simultaneous control of pests and diseases, for instance the application of the mixture of Bordeau liquid along with copper aceto-arsenite in controlling orchard pests and diseases. But this measure could not be applied in all cases due to the possible chemical reaction by the components of such compounds. Therefore the investigators did not pay much attention to it, and, besides, many schemes were worked out abroad for principal compounds ("combination star"). Of the work of this category we may indicate the experiments of SAIZR with the application of arsenites and arsenates as emulsifiers for the emulsion of mineral oils. Besides the combination of intestine insecticide with the contact one, such an emulsion allowed to replace the usual emulsifier - soap - by a new one useful for the cases with hard water.

The creation of prepared compounds of combined action was in this respect more promising. One of these compounds is copper meritol, worked out by NIYIF (НИУИФ) which passes already the stage of productive testing and will be shortly introduced into production. Further, it is necessary to mention the work of studying and introducing into practice some compounds which possess simultaneously the insecticide and fungicide effects, for instance the work of Rostov Stazra (СТАЗРА) Station for Plant Protection with hydrogen sulphide which proved to be very promising in this respect, being simultaneously an insecticide, fungicide, zoocide and bactericide. We may also indicate the study of fungicide and bacteriocide characteristics of chlorpycrin, widely applied in controlling pests and rodents, in research of insecticide characteristics of some mordants (PD, compound of organic arsenic) etc.

Along the line of improving application procedure wide prospects open in the domain of decrease in cost of chemical compounds. The introduction of the pollination method and, especially, the aviomethod opened a new era in the field of pest control. The advantages of this method under the conditions of socialist agriculture in comparison with the method of spraying soon placed it first, and it occupied the leading position among other forms of chemical pest control. Nevertheless the method of spraying did not lose its significance since a series of effective compounds, due to their physical characteristics, could not be applied by the method of pollination (emulsion of mineral oils, soap, barium chloride, sodium fluoride etc.). Besides, the spraying method has a great advantage over the pollination method: it permitted to obtain the necessary effect under less consumption (several times less) of compounds. These conditions, in connection with the general deficiency of insecto-fungicides and the constant growing demand for them, made it imperative to pay attention lately to the given application form. Aiming to decrease the amount of labor during the spraying method and to draw it nearer to the method of pollination as far as productivity is concerned, VIZR worked out a measure of compounds in way of concentrated solutions. As indicated by experiments which were carried out with concentrated solutions of barium chloride on sugar beets against weevil, by means of decreasing the liquid expenditure under increased concentrations the cost of work not only decreases while the productivity of the same amount of compound on a unit of green increases, but the technical effectiveness of the compound increases as well. By decreasing the amount of consumption from 400 l/ha with the dosing of barium chloride 3 percent up to 80 l/ha 15 percent of the solution, its technical effectiveness increased from 62 up to 81.7 percent (experiments by VIZR, 1939). We may expect that in other cases, for instance with the application of concentrated suspensions and emulsions an analogous economic and technical effect will be achieved.

The scientific research work in improving the application procedure was moving mainly in the direction of revision of separate instances of technics and of introducing corresponding corrections in the existing practice. Among the work of this kind we may indicate the work of VIZR in studying the electrical load of compounds and its influence upon the effectiveness of their action, the comparative effectiveness of short exposures with high concentrations and long exposures under low concentrations of fumigant under room fumigation, of the study of the regime of the generator during room fumigation by hydrocyanic acid, working out the technics of field analysis of gas mixture during fumigation under tents and in rooms and others, the work of NIUIF in studying the conditions of the inflamation of hydrogen sulphide and its mixture with carbonic acid, the effect of steam of dichloretan and of fourchloric carbon upon metals etc.

An extensive work has been carried out also in assimilating new measures and methods in chemical control which were unknown in Russia before the October Revolution. In particular, the method of fumigation was not applied previously in controlling pests, except for a few casual experiments which did not have any practical results. At the present time the methods of room fumigation, fumigation of buildings, stall and case fumigation, gas control of hole rodents are well worked out, assimilated and have wide practice.

The method of soil fumigation is now in the process of work. The methods of surface and over surface pollination, methods of dry treating with mordant of seed grains are fully worked out, assimilated and widely applied. The working out of measures of chemical immunization of plants for the protection against fungi diseases has begun.

Finally, it is necessary to indicate the very extensive work carried out by a series of scientific research organizations for plant protection, concerning the expansion of the scope of applying the chemical method as a while, its separate forms and compounds. The application of the chemical method in controlling the Swedish fly [the frit fly, Oscinella frit], hydrogen sulphide and sulphur slag as mordants for bean seeds against bacterioses, cyanosis in controlling locust, cyanosis with polychloride in controlling the sugar beet weevil in boundary ravines, the method of poisoned attractants in controlling the cotton owlet [corn earworm, Chloridea obsoleta] etc. - these are the examples of such work.

According to the task which confronts the party and the government for the third Five-Year Plan concerning the ensurance of the further growth of the yield of agricultural plants, the scientific research work of the chemical method in controlling pests must solve the following problems:

1. To increase the technical and economic effectiveness of the operating measures by means of searching for highly effective compounds of complex action, insecto-fungicides - intestine and contact, the

Il'inskii, A. M.

application of more perfect and economically more profitable measures and methods of chemical control than the ones applied at the present time.

2. To widen the scope of applying the chemical method by working out some methods of chemical control for such insects upon which it has not been applied as yet, for instance for dusty smut, the grain rust, spottiness of fodding grass, the curling of oats and of barley, Swedish and other flies, wire worm and others.

3. To take an inventory of all the work accomplished up to present time and to transfer the most valuable accomplishments of the investigating thought into production.

4. To carry out a wide revision of the existing assortment of compounds in controlling pests and diseases for determination of the scope of application of separate objects, replacing the deficient and the undesirable for further application (formalin, AB, protars, carbon bisulphide, chlorpycrin, cyanides etc.).

5. To assist the operating organizations in organizing the supply and utilization of insecto-fungicides by means of inspection of the existing ones and of working out new standards for compounds and organizing the cultural trade of insecto-fungicides.

END OF ARTICLE

* * * * * * *

Typed 13 June 1951

Considerable efforts are expected from Soviet scientists and industry in excess of those prevailing now, to be directed towards the speediest solution of problems of mechanization of all procedures in chemical and mechanical pest and disease control. Inexpensive Soviet machinery, powerful, productive, and of superior quality should be used at collective and state farms, in orchards, gardens and vineyards.

4 June 1951 END OF ARTICLE

Lysenko, T. D.
Genetics. In Sel'skokhoziaistvennaia Entsiklopediia. Ed. 3, vol. 1. Moskva, 1949. p. 427-435. 30.1 Se42 Ed. 3.

Translated from the Russian
by S. M. Monson

Genetics represents a subject in biological science devoted to the development of organisms. It may also be referred to as a subject in science which studies heredity and its changes. Two genetical sciences are in existence today, the old and the new, which differ radically in their points of departure.

The first, Mendel-Morgan genetics, views an organism as a germ plasm distinct from the body (soma) of the organism which in contrast to the ordinary body alone possesses hereditary characteristics. According to T. Morgan, "heredity is a term which expresses the relation of the germ plasm and the results of its activity in successive generations which originated from the germ plasm." The changes in the latter (mutations) are supposedly altogether independent from the body of the organism. It follows therefore that changes (mutations) of germ plasm or of hereditary substances are independent of the conditions which affect the body of the organism. New characteristics and traits acquired by the organism as a result of environmental influence are consequently never inherited.

173

The reproduction of characteristics in successive generations is determined not by the body of the parents but by the germ plasm, the changes of which are supposedly independent from the body of the organism. Hence the Mendel-Morgan theory categorically rejects the possibility of "directed" transformation of the nature of vegetative and animal organisms through the influence of conditions of life and development. Hereditary transformations (mutations) of organisms are, according to this theory, independent from the environment. Only the development of the body of the organism but not its heredity depends upon these conditions. Heredity may change (mutation) but the nature of these transformations does not depend upon the specific influence of conditions under which organisms that had produced the changes existed. According to the Morgan theory, man may only use mutations that occur accidentally and are not controlled, i.e. hereditary changes.

This precludes finding means for directing the transformation of nature (heredity) of organisms. The Mendel-Morgan theory has therefore been always in drastic contradiction to the demands and requirements of selectors and seed growers or livestock breeders.

In contrast to the Mendel-Morgan theory, Michurin's motto was: "We cannot expect favors from nature (accidental changes, mutations); our task is to take them from her". The new Michurin genetics rejects the basic claim of the old Mendel-Morgan theory concerning the complete independence of hereditary characteristics from conditions in which plants and animals live. Michurin genetics does not recognize the existence of any hereditary substance distinct from the body of the organism. The new science understands under heredity the capacity of the living body to live, feed, grow and propagate in accordance with its nature. Transformation in the heredity of a given organism or of any individual part of its body is always the result of a change in the living body itself. Transformation of the living body is achieved by the transformation of the type of assimilation and dissimilation and the transformed metabolism.

Lysenko, T. D.

Changes in organisms, or in their individual organs and characteristics, although not always and in full measure are transmitted to the offspring, but transformed germs of new organisms are invariably obtained as a result of transformations in the parental body and the direct or indirect influence of environmental conditions upon the development of the organism or its individual parts.

Changes in heredity, the acquisition of new traits and their strengthening in a succession of generations are always determined by the conditions under which organisms exist. Heredity is transformed and gets more complex by acquiring characteristics obtained by organisms throughout successive generations. Only by controlling the environment and development of plants and animals is their nature better understood and ways found to "direct" them into channels desirable for practical agriculture.

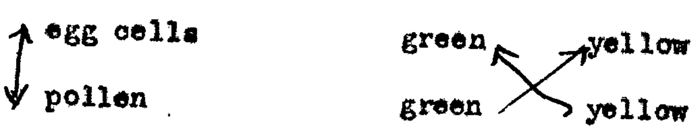
The basic points of departure in old and new genetics are therefore in direct contradiction to each other.

MENDEL-MORGANISM (CHROMOSOME THEORY OF HEREDITY)

In referring to Mendel-Morgan genetics we shall quote from statements of T. Morgan published in his article "Heredity" in 1945 in the Encyclopedia Americana. "...Beginning 1883, August Weissman in a series of articles which were frequently speculative but supported by repeated references to observations and experiments, criticised the prevailing idea that traits acquired by individuals are transmitted by germ cells and may appear in the offspring. It was proved in many instances that germ cells separate from the remaining cells already in the early stages of the embryo's development and remain undifferentiated, while other cells from which the body of the organism is formed are differentiated. Germ cells eventually become the basic part of the ovary and sperm. They are therefore by origin independent from the rest of the parts of the body, nor were they ever a part of the latter. The body protects and feeds them but does not affect them in any other way (that is, does not transform them, T.L.). The germinal path represents an inexhaustible flow which separates body cells in every generation, the purpose of which is to preserve germ cells. All new transformations appear first in germ cells, in characteristics of specimens which developed from these germ cells. Evolution is of a germinal and not a somatic (i.e. bodily, T. L.) nature, as was formerly believed. This concept concerning the origin of new characteristics is at present accepted by almost all biologists." Heredity is consequently determined by the preservation in the germ plasm of those elements, old and new alike, which were produced in it from time to time. Germ plasm represents the "capital" (storehouse) of a variety in which new specimens in each generation spend only the "interest".

Mendel discovered the authentic (true) mechanism of heredity... It was subsequently found that his laws apply not alone to characteristics of cultivated plants and domestic animals and such external characteristics as color, but also to the characteristics of wild animals, to dintinctions in species and the most fundamental characteristics in living beings. The Mendelian law of segregation established that elements transmitted by two parents to their offspring came in pairs and that in the formation of germ cells of the offspring the members of each pair separate from each other in such manner that every germ cell contains only one member of each pair. Mendel, for instance, crossed the green-seeded pea variety with a yellow-seeded pea variety; the result was all yellow seeds in the offspring. Yellow clearly dominated green. If plants from these hybrid seeds are self-pollinating (or crossable) they produce yellow and green seeds in the proportion of three yellow to one green. Green seeds are pure and always produce only green seeds. It was found, however, that yellow seeds were of two kinds. One part was pure with regard to yellow color and always produced yellow offspring. The other, a hybrid, produced both yellow and green seeds in the proportion of three to one. Seeds of the second generation were obtained in the proportion of one pure yellow, two hybrid yellow, one pure green. Mendel observed that if the original green ancestor had contributed the green element, while the yellow ancestor had provided yellow color, these contrasting elements form pairs of hybrids of which the members separate (from each other) in forming germ cells (gametes). As a result one half of the egg cells will contain yellow and the other green color. In the same way one half of the pollen grains will contain yellow, the other half green. Accidental combinations of egg cells and pollen produce thus the following combinations: One green green, two green yellow, one yellow yellow.

Follows sketch:...



The second Mendelian law relates to cases which refer to more than one pair of characteristics. It was discovered that the tall and short stature of peas offered contrasting traits which segregate (split) in the same manner as do the yellow and green colors. If a tall yellow-seeded stature is crossed with a short green-seeded one, the segregation of each pair will not depend upon the segregation of the other pair, so that a quarter of the egg cells of such hybrid will contain elements of tall yellow-seeded stature, another quarter tall green-seeded; a third quarter short green-seeded plants, and the last quarter short yellow-seeded stature.

In pollen formation four types of gametes are produced. Accidental fusions of egg cells and pollen produce 16 combinations. So long as yellow dominates green, and tall stature dominates short, there will be nine tall yellow in the second daughter generation (F_2); three short yellow; three tall green; one short green. Consequently, during the maturation of germ cells when the segregation of members of each pair of hybrids occurs, the division of every pair occurs independently from the other.

This is the substance of Mendel's second discovery which may be named "the law of independent segregation".

Mendel proved that three pairs of characteristics conduct themselves in the same manner, i. e. segregate their genes independently, and there is reason to believe that this law is applicable to all cases where genes, which determine two or more pairs of characteristics, are found in different pairs of chromosomes. But, as will be shown below, their segregation is determined by a third law of heredity, i.e. the law of linkage ("stseplenie").

Units which supposedly represent hereditary traits in a certain sense, are usually called genes, and the term "genetics", or the study of the conduct of genes, has in contemporary science replaced the old term "heredity" with the latter's manifold meanings. Mendel's traits are frequently referred to as individual traits and it is sometimes supposed that the gene directly forms every such characteristic. Nevertheless, there is proof in support of the fact that the so-called "individual trait" represents only one of the numerous manifestations of actions of the gene which the latter may always produce together with many and all other genes. Thus the germ plasm is viewed as the total sum of all genes, the joint conduct of which is responsible for every characteristic of the body. While the latter is formed by the inter-action of substances, formed by genes, genes act as independent units which gather in pairs and then segregate. Genes which are distributed in different pairs of chromosomes, segregate independently from each other, while genes located in one chromosome are linked.

Contemporary work on cells has unfailingly pointed to the mechanism with the aid of which segregation and distribution of chromosomes are accomplished. Every body cell or immature sexual cell contains the double set of chromosomes (with the exception of males of certain groups which lack one of the sexual chromosomes). One member of every pair originates from the male parent, the other from the female parent. In the process of maturing the female and male chromosomes pair with each other, like with like. Next, at the so-called reduction division ("delenie"), one member of each pair passes into a daughter cell, the other into another daughter cell. If chromosomes contain genes, female and male genes will segregate during the reduction of chromosomes in forming gametes. But during the reduction division there is no separation of maternal and paternal chromosomes, instead each pair of chromosomes separates independently from the rest of the pairs. As a result daughter cells may obtain any possible combination of paternal and maternal chromosomes, but always only one member of every pair. This situation fully satisfies the conditions of the Mendel law with regard to independent segregation.

It is evident, nevertheless, that if (as is supposed) chromosome threads are carriers of genes and if, as is usually accepted at present, threads represent structural units which do not vary even in dormant cells, genes should be inherited in groups to conform with the number of chromosomes. Beginning in 1906 the number of known cases of linked genes has risen steadily and at present there is no doubt concerning the fact that this represents a characteristic of Mendelian heredity. A test made with the fruit fly Drosophila ampelophila established that 200 known hereditary distinctions are inherited in four groups that correspond to four pairs of chromosomes. Thus the Mendel law of segregation found its confirmation in the cytological mechanism of reduction in sexual cells, while the law of independent segregation is confirmed by the distribution of chromosomes.

The discovery of the significance of linkage subsequently led all basic regularities into complete correlation with the chromosome mechanism. It was found, however, that the "individualism" (unity? discreteness?) of chromosomes which provoked linking is not absolute, since it was also proved that members of one pair occasionally "cross-over" their equivalent parts. But this crossing-over follows a definite pattern and while it complicates results, it does not undermine the general principle. Crossing-over takes place only in females (Drosophila) in some species, in other species only in males (silkworm), while in still other species crossing-over occurs in both sexes, as it does in monoecious plants.

The inheritance of sex was one of the great biological discoveries of our century. It established that the sex factor or factors are located in special chromosomes, so-called sex chromosomes. In some large groups (mammals, the majority of insects, etc.) the presence of two of these chromosomes, called x-chromosomes, produce a female and the presence of one of them produces a male. Thus the female is represented by XX, the male by X. In the process of reduction division, the female eliminates one x-chromosome from the egg; each egg contains therefore only one x-chromosome. The male has only one x-chromosome which under reduction division is transferred to one of the two cells of the sperm, as a result of which two types of spermatozoa develop. During fertilization, accidental union of any egg with any spermatozoa produce two types of two x-chromosomes (female) and one x-chromosome (male). This mechanism ensures numerical sexual equality. In other groups (birds, butterflies) the proportion is reversed, the male has two x-chromosomes, the female only one. Consequently, all spermatozoa contain only one x-chromosome, one half of the eggs carries an x-chromosome, the other lacks it altogether".

These are the fundamental points of the chromosome theory of inheritance in T. Morgan's presentation which form the basis of his theory.

CRITICISM OF THE CHROMOSOME THEORY OF INHERITANCE

At the basis of the chromosome theory lies Weissman's absurd statement concerning the uninterruptedness of germ plasm and its independence from soma, a factor already rejected by K. A. Timiriazev.

The Morgan-Mendelists, following in Weissman's footsteps, proceed from the premise that parents are not the parents of their offspring. That the latter and their parents are merely brothers and sisters. Parents and offspring, moreover, do not appear as such. They are only side products of the inexhaustible germ plasm. The latter is completely independent of its side product, i.e. the body of the organism.

All this is stated in T. Morgan's article. It suffices to call attention to the first part of the above excerpt presenting the Weissman theory as the basis for the chromosome theory of inheritance. Let us quote them:

"Germ cells eventually become the basic parts of the ovary and sperm. They are thus independent from the remaining parts of the body in origin, nor were they ever a part of the body. Evolution has a germinal and not somatic nature, as was formerly believed. This concept concerning the origin of new characteristics is at present accepted by almost all biologists."

The same, only in greater detail, is told in an article by Castle, "Genetics", published in the same issue of the American Encyclopedia. In referring to the fact that an organism usually develops from a fertilized egg, Castle proceeds to provide "scientific" basis for genetics. Let us refer to them.

"Parents actually do not produce any offspring, nor do they produce a cell from which an offspring is obtained. The parental organism presents no more than a "side product" from which a fertilized egg originates. The direct product of zygotes are other productive cells, similar to those from which they originated... It follows, therefore, that heredity (i.e. the resemblance between parents and offspring) depends upon the intimate bond between productive cells from which the parents originated, and those cells which produced the offspring. The latter are the direct, immediate products of the former. This principle of the "uninterruptedness" of the germ substance represents one of the fundamental principles in genetics. It indicates why changes in a body produced in parents by the surrounding environment are not inherited by their offspring. This is because the offspring are not products of the parent body but only products of the germ substance surrounded by that body. Credit for the original interpretation of this factor belongs to August Weissman. He therefore must rightly be considered one of the founders of genetics."

The above statements of Mendel-Morganists are fundamentally wrong (chromosome theory of heredity). They do not conform to reality. While these statements are fully shared by proponents of the Mendelian-Morgan theory in the Soviet Union, they are, as a rule, not openly expressed. Nor are they referred to in articles and lectures on the subject from fear of ridicule on the part of readers and listeners who are well aware that germs of organisms or sexual cells represent one of the results of the life activity of parental organisms. Only by withholding fundamental statements of Mendel-Morganists in front of people unfamiliar with the life and development of plants and animals, will the chromosome theory of heredity appear orderly and in some measure correct. By assuming the absolutely correct and well-known fact that sexual cells or germs of new organisms are produced by the organism and its body and not by the sexual cell from which the mature organism originates, the entire orderly chromosome theory of inheritance is completely upset. This circumstance, nevertheless, does not minimize the role and significance of chromosomes in the development of cells and organism.

Mendel-Morganism, pretending to have discovered the laws of the development of living bodies (laws of inheritance) completely refutes their very development. According to their reasoning the chicken is developed from an egg. But the egg is not produced by a chicken. Eggs are produced directly only from eggs. The body of a chicken may not affect the offspring in any way since the organism is supposedly unable to produce any offspring. The latter is created only indirectly from the same egg that created the organism. In other words, development does not enter into offspring and invented, "uninterrupted (?) germ plasma" alone produces offspring. The chromosome theory of inheritance is based on this scholastic foundation. Instead of uninterrupted life produced in the development of egg-organism-egg, the Mendel-Morganists substitute the uninterruptedness of the "germ plasma" (egg-egg). The development of the living body is therefore shut off from their sphere of vision.

The basic characteristic of the Mendel-Morgan theory is the detachment of the organism from its environment. Since life is detached from its environment, it cannot grow, develop or exist, and, consequently, does not possess hereditary characteristics. Mendel-Morgan genetics were therefore forced to recognize the connection between the body of the organism and existing conditions in the construction of their theory of inheritance. In taking this proper step, they were bound to commit a grave error. They removed the basic capacity of a living organism (inheritance) from its body. According to their reasoning, only the chromosomes of cells have "hereditary substance." Hence the designation: "Chromosome theory of inheritance".

At the base of this theory was the fact that chromosomes are not related to the ordinary body, that they consist of a special substance to which only heredity belongs. The rest of the body of the organism apparently does not possess heredity. This led to the conclusion that the organism and every one of its cells consist of an ordinary body (soma) and a hereditary substance (chromosome). But, according to Michurin, the organism consists only of an ordinary body. There is no separate body of hereditary substance in the organism of cells.

Heredity is possessed not only by chromosomes but generally by the living body and every particle of it. It is therefore wrong to conclude that because chromosomes possess hereditary capacity, they may be considered special hereditary substances in the organism and cell. There may be different organs in the organism, including organs of propagation, but there can never be an organ of heredity. To search for a special organ of heredity in the organism is equal to searching for the life organ in an organism.

Changes in heredity, connected with changes in chromosomes, do not speak for but against the chromosome theory of inheritance which asserts that the change of the living body does not involve changes in traits of inheritance.

Morganists have themselves accumulated numerous data in support of the fact that morphological changes in any organ of the body, i.e. chromosomes, are fairly accurately transmitted by heredity under the influence of an external environment. The change in chromosomes acquired in the process of individual development of the cell or organism will, as a rule, always be transmitted to daughter cells by heredity. Does this not testify to the transmittance of traits acquired by heredity? Do not the fact of changes in chromosomes and the transmittance of these changes by heredity serve as a refutation of the chromosome theory of inheritance? The entire factual cytological part of the chromosome theory confirms the Mendel-Morgan theory only formally. The factual cytological material fundamentally contradicts it.

Lysenko, T. D.

It is true that chromosomes exist. Their number in sexual cells is half that in ordinary cells. When sexual cells with any chromosome changes are present, changed organisms are obtained. It is true that any observed, morphological changes of a studied chromosome cell are frequently or almost invariably followed by changes of any traits in the organism. It has been proved that the presence of two x-chromosomes in a fertilized egg of the Drosophila usually settles the question of male or female produced from this egg. All these facts and other factual data are true. It is indisputed that the changed egg or its chromosomes produce a changed development of the entire or individual plots of the body of the organism, but it is equally indisputed that changed conditions in the external environment may transform the process in the construction of the body, including the construction of the chromosomes and the germ cells for the future generation in general. In the former case the germs (egg), changed by conditions in the external environment, produce changed organisms; in the latter, the organism changed by conditions of the external environment may produce changed germs. But the latter statement is fully rejected by Mendel-Morganists, and here lies their fundamental error.

The development of an organism may not be understood correctly, nor its uniformity disclosed if the organism is not accepted for study in its dialectic unity with conditions of life. The very fact that a living body, when deprived of necessary living conditions stops to exist speaks in support of the dialectic unity between the organism and its environment. All living matter depends not only upon conditions of the external environment but it all originated under certain conditions at one time from non-living matter. Vegetative and animal forms were produced by living conditions, those of external surroundings. The organism, having its origin in an egg, builds its body with all its characteristics, including the basic characteristic which is heredity.

Heredity is the capacity of a living body to live, grow, develop, propagate in a definite, specific manner. The characteristics of heredity may only be understood through the study of conditions required by the organism for the construction of a living body, i.e. a body possessing the trait of heredity. Agricultural techniques by "directing" living conditions of plant organisms find in agricultural practices new methods for increasing the productivity of plants. Only in this manner is it possible to transform the nature (heredity) of organisms. Proceeding from these general aspects, Michurin genetics develop concrete ways and methods for controlling the nature of vegetative organisms.

MICHURIN GENETICS

I. V. Michurin created a new agro-biological theory based on his highly valuable varieties of fruit and berry plants. This theory is widely accepted in the Soviet Union. According to the principles of Michurin's theory, the organism and the conditions essential for its existence should be represented as a unit.

Different living bodies require different conditions for their development. We realize therefore that they possess different natures and a different heredity. Heredity is the capacity of a living body to require definite conditions for its existence and development, and to react in a definite manner upon conditions.

A knowledge of natural requirements and the relations of an organism to the external environment offer the opportunity to control the existence and the development of an organism. Equipped with this knowledge we are able to transform the heredity of organisms in a manner desired by man.

The difference in the above approach to the study of heredity from the approach of geneticists of the Mendel-Morgan group may be demonstrated by the following example. ~~The~~ Mendel geneticists repeatedly studied the heredity of winter and summer cereal crops. Winter varieties were crossed with summer varieties for this purpose and the progeny established how many plants were winter crops, i.e. resembled one of its parents in this respect, and how many were summer crops, i.e. resembled the other parent. The final conclusions were that hereditary traits of winter crops differ from those of summer crops by one or a large quantity of genes, i.e. particles of some unknown substance supposedly contained in the chromosomes of cells of winter and summer plants. What actually represents the essence of winter or summer traits in plants and how the development of these traits should be controlled remained unexplained in this study.

Michurin genetics calls for a totally different approach to the study of heredity. In studying the causes of non-tillering of winter crops during spring sowing it was established that one of the processes in the development of winter plants, called the stage of vernalization, requires in addition to spring nutrition under field conditions, moisture, and air, also a relatively prolonged period of reduced temperature (0-10°). The lack of a prolonged period of reduced temperature under spring field conditions interferes with the process of vernalization and causes the delay in future processes, tillering and fruit bearing. By establishing the nature of the stage of vernalization it became possible to compel any winter crops to tiller and bear fruit. Prior to planting, moistened seeds are maintained for this purpose under relatively low temperatures. This satisfies the hereditary requirements for the development of the above process. Once the latter is completed all subsequent hereditary requirements of winter plants will be met under prevailing field conditions and their development will proceed normally up to the time of the germination of seeds. This study reveals the essence in heredity ~~of~~ with regard to winter and summer crops.

Every living body builds itself in its own way from the external in accordance with its heredity. This accounts for the variety of organisms in one environment. As a rule, every generation of plants or animals in many respects develops as do their predecessors, especially those nearest to them. The reproduction of identical species represents a general characteristic of a living body.

In all cases when an organism finds conditions in its environment corresponding to its heredity, its development proceeds in the manner it did in preceding generations. In instances, however, when organisms do not find desirable conditions and are obliged to assimilate those in an unsuitable external environment, the result is the production of organisms or individual parts that differ in some form from the preceding generation. If the transformed part of the body is of initial significance to the new generation, the latter will differ in its requirements and nature from the preceding generation.

The cause for the transformation of the nature of living organisms is the change in type of assimilation and type of metabolism. For instance, vernalization of summer crops does not require reduced temperatures. Vernalization of summer crops proceeds normally under ordinary summer and spring temperatures. If, however, the period of vernalizing summer crops under reduced temperatures is prolonged, one frequently observes that summer plants will be transformed into winter crops in two or three generations. It is known that winter crops are unable to go through the process of vernalization without reduced temperatures. This illustrates that the offspring assimilated the new characteristic, their demand for reduced temperatures, while changes in their requirements, i.e. the heredity of the living body, correspond to the reaction of environmental conditions.

Sexual cells and any other cells through which organisms propagate are produced by the transformation of the entire organism, and by metabolism. The course which the development of an organism follows accumulates in cells dominating in the new generation. One may therefore claim that the "degree" to which a body (let us say that of a plant) is produced determines all its characteristics, including that of heredity.

The development of different cells in the same organism and the development of individual processes require different conditions from an external environment. In addition, these conditions are assimilated in various ways. It is necessary to stress that assimilated conditions are external, those which do the assimilating of the internal conditions. The life of an organism proceeds through an innumerable number of regular processes and transformations. The food absorbed by the organism is assimilated by the living body from the external environment through a chain of varied transformations from external to internal conditions. The internal, i.e. the living substance, when crossed-over with substances of other cells and particles of body, feeds them and thus acts as the external factor in relation to them.

An organism may never entirely realize all its hereditary potentialities. Many traits are not fully developed and remain undeveloped in some measure (recessive) without substantially reflecting upon the development of the organism as a whole. These traits may develop in subsequent generations, if necessary conditions prevail in the external environment. Different processes and the development of various characteristics carry different significance for the life of the organism. The development of the organism as a whole may depend in a lesser degree upon the development of some characteristics and in a greater degree upon the development of others, and finally may depend in such measure upon a third group that it may not develop or exist without them.

Two types of qualitative transformations are observed in the development of vegetative organisms.

1. Changes connected with the realization of individual development, when natural demands, i.e. heredity, are normally met in suitable conditions of an external environment. The result is the production of a body of the same heredity as of the preceding generation.

2. Racial transformations, i.e. changes in heredity; these are also the result of individual development but deviate from the normal, common course. Hereditary changes usually result from the development of an organism under conditions of an external environment which in some form or other do not meet their natural requirements, i.e. their heredity.

Changes in living conditions produce changes in the development of vegetative organisms. They represent the primary cause of changes in heredity. All organisms which cannot adapt themselves to changed living conditions are unable to survive, nor do they leave any offspring.

Organisms and their nature are produced only in the process of development. A living body may also change outside of the process, but such change will not be characteristic for living bodies.

Numerous facts indicate that changes in different parts of the body of a vegetative organism are frequently not fixed in the same manner or are assimilated in the sexual cells, i.e. in "products" of propagation.

This may be explained by the fact that the development of every organism, of every particle in a living body demands relatively definite conditions from an external environment. These conditions are selected from the surrounding environment by the development of every organism and its characteristics. Hence, if any part of the body of a vegetative organism is compelled to assimilate relatively uncommon conditions, is transformed as a result of this and differs from analogous parts of the body of a preceding generation, the substances trammitted by this part of the body to adjoining cells may not be selected by the latter and not be included into the subsequent chain of necessary processes. The union of the changed part of the body of the vegetative organism with other parts of the body will naturally prevail, since it may otherwise not exist, but this union may not be entirely mutual. The changed part of the body will be nourished by the adjoining parts, but it will not transmit its own specific substances since the adjoining parts will not select them.

This explains the frequently observed fact of any changed organisms or characteristics of an organism not being reproduced in the offspring. Changed parts of the body of the paternal organism always possess a changed heredity. Gardening and horticultural practice have known this long ago. The changed branch or bud of a fruit tree or the eye of a potato tuber may, as a rule, not influence the heredity of the offspring of the respective tree or tuber, which do not immediately originate from changed parts of the parent organism. If the changed part is, however, grafted and grown as a separate, independent plant, the latter will generally fully possess the changed heredity, the one that had prevailed in the changed part of the parent body.

The degree of the ability to transmit changes will depend upon the degree of inclusion of the substance of the changed part of the body into the general process leading to the formation of reproductive sexual or vegetative cells.

Variability of processes in the development of organisms and characteristics may always be adapted to the conditions of an external environment under the influence of which it takes place, but one should bear in mind that the adaptable variability is not always expedient for the organism as a whole. A relative expediency, the harmony of plants and animals in nature is created only by natural selection which includes heredity, variability and viability. By knowing ways to "create" the heredity of an organism it is possible to "direct" its transformation by creating certain conditions at definite moments of its development.

Good varieties of plants, as well as good breeds of animals have always been produced in practice only under conditions of good agro-technique and superior zoo-technique. Poor agricultural practices will not produce good results from poor varieties but in many instances even superior cultivated varieties will after several generations become inferior. The principal rule in seed growing practice is to raise plants on seed plots as carefully as possible. Good agricultural conditions are essential for this purpose, those meeting the hereditary requirements of the respective plants. Among well developed plants the best are selected for seeds. In this manner plant varieties are improved in practice. Under poor agricultural techniques, however, selection among the best plants will fail to produce any results. All seeds will be poor and the best among them will still be poor. The chromosome theory of heredity recognizes the possibility of obtaining hybrids by sexual methods only, although Darwin and several other prominent biologists recognized the possibility of obtaining vegetative hybrids. They admitted the possibility of producing one species from a mixture of two by sexual crossing and also by vegetative crossing. I. V. Michurin not only recognized the possibility of vegetative hybrids but also developed the Mentor method. This method consists in grafting branches of any varieties of fruit trees to the crown of a young variety, with the result that the characteristics lacking in the latter are absorbed and transmitted from grafts. With the aid of this method, Michurin produced and improved many new superior varieties.

His followers found means of obtaining mass vegetative hybrids. Vegetative hybrids represent convincing proof of the accuracy of Michurin's understanding of heredity. At the same time they represent an unconquerable obstacle to the Morgan-Mendel theory.

Non-formed organisms which did not complete the cycle of their development will when grafted always change, compared to non-grafted plants. In grafting an organism of a different variety is obtained, i.e. a wilding (stock) and a scion. By gathering and planting seeds from either wilding or scion it is possible to obtain a generation of plants of which individual representatives will possess characteristics not only of the variety from which the seeds were taken but also the other to which it was grafted.

Wilding and scion were unable to exchange chromosomes of the nucleus of cells but the hereditary characteristics may nevertheless be transmitted from wilding to scion and vice versa. Consequently, plastic substances produced by wilding and scion equally possess natural characteristics, i.e. heredity.

A vast amount of factual data assembled on the vegetative transmission of various characteristics of potatoes, tomatoes, and many other plants leads to the conclusion that vegetative hybrids are in principle not different from hybrids obtained by sexual method. Any trait may be transmitted from one variety to another by graft, as well as by the sexual method. The conduct of vegetative hybrids in successive generations is also identical with the conduct of sexual hybrids. In planting seeds of vegetative hybrids without further grafting, such as tomatoes, for instance, the hybrid characteristics of plants of the preceding generation are obtained in plants of the succeeding generation. The factor of segregation ("rasshcheplenie"), frequently observed in generations of sexual crossings, takes place also in seed generations of vegetative hybrids. Only in the latter the so-called segretation ("rasshcheplenie") is observed more frequently and in larger measure, whenever a mosaic characteristic of the body of the organism is obtained.

Representatives of Mendel-Morgan genetics are unable to obtain not only "directed" changes in heredity but they categorically deny the possibility of transforming heredity to match (relatively) the influence of the external environment. Following the same Michurin principles it is possible to transform heredity to conform with the influence of living conditions. For instance, A. A. Avakian and other scientific students obtained by means of suitable growing many hereditary summer forms from winter forms. Hereditary summer forms of summer wheats were obtained from all varieties of winter wheats experimented on. An entire group of summer wheats and barleys was equally transformed into winter crops.

Tests for transforming summer and winter cereals into more decidedly winter crops for Siberian severe winters are of considerable interest in obtaining frost resistant varieties. We already have winter wheats obtained from summer wheats which do not lack in frost resistance and frequently excel the best frost resistant varieties known in practice.

Many experiments show that in eliminating the old established characteristic of heredity, such as the characteristic of wintering, a new characteristic (in this case the summer characteristic) is not immediately acquired. The majority of these instances apply to the so-called "shattered heredity".

Vegetative organisms of shattered heredity are those which have lost their conservatism and where the selectivity to conditions of the external environment has been weakened. These plants preserve or acquire anew the tendency to prefer some conditions to others.

Shattered heredity may be obtained from:

1. grafting, by connecting tissues of plants of different varieties.
2. by influencing the development of conditions of the external environment at definite times.
3. by crossing, especially forms which differ radically in their habitat or origin.

The foremost biologists, Burbank, Vilmorin, and especially Michurin have paid considerable attention to the practical significance of vegetative organisms of shattered heredity. Plastic vegetative forms of unestablished heredity, obtained in one form or another, should be planted from generation to generation under conditions desirable to produce ~~in~~ the respective organisms.

In the great majority of plants and animals new organisms are developed only after fertilization, the union of male and female cells. The biological significance of processes of fertilization consists in obtaining organisms of dual heredity: maternal and paternal. Dual heredity provides for the greater viability of organisms and their greater adaptability to changing conditions of life.

All common (non-sexual) cells when developed are divided into two kinds; this is the manner in which cells propagate and the body grows. Sexual cells do not divide, however, into two once their development is completed, but on the contrary, normally one cell is produced from two sexual cells (female and male); which is usually more viable, compared to a single one.

Both female and male cells possess the characteristics of their respective genes in full measure. The species is different in various degrees. After obtaining zygotes (the fertilization of the female sexual cell), one cell is produced from two cells, representing the beginning of an organism with racial characteristics of each form. Based on the contrast obtained from both relatively different sexual cells, viability is either produced or strengthened and so is the capacity for transformation. This determines the biological necessity for crossing forms which differ from each other even slightly. Darwin repeatedly stressed the natural law of the practicability of crossing and the biological harm of self-fertilization.

Lysenko, T. D.

Rejuvenation, strengthening of viability in vegetative forms may proceed by vegetative, non-sexual method. It is achieved by the living body assimilating new, unusual conditions from an external environment. In vegetative hybridization it is possible to observe rejuvenation and strengthened viability of organisms in experiments intended to produce winter crops from summer crops or vice versa.

K. A. Timiriazev gave a correct classification of facts for the different behavior of sexual hybrids. He divided factors of heredity into two groups: simple and complex factors.

It is known that self-pollinating plants such as wheat, or plants propagated by tubers, grafting, cuttings, etc. possess, as a rule, maternal hereditary traits in a more pronounced measure. This hereditary form Timiriazev named "simple".

In crossing the heredity of two organisms is usually united. This he called "complex". The latter may, depending upon the forms in which it appears, is in turn divided into several groups.

In some animals one spot of fur resembles the male parent, the other the mother; or in plants, some cells of the epidermis of leaves resemble the paternal, others the maternal plant, etc. This heredity is called "mixed". The distinction may vary, ranging from large to microscopically small size.

Most frequent are cases where hereditary traits of both parents are found in the progeny; when new characteristics do not appear in the progeny in pure form. Timiriazev calls the latter heredity "fused" and attributes much significance to it.

Lysenko, T. D.

There are cases when contrasting parental traits do not mix in the hybrid offspring. For instance, in crossing varieties of green seeded peas with yellow-seeded specimens, characteristics do not fuse. New or average characteristics are not obtained and the characteristic of only one parent is produced; the characteristic of the other parent is somehow eliminated. This form of heredity is called "conflicting".

In a conflicting heredity two categories of facts are observed. To one category belong instances when hybrid organisms are uniform in the first and all succeeding generations. In other words, the hybrid progeny does not vary, does not segregate in future generations; the characteristics of one parent are frequently completely absorbed. This form is called "Millardeism", after the French scientist Millardet, who studied these hybrids at great length.

The other category of conflicting heredity refers to cases of the so-called Mendelism. In these instances, beginning with the second generation, the hybrids show segregation and variation, one form possessing the paternal characteristics, the other the material.

It is now evident that different variations of hereditary forms may take place in vegetative hybridisation.

Vegetative hybrids exhibit mixed forms of heredity when one part of the organism shows characteristics of one variety and the other part characteristics of another component. There are also instances of fused and conflicting heredity.

Acceleration of development is also noted in vegetative hybrids; as well as lowered viability, as in sexual hybridization. This does not indicate there is no distinction between sexual and vegetative hybridization.

But it is important to stress the similarity in hereditary forms among vegetative and sexual hybrids. They are not separated from each other by an inpenetrable wall but represent factors of one order. By regulating the conditions of an external environment it is possible to direct, transform and produce varieties of desired heredity.

HEREDITY is a concentrate of conditions of an external environment, ~~which are~~ assimilated by vegetative organisms during many preceding generations. By skillful hybridization, by the fusion of varieties by sexual methods, it is possible to produce in one organism all that has been assimilated and strengthened (from the non-living into the living) in many generations in crossing. But according to Michurin, no hybridization will produce affirmative results if conditions that contribute to the development of traits are not produced, the hereditary characteristics of which it is desired to obtain for the variety under production or its ~~to be~~ improvement.

One should remember that non-living nature is the origin of living nature. The living body builds itself from conditions of the external environment and thereby transforms itself.

End of Article

****

References: Darwin, Chas. Transformation of animals and plants in their domestic state. M.-L. 1941

Darwin, Chas. Origin of Soecies. M.-L. 1937

Lysenko, T. Agro-Biology, 4th ed., M. 1948

Michurin, I. V. Works, vol. I - IV, 2nd ed., M., 1948.

On conditions (situation) in biological science. Stenographic report of session of All-Union Lenin

Lysenko, T. D.

Academy of Agricultural Sciences, of July 31, August 7, 1948, M. 1948.

Timiriazev, K. Works, vol. VI - VII, M. 1939.

Typed 14 June 1951

Transl. 174: ~~Plant Protection~~ also Phytoncides

R-137

Bordukova, M. V.
New developments in the control of phytophthora. Sad i Ogorod, No. 9, p. 62-65, Sept. 1947. 80 Sa13

Translated from the Russian by S. M. Monson

Translator's Copy

The most resistant and highest yields of potatoes are obtained at Moscow, Leningrad and Smolensk oblasts, Belorussian SSR, the black earth belt region, Western and Eastern Siberia, and other sections where the end of summer is warm and humid. However, the highest percentage in loss of crops is equally obtained in these localities. Loss in potatoes is caused by phytophthora, which appears towards the end of summer in the form of dark, brown spots on the plant's leaves. In early morning, when the dew is on, a whitish flocculent down is observed on the dark spots which represent the fruiting of the fungus. They consist of conidia and conidia carriers (ill. 1, p. 62). Conidia develop in a drop of water (dew or rain) on the potato foliage or penetrate directly into the fungus thread (ill. 2, p. 62) which enters the tissue, or zoospores are formed within the conidia at temperatures of the air of 6 - 13° C; 300 spores abandon the conidia and swim freely in water (with the aid of two flagella), and later develop mycelium (ill. 2, 3, 4, p. 62 and 63); the fungi penetrate the tissue of the leaf (ill. 5), spread and cause the cells to die. In place of the dead cells a spot is formed (ill. 6). The phytophthora fungus is the inducer of that disease. The new tubers are eventually infected by the diseased foliage.

This disease has been raging in Europe for over one hundred years and investigators of all countries have been engaged in studies of phytophora and of methods to control it for as many years. Many agricultural techniques were proposed to reduce in some degree the percentage of diseased tubers. Among these were supplementary hilling proposed by Putsch in 1827, treading and crushing of the foliage, as suggested by Vol'ni? (1897), etc. A multitude of poisons were tested in this connection.

There are, ~~however~~, no radical means for controlling phytophthora to date. The Scientific Research Institute of Potato Industry is engaged not only in verifying (checking) all known methods of controlling phytophthora, but in finding a new vegetative fungicide.

There is no doubt that such a vegetative fungicide exists. Numerous observations convince us in this supposition in noting the different degrees of contamination of potatoes by this disease. Plants of the same variety and age, grown in practically identical conditions with regard to relief of location and the physical structure of the soil, given the same amount of fertilizers, same moisture and density of planting, etc., are affected in different degrees in a year of severe outbreak of phytophthora. The foliage rots completely in the course of several days in the majority of plants, but on the same field, against the background of destroyed potatoes, it is possible to find altogether healthy specimens.

The history of this problem is extremely scant, although convincing. We know on the basis of literary data that the population of the American Andes improved the keeping quality of potatoes by using a grass called "munia", smelling like mint, for layers in storing potato crops.

In the belief that the presence of some poisonous grasses interfered with the development of phytophthora, we tested, in 1941, such plants as "durman" [Datura stramonium], "belena", henbane [Hyoscyamus niger], "snit'", gout weed [Aegopodium podograria], etc. The war interrupted our work in this direction. But even those few experiments established that plants which are poisonous to man and animals are far from poisonous to phytophthora.

Bordukova, M. V.

The matter evidently lies not in poisonous plants, but in the phytoncides they possess and concerning which Tokin in his work "Vegetative bacteriocytes" writes: "Science does not know as yet what phytoncides are. They possibly are chemical substances of complex structure or are "rays" of unknown origin." Fungi react differently in the presence of various phytoncides. We tested about 130 plants of different families and made close to 150 experiments in order to establish the most active phytoncides and their reaction upon the development of phytophthora. Experiments on testing plants were made in special grass vessels-exicators?. At the bottom of the vessel were placed crushed leaves of the plant under test. Above them on glass bars, were placed artificially infected cut potato slices or entire tubers. The vessel was covered with a glass top.

In the very first series of tests seed garlic [Alliaria DC - Erysimum Alliaria Scop] revealed drastically its interference with the development of phytophthora. If on control tubers (i.e. infected tubers, kept away from the influence of garlic), the disease appeared on the 5-6th day, on tubers exposed to phytoncides on crushed garlic, there were no signs of infection even on the 12th day. Numerous tests conducted in the laboratory with artificially phytophthora infected potatoes invariably gave positive results.

The effect of these experiments is better understood if the direct action of phytoncides of garlic upon the fungus is examined. Usually the zoospores of the fungus are capable of floating freely in a drop of water with the aid of flagella, for as long as 20-30 minutes. But as soon as a particle of crushed garlic is introduced into the drop filled with active zoospores, the movement of the latter stops within 20-60 seconds.

Bordukova, M. V.

If a small quantity of garlic is placed close to the drop filled with zoospores (i.e. when only the smell of garlic affects the zoospores), they become immobile after one and a half, two minutes.

The immobility of zoospores nevertheless does not signify the loss of their viability; our subsequent experiments established the duration of the action of phytonoides of garlic. It appeared that if one drop of garlic juice is introduced into 100 cub. cm. of water filled with zoospores, the latter lose their capacity for growth entirely in four hours. Prior to that they remain in a sort of paralized condition.

Of equal importance is the knowledge of how deep the garlic phytoncide penetrates into the tissue of the tuber. Is it capable to prevent infection in the event that the fungus already penetrated the tuber? It is to be noted that the penetration of the fungus into the tissue of the tuber lasts from 5 to 8 hours. The experiment with ten infected tubers established that garlic phytoncides ~~do~~ prevent ~~even~~ the infestation of tubers, the tissue of which the fungus has already penetrated.

How garlic was used	The time Garlic was Used			
	Immediately after infestation	after 8 hrs	after 15 hrs	after 24 hrs
	Number of diseased tubers			
Garlic skin (peeling)	10	10	10	10
Exposure to garlic for ten days	0	0	10	10
Tubers smeared with crushed garlic	0	0	10	10
Control - infected tubers stored without garlic	10	10	10	10

Bordukova, M. V.

In all variants of this test the influence of garlic was observed for 12 days. Having convinced ourselves that garlic phytoncide stops the development of the fungus phytophthora, we started to prepare an experiment on 100 kg of potatoes. Finely crushed garlic was strewn at the bottom of a box where potatoes were later stored. Next was placed a layer of artificially infested tubers (two tubers thick), then garlic, alternating again with potatoes and garlic. The top layer was garlic. Artificially infected tubers of potatoes, not exposed to garlic, were used as control.

All tubers were kept under conditions favoring the development of the disease. Moisture of 100 percent and the temperature of 20-21° C. were maintained in the box where potatoes were stored. The tubers were lightly covered with paper to prevent suffocation.

Seven days later control tubers were infested 100 percent; of tubers under test 84.8 percent had remained completely healthy and 15.2 percent were infested with phytotophthora.

To preserve almost 100 kg of potatoes one head of garlic (ab. 100g) had sufficed. Garlic rots eventually but this does not affect the tubers. Not all varieties of garlic react similarly, however. Some possess a yet unknown, disinfectant substance in large amount, others possess smaller amounts. The study of varieties of garlic will be continued.

It follows that fall storing of potatoes with crushed (pulverized) garlic will greatly decrease losses in yield. Actually, the tubers are destroyed by phytophthora in the first three weeks of storing when the relative moisture of air in storing is high, the freshly dug potatoes are still wet and carry on their surface a mass of fruit... of the fungus, and the temperature in the quarters is higher than the required 1 - 2° C.

Bordukova, M. V.

In studying phytoncides of numerous plants, we noted extremely interesting factors. If garlic had proved to be a controller or disinfectant of phytophthora, there are, evidently, other plants which contribute to the development and spread of the disease. Among similar stimulants are "lebeda", goosefoot? [Chenopodium], "ptichia grechishka" [Polyganaceae, Polygonum avium], "grechishka v'unkovaia" [P. convulvus L.]; "osot polevoi" [Sonchus arvensis L.]; "khvoshch polevoi" [Equisetum arvense L.] "shchavelek maly" [Rumex L.] (small); "schavelek konskii" [R. confertus Willd], and many others.

These weeds are pests of potato plants not only because they deprive the latter of water and interfere with their nutrition, but also because they contribute to the development of phytophthora.

Moreover, it seems relevant to note the type of plants growing close to potatoes. Sunflowers, tomatoes, apple, cherry trees, raspberries, squash, cucumbers are, for instance, clearly contributing to the development of the disease while sugar beets, carrots, lettuce, dill, onions, parsley, cabbage and others hinder its development. It was established that potatoes grown on a plot surrounded by birch trees rot faster than those on plots bordered by pines.

~~Data was~~ We obtained data with regard to experiments on common rowan [Sorbus aucuparia]. The Phytoncide of this plant proved stronger and more resistant even than garlic phytoncide.

At present effective dosages of phytoncides of Sorbus and the techniques for their application are being determined.

End of Article
****

Typed 14 June 1951

Kameraz, A. IA.
Development of economically valuable, Phytophthora-resistant potato forms in hybridization of wild species, Solanum demissum, with the cultivated species S. tuberosum. Vsesoiuzn. Inst. Rastenievod. Trudy po Prikl. Bot. Genet. i Selek. 28(2): 19-44. Ref. 1949. 451 R92.

Translated from the Russian
by S. M. Monson

Phytophthora (Phytophthora infestans) of potatoes is, next to potato canker (Synchytrium endobioticum), the most dangerous disease of this important crop. Phytophthora causes enormous annual losses in yields in all countries of the world. In the USSR, according to estimates by N. A. Rozhdestvenskii, phytophthora drastically reduces potato yields.

The production of phytophthora-resistant varieties of potatoes is the safest method to control the disease. Potato selection engaged in for the purpose over a period of many years has, nevertheless, proved unsuccessful. All selected potato varieties are affected by phytophthora in various measure.

Soviet expeditions collected in Mexico wild species of potatoes, including phytophthora-resistant species. The availability of phytophora-resistant species of wild potatoes offered the opportunity to approach the problem of selection for phytophthora resistance in a new manner.

175

We used Michurin's method of distant hybridization and the training of hybrid seedlings as the basis for producing phytophthora resistant varieties and followed Michurin' claim: "It is possible to produce, in relative brief periods, considerable changes in hybrid plants by artificial cross fertilization (hybridization), the plants gradually gaining complete resistance when crossed repeatedly for several years."

The task may be solved successfully by introducing a variety of phytophthora-resistant species into selection and by developing the most rational methods of using them.

This article presents data concerning the production of economically valuable phytophthora-resistant hybrids of potatoes by distant hybridization, with the aid of the wild Mexican species demissum (Solanum demissum). This particular species was widely used in our selection work. It contains valuable characteristics: resistance to phytophthora and frost, immunity to the Colorado beetle, high content of starch and albumen.

Our studies refer primarily to results of research conducted prior to the war. Sexual distant hybridization is valuable, but not the only method of producing phytophthora-resistant varieties.

At present, work on vegetative hybridization and "directed" training of hybrids has been engaged in, based on achievements in genetics of Michurin and his follower, the academician, T. D. Lysenko.

ECONOMIC CHARACTERISTICS OF HYBRIDS OF DEMISSUM AT VARIOUS STAGES OF SELECTION.

Kameraz, A. IA.

A single crossing of demissum with tuberosum does not provide the opportunity for obtaining hybrids of any practical significance. Further selection is essential for the production of valuable hybrid forms. Of primary importance in this connection is the particular method that is used. It is important to determine first: 1. How many times demissum should be crossed with tuberosum to obtain the desired forms in a hybrid progeny. 2. which proves more effective: the creation of complex hybrids by repeated crossings with tuberosum or the production of superior generations from demissum x tuberosum hybrids.

In the years 1937 to 1940 the author studied a large number of groups of demissum hybrids at the experimental station of the All-Union Institute of Plant Industry, "Red Plowman" (near Leningrad). Below we present data concerning individual characteristics and several groups of hybrids.

YIELD.

Average figures on yields over a period of four years obtained from several different groups of hybrids from crossings with different varieties by reproduction with seeds and tubers (first tuber reproduction) are listed in table 1.

Yield in F_1 is usually low. The majority of plants (in some varieties from 60-100%) have no tubers or produce yields which do not exceed 100 to 200 hectares. Of considerable significance in obtaining hybrids of higher yields in F_1 is the choice of components among tuberosum. The average yield from one plant represented 69 hectares from seedlings and 74 hectares from tuber reproduction.

In the second generation the yield of hybrids is increased from seedlings, representing an average of 176 hectares per plant.

By repeated crossing with tuberosum, the yield of hybrids was increased still further, as compared to F_1. Some varieties of "back-crosses" produce a relatively high yield of tubers from both seedlings and tuber reproduction. Yields over 1 kg per clump were found in many varieties; reaching occasionally even 2 kg. [The varieties (demissum x Zeidlitz) x Katadin; (Epicure x demissum) x Rosafolia; and (Epicure x demissum) x Roon).]

The number of clumps in a variety, yielding over one kg (seedlings) is frequently limited, an average of 1%, but occasionally it may in some varieties reach 20% and higher (especially in some varieties crossed with Sweetest, etc.). Yields of hybrids from back crosses are also to a large extent dependent upon the choice of components among tuberosum.

The average yield of one plant (seedling) of back crosses (B) * is almost three times as high as F_1. In tuber reproduction the average yield from one plant of back crosses is increased 7 times compared to F_1.

*) The following designations will be used in the text: back-cross "B"; repeated back-cross "B^2"; triple back-cross "B^3", etc. The first generation from back-cross "B_1", the second and third generations "B_2" and B_3" respectively.

Kameraz, A. IA.

Yields from a variety are increased, reaching in tuber reproduction in some plants 2930 hectares per clump, and an average of 752 hectares per plant from seeds of self-pollinated plants of back-crosses. [(B_2 demissum x tuberosum) x tuberosum]. According to estimates for 1937, the following varieties proved of highest yield in the first tuber reproduction:

B_2 [(Epicure x demissum) x Katadin] 2000 hectares (number of plants yielding 1000 hectares and above 21 per cent).

B_2 [(Epicure x demissum) x Centifolia] 2950 hectares; 35 per cent of all plants produced yields of 1000 hectares and above.

B_2 [(Epicure x demissum) x Lutzow] 1700 hectares.

By obtaining superior generations from back-crosses [(B_3 demissum x tuberosum) x tubercsum] the yield is significantly reduced.

Among repeated back-crosses (B_2) forms of very high yields are frequently found in seedlings. Seedlings of repeated back-crosses produce generally higher yields than seedlings of back-crosses. Thus in 101 varieties of seedlings (1937) about 25.7 per cent of all varieties produced a maximal yield of close to 1000 hectares; 42.6 per cent produced 1000 to 1500 hectares; 27.7 per cent from 1500 - 2000 hectares; 4 per cent over 2000 hectares.

The highest maximal yields were obtained from the following varieties:

[(demissum x Alma) x Alma] x Regina 2200 h.;

[(Korenevski x (Epicure x demissum) x Centifolia];

Kameraz, A. IA.

[(Korenevski x (Epicure x demissum) x Katadin];

[(Korenevski x (Epicure x demissum) x Centifolia];

[(demissum x Alma) x Alma] x Epron, produced 2000 hectares.

The number of clumps in a variety of which yields exceed 1000 hectares, represents frequently from 2 to 7 and to 10 per cent of all plants of a variety. Occasionally the quantity of best yielding clumps in a variety is much higher. We refer in this connection to the following varieties:

[(Epicure x demissum) x Rosafolia] x Kalitinets; maximum yield 1800 hectares, number of clumps in yields above 1 kg, 18 per cent.

[Sweetest x (Epicure x demissum)] x Katadin 1600 hectares, 21 per cent; Korenevski (Epicure x demissum) x Katadin 2100 hectares, 32 per cent.

(demissum x Alma) x Alma x Peppo 1250 hectares, 22 per cent;

[(Epicure x demissum) x Katadin] x Regina 1750 hectares, 18 per cent;

Epron x [(Epicure x demissum) x Katadin] 1900 hectares, 19 per cent.

(Omitted p. 21 to 24)

PHYTOPHTHORA RESISTANCE F_1 DEMISSUM X TUBEROSUM.

As a rule, no less than 50 per cent of plants under field conditions, and occasionally up to 100 per cent, are resistant to phytophthora. The remaining plants are only lightly affected by phytophthora. A high resistance of the foliage of this group of hybrids

Kameraz, A. IA.

was also observed in artificial infestation. About 20-25 per cent of plant varieties proved to be without any trace of the disease. Occasionally their number amounted to 70 per cent.

The remaining plant varieties exhibited, in addition, increased resistance in the majority of cases. The leaves had small brown ppots but mycelium did not develop on them and there was no fruiting of phytophthora. Definitely infested plants (mycelium and fruiting of phytophthora) varied in number in different varieties; frequently as much as 20-30 per cent.

Artificial infestation of tubers produced also a large number of resistant tuber forms, an average of 48 per cent; of tubers without any traces of infection (graded 0) 3.5 per cent and up to 29 per cent in forms where tubers which, when infested, produced light brown tissue without mycelium formation or fruiting (61-62).

F_2 DEMISSUM X TUBEROSUM.

A significant amount of plants, occasionally 20-50 per cent, is not infested by phytophthora under field conditions. The rest shows different degrees of infestation which include severe forms. When tubers were artificially infested, some specimens also proved resistant in various measure. However, the number of resistant tuber forms was much larger, compared to F_1, and represented an average of only 6 per cent; none had the highest degree of resistance (graded 0).

Kameraz, A. IA.

BACK-CROSSES.

Under natural conditions (near Leningrad) a large number of hybrids of back-crosses demissum (frequently 40-50 per cent of plants of a variety) proved not infested by phytophthora even during severe outbreaks of the disease among selective varieties.

During artificial infection of the foliage the total percentage of specimens that did not exhibit any traces of the disease and showed only small brownish spots without mycelium formation and fruiting, was usually lower.

The number of plants in a variety without traces of infection, when leaves were infected artificially, varied between 1 and 10 per cent, occasionally between 10 and 20 per cent, and was higher only in few varieties.

A relatively large number of varieties did not have plants without traces of phytophthora infection in cases when leaves were artificially infested.

The number of hybrid forms, resistant to phytophthora when tubers were infested, is larger. Back-crosses (seedlings) in all experimented-on varieties showed the averages: (77 varieties, 4398 plants in 1937; 48 varieties, 222 plants in 1938); more or less resistant (tuber) in 1937 were 8.86 per cent of the seedlings; in 1938, 8.32 per cent; among these plants no traces of infection (tubers) (graded 0) in 1937, 0.6 per cent; in 1938, 0.98 per cent; light brown tissue, without mycelium and fruiting (graded 61-62) in 1937, 4.5 per cent; in 1938, 5.9 per cent.

Kameraz, A. IA.

SECOND GENERATION OF BACK-CROSSES.

Among many varieties there were practically no phytophthora-resistant plants in the field. Experiments made in 1938 established a very small number of plants of which tubers were resistant, (about 8 per cent); none were graded 0.

REPEATED BACK-CROSSES.

Under natural conditions the number of non-affected plants in varieties in this group of hybrids is frequently lower compared to back-crosses. The quantity of non-affected plants varies considerably according to varieties. The average for all plants among 101 varieties of seedlings of non-affected plants was 17.4 per cent, i.e. twice as low as in back-crosses.

When tubers were artificially infested (data of 1937 and 1938), the larger amount of varieties did not have plants of which tubers were not affected. The average among all varieties of repeated back-crosses (in 1937, 101 varieties, 7540 plants, and in 1938, 163 varieties, 1187 plants) showed a difference in degree of resistance: in 1937, 5.64 per cent; in 1938, 7.75 per cent. Included were those not having traces of tuber infestation (graded 0) in 1937, 0.22 per cent; in 1938, 0.86 per cent; those showing a light browning of the tissue without mycelium formation and fruiting...(graded 51-62) in 1937, 2.03 per cent; in 1938, 3.36 per cent.

Judging from these facts, the summarized percentage of forms resistant to phytophthora in tubers is somewhat lower in repeated back-crosses than it is in back-crosses. The number of more resistant forms is also lower in the former. Repeated back-crosses represent at the same time, as distinguished from back-crosses, material from which hybrid forms may be selected with greater success and which, together with phytophthora resistance, carry other economically valuable characteristics.

HYBRIDS OF THE TYPE TUBEROSUM X (F_2 demissum x tuberosum).

Phytophthora resistance of the foliage under field conditions, according to data of 1937, is occasionally observed in a relatively large number of plants (from 1-7 to 12-15 per cent and even in some cases 25-35 per cent of plants in a variety). A high degree in phytophthora resistance (including the artificially infested tuber) is seldom observed.

Among 32 varieties only 6 had forms in which tubers proved resistant (0.5-3 per cent and in one instance 8 per cent in a variety); none were graded 0 and 0.5 to 2 per cent could be graded 61-62.

Data of 1937 indicates that the average in all plants (2159) in all varieties of this type of plants, resistant to tuber infestation, did not exceed 0.65 per cent, including 0.23 per cent of those graded 61-62.

TRIPLE BACK-CROSSES

According to data of 1937, a considerable part of varieties did not possess resistant hybrids under natural conditions of infestation.

Kameraz, A. IA.

Average resistance under field conditions in all varieties amounted to 12.2 per cent in plants.

During the artificial infection of a tuber, one half of the varieties were not resistant in 1937 and 1938. In the remaining varieties, where the participating component was the phytophthora-resistant hybrid of the repeated back-cross, the number of resistant forms is occasionally rather high. Among 1004 plants of this group about 11 per cent proved resistant (tuber), including about 1 per cent graded 0 and 6 per cent graded 61-62. Among 551 plants of 56 varieties there were 10.52 per cent of seedlings of triple back-crosses (1938); a different degree of resistance (tuber); graded 0; 0.9 per cent graded 61-62, 5.26 per cent.

It is notable that in triple back-crosses of seedlings (1937 and 1938) there was no reduction of the relative number of seedlings, resistant to phytophthora (tuber) (compared to repeated back-crosses); on the contrary, an increase in relatively resistant forms was observed. This may be explained by the fact that in order to obtain more complex hybrids only highly phytophthora-resistant hybrids of repeated back-crosses were used.

It follows, therefore, that by the careful selection of the most resistant hybrids and by multiple crossings with tuberosum, it is possible to obtain a considerable number of resistant forms.

(Omitted p. 27-39)

Kameraz, A. IA.

CONCLUSIONS

In summarizing briefly our material on hybridization, as pertaining to the wild Mexican species demissum (S. demissum) with the cultivated species tuberosum (S. tuberosum), it is possible to come to the following conclusions:

1. A single crossing of demissum and tuberosum does not provide for hybrids of immediate practical significance. Repeated crossings with tuberosum are required for the selection of similar forms.

2. As a rule, back-crosses of demissum seldom produce hybrid forms with a full assortment of economic characteristics. Selection of economically valuable hybrids among back-crosses is therefore possible only during a most favorable combination of components, primarily varieties of early tuber formation.

3. Repeated back-crosses represent material from which hybrid forms may be selected, which, along with phytophthora resistance, possess other economic characteristics.

4. During the period required for the production of repeated back-crosses, hybrids may be obtained in other ways: a) by growing a second generation from back-crosses or b) by crossing tuberosum with F_2 demissum x tuberosum. According to available data, similar hybrids possess usually less resistance to phytophthora than do repeated back-crosses. In order to select phytophthora-resistant, economically valuable forms, repeated back-crosses are of considerable interest.

5. Subsequent hybridization of repeated back-crosses with

tuberosum may be of interest in the event that the phytophthora-resistant hybrid of the repeated back-cross has some defect which it is desirable to eliminate by combining the particular hybrid with a cultivated variety. If the original hybrid of the repeated back-cross possesses a high degree of resistance, it is possible to obtain a considerable amount of phytophthora-resistant forms from a quadruple crossing with tuberosum.

6. In hybridizing with demissum, to obtain economically valuable forms, including those of high yield, starch content and good tuber shape, the choice of components among tuberosum is extremely important at all stages of selection work. In choosing components among tuberosum, it is essential to introduce canker-resistant varieties into crossings, as well as those distinguished by early and medium-early tuber formation. Crossing of demissums with predominating late maturing varieties will drastically hinder the production of hybrids of high yields. Hybrid plants, seedlings and tuber reproductions should be grown under "directed" training, specifically under conditions of high agricultural "backgrounds".

7. At present a group of phytophthora-resistant hybrids have been obtained, which do not yield in high productivity and other economic characteristics to standard productivity. All these hybrids are being studied and experimented upon in detail. The majority were obtained by triple and quadruple crossings of demissum with

Kameraz, A. IA.

different varieties of tuberosum and subsequent training of the hybrids under high agricultural techniques.

End of article.

6-25-51.

References:

Gabchenko, G. D.
On the programma [!] of the plant protecting work in collective and sovjet [!) farm laboratories. Zashch. Rast. 5:5-8. 1935. 421 P 942

Translated from the Russian
by R. G. Dembo

The struggle against agricultural yield losses due to pests and diseases is the most important problem of every collective and state farm and machine tractor station in constructing a prosperous and cultural life of the collective farmers and the strengthening of the collective system.

Based on the decisions of the June meeting of the Central Committee of All-Union Communist Party (b), the collective and state farms and the machine tractor stations have joined more actively in the control of agricultural pests and diseases. Nevertheless, at the present stage of the development of agriculture, the collective and state farms and machine tractor stations are not satisfied with the knowledge of separate technical devices in controlling pests. Every collective farmer, even the average one, understands now that for the correct organization of this work, a thorough scientific knowledge of plant protection is imperative. Therefore, the urge of collective farmers to acquire the cultural methods of organization and of agricultural management and to assimilate the achievements of agricultural science and technique in plant protection is quite comprehensible.

"Our collective agriculture is arriving at a new stage. The decisive peculiarity of this stage should be a cultural, scientific organization of collective agriculture in all its basic and subsidiary branches" (Postyshev). The organization of ten thousands farm laboratories is a conspicuous example of the struggle of the collective farmers for a cultural, scientific organization of collective agriculture. Already in 1935, thousands of farm laboratories will survey the results of their first experiments and observations.

176

"Our best farm laboratories became already the organizing center of experience, of struggle for acquiring agrotechnical knowledge, for the introduction of the newest achievements in agricultur"(Postyshev). What we now possess, says comrade Postyshev, is "only a nucleus of collective farm laboratories which will undoubtedly grow and strengthen". The new regulations of agricultural personnel is a strong stimulus in the development of collective experience.

The workers of scientific research and operating organizations in plant protection should take into consideration the great significance of farm laboratories and must construct their work accordingly.

The collective farm laboratories, being the first nucleus in agriculture, should play the most important role in accumulating the primary experimenting material in generalizing the experiment of agricultural progress, in furthering a series of basic problems which confront collective production. The collective farm laboratories should become the exponents of scientific achievements in plant protection in agricultural production. Nevertheless, it is necessary to notice that up to recent time the workers in plant protection were not able to evaluate the great significance and role of farm laboratories. Many workers do not take into consideration their experience and do not encourage the expansion of their work. Until now the consultation with farm laboratories and with skillful farmers in plant protection has not been organized.

A few undertakings indicate the unfamiliarity with this problem. Attempts were made to transform farm laboratories into divisions of plant protection institutes to thrust upon them the plans of the plant protection workers, namely, to apply such methods against which comrade Postyshev warned.

In carrying out experimental work for farm laboratories, many workers are unable to realize that the "weakest part in the work of farm laboratories is the absence of elementary knowledge in the method of organizing the experiments and observations" (Postyshev), as a result of which, tasks are suggested which are absolutely unrealistic. And finally, many workers have the tendency of putting the work with farm laboratories on a social footing, which cannot be considered normal.

Such an approach to farm laboratories on the part of scientific research organizations, especially at the outset, does not bring any benefit and even has a negative influence upon further work. We must reevaluate the relationship of all organizations and of separate workers in plant protection to the development of constructing farm laboratories. First of all, every organization should work out a plan along with the farm laboratory, compose the program, whereby this program should be based, not on abstract principles, but in agreement with concrete raion problems of collective production, mutual assistance, considering, also, the time of agricultural work (spring, summer, etc.). It is also important to specify the amount of work, namely, to plan a specific number of farm laboratories in which it is possible to construct realistic work by which the realistic assistance could be ensured. From method's point of view, it would be better to organize a smaller number of farm laboratories and organize the work correctly and effectively than to try to assist many of them and have the work done superficially, on social manner, without any serious preparation, and without any serious ensurance of further development of the work.

In order to establish a systematic connection with the farm laboratory, it is necessary to outline a specific circle of the most important problems which are not only interesting for a scientific institution, but for the productivity of the said farm as well. The success of further work will depend entirely upon the effect of the applied measure as the result of the experiments.

Undoubtedly, there could be no universal program or plan for all farm laboratories. Each program has to be planned according to the conditions of individual farm laboratory or group, and should reflect the productive part of the given farm. There could not be separate methods in carrying out the outlined program either. They should be worked out in agreement with the character of the works being carried out.

The general arrangement of the plan concerning plant protection for the majority of farm laboratories could be presented in the following manner:

First of all, the scientific research institutions should ensure the consultation of the farm laboratories concerning the problems of plant protection. This consultation should go along the following divisions:

1) determination of pests and diseases disclosed in the farm;

2) the working out of suggestions concerning the method of inspecting agricultural plants as to their infestation by pests and diseases;

3) suggestions concerning the method of research as to the infestation of seed and planting material by pests and diseases;

4) the working out of the simplest methods in determining the poisons under the conditions of farm laboratories;

5) replies to all current questions of farm laboratories.

The second and the most complicated division of the plan is the organization of experiments concerning various problems of plant protection. We should approach this division of work quite attentively, taking into consideration all the conditions and possibilities under which the experiments will be carried out. Experiments which are the most simple in the methods available for the procedure and also experiments which solve the problems in the shortest time will be most successful. From this point of view, it is inexpedient to recommend experiments which require observation for many years and a systematic participation of a scientific-research personnel. The initiative in carrying out the experiment should originate from the farm laboratory.

Therefore, for the time being, we must confine ourselves to organization of the experiments in farm laboratories according to the following divisions:

1) the influence of the seed treatment with a mordant by means of various poisons and in various doses for the increase of yield;

2) the testing of the effectiveness of various poisons against various pests and diseases under field conditions;

3) the influence of the sowing schedule upon the infestation of the plants by pests and diseases;

4) the influence of various methods of taking care of plants upon the spreading and damage of pests and diseases;

5) observation of the immunity of separate plants;

6) registration of yield loss from pests and diseases, etc.

Surely, out of this list not all should be taken, only separate problems, but they should be arranged seriously, thoroughly and carried out until the end.

In order to ensure the minimum of conditions for work and the execution of the outlined program of individual farm laboratory, the scientific research institutions, and primarily VIZR, should give:

1) methodical suggestions concerning the collection, conservation and transportation of insects and the damaged examples;

2) methodical suggestions in composing biological collections of harmful insects, diseases and rodents which damage agricultural plants;

3) methodical instructions and supervision in organizing the experiments and the observations with the principal pests and diseases considering the agricultural raioning of USSR.

Besides, it is necessary to assist the farm laboratories in composing a schedule of the development of the principal pests and diseases and the timing of controlling them under the conditions of the given farm so that the calendar could become the operating manual for action for the farm laboratory.

It is desirable that each farm laboratory should have not only the list but the samples of the pests and diseases and of the damaged plants as well, so that every farmer, when arrived in the farm, would become familiar with the pests which he had to control.

To accumulate an appropriate library concerning the problems of plant protection, however not in general terms, but applying to the conditions of the given raion, the given farm.

To organize a corner for plant protection at the farm-laboratory does not mean to hang collections and posters concerning pests and diseases upon the walls of the main building and confine it to that. The corner for plant protection should be the "organizing center of experiments". Here should be reflected all the achievements of the farm in plant protection. It should attract and interest not only the attention of the active farmers, but the entire mass of the farmers.

This is only an incomplete sketch of the measures which should be carried out by each organization, by each worker in plant protection, and the imperfection of these suggestions indicates that, until the present time, we do not have a concrete idea of the farm laboratory, its work and the further prospects for its development.

The problem consists of the fact that along with assisting farm laboratories, we should organize the study of the practice of progressive farm laboratories.

It is necessary to aspire towards a wide elucidation of this experiment in the press, thus familiarizing every farmer with the achievements of the best farm laboratories. Only such organization of work will ensure the possibility for a speedy and correct organization of assistance for farm laboratories which, according to comrade Postyshev, "will result into a wonderful, inexhaustible spring of knowledge for the practice of agricultural construction".

End of Article

15 June 1951

Shorokov, S. I. Transl. 177; Plant Protection

Latest achievements in agricultural plant protection against pests and diseases at the All-Union Agricultural Show, Moscow, in 1940. Vestn. Zashch., Rast.: 1940(5); 15-21. 421 P 942

Translated from the Russian by R. G. Dembo

The All-Union Agricultural Show is considered the largest national university of Stakhanovite workmanship in agriculture. The results of basic changes and of the growth of socialist agriculture of USSR, especially quickened during the years of Stalin Five-Year-Plans, are graphically demonstrated.

This show indicates the tremendous unlimited resources of our land for the progress of agriculture.

The show demonstrates the great amount of outstanding achievements of collective farms, state farms and scientific organisations obtained in the study of new forms, methods and work measures which ensure high yield of agricultural crops. Millions of visitors (close to 30,000 daily) studied these achievements. They will carry over the experiments of the foremost people of agriculture into wide production, thus increasing the number of best links, brigades, which obtain the highest yield which give the right to participate in the show.

The organizing role and the significance of the show for advertising are quite obvious. By organizing a national socialist contest of the best workmen of agriculture, the show furthers the fulfillment of the government's agricultural task during the Five-Year Plan. Of particular great significance is the achievement of plant protection against pests and diseases. The assimilation of these accomplishments by wide practice in agriculture is very important.

177

The wide show of the newest materials as results of study of pests and diseases of agricultural plants, the study of new measures in controlling them, the mechanization of control, and also providing the visitors with well qualified guides and consultants, and with lectures, all this helped to introduce into production all the effective methods and measures for the protection of yield against pest and diseases in a very short time.

In comparison with the show of 1939, the one of 1940 is considerably extended. Nevertheless, it does not satisfy entirely all the demands required by the visitors.

The achievements in the field of studying pests and diseases of agricultural plants and the search for means of controlling them were exposed on the All-Union Agricultural Show of 1940 in 18 branch pavilions, 14 zonal pavilions and on five open fields and squares. In this exposition, over 140 collective and state farms, mechanical tractor stations, up to 20 brigades of agricultural special applications, 20 agricultural divisions, 40 points of quarantine inspection, 1 plant which produces heavy industry, more than 60 scientific research institutions, stations, laboratories and points are taking part. Besides, the show includes many farm laboratories, biolaboratories, stations of young naturalists and high schools.

In 1940 more than 700 entomologists, phytopatholigists, agronomists, engineers-constructors and inventors, collective farm organizers in controlling agricultural pests, technicians and workers in the equipment production, laboratory managers, educators, young naturalists, etc. were taking part in the Agricultural Show.

The exhibits are placed upon 47 full and 6- additional stands along with other materials. Besides, the pavilions have about 20 albums, 8 diagrams and panels and 15 heavy machines besides the 17 machines exhibited in the pavilion "Mechanization".

In the pavilion "Grain" are exhibited the achievements of the All-Union Plant Protection Institute, of the All-Union Selector-Genetic Institute, the avangard raions(s) of the Ukraine, which obtained high results in their control of eurygasters, of the Microbiological and Biochemical Institute of the Academy of Science of USSR and of the Ukrainian Institute of socialistic agriculture (the pavilion "Ukraine").

The achievements of VIZR (Director M. P. Eleukov andVice-Director I. M. Poliakov, participants in the Agricultural Show) are presented by the work of six laboratories. The coworkers of the entomological laboratory worked out the theory of forecasting the arrival of the desert locust and determined its spreading (S. A. Predtechenskii) and also worked out new mechanized methods with the attractant in controlling locust. All these works are widely utilized in production.

The coworkers of the phytopathological laboratory worked out measures for protecting tomatoes against the infestation of brown rot (K. Ia. Kalashnikov); the differentiation of doses of dry poisons in relation to the degree of seeds spored by smut (V. I. Lobik); the indexes of a short forecast of rust of grain crops and the method of warning rust (K. M. Stepanov); measures for controlling sclerotinia [Sclerotinia Libertiana] upon winter crops (S, M. Tupenevich); the parasites of second order has been separated for the control of wheat rust, and the method of mass accumulation of this parasite upon artificial feeding has been worked out (N. S. Fedorinchik).

The coworkers of the plant immunity laboratory worked out a sulphuric method of evaluation of the immunity of agricultural plants to diseases (T. I. Fedotova). This method permits the decrease of selectors' work in several days.

The methods of acclimatizing parasites and their mass propagation under artificial conditions were worked out in the laboratory of biological method of pest control (N. F. Meier, I. V. Vasil'ev, Ia. A. Alekseev and others). The biological method of controlling the winter owlet [Agrotis segetum] by means of the trichogramma and the harmful eurygaster by means of telenomus has been introduced into practice and is applied upon hundreds of thousands of hectares.

The coworkers of mechanization laboratory constructed 13 machines and equipments for the chemical and thermic control of agricultural pests and diseases. The equipment for thermic poisoning of grain in controlling the dusty smut has been constructed (I. G. Chaiko). Technical projects of the automixer of attractants "AC-2", autothrower of attractants "AP-0" were worked out, and the pollinator BV-1 has been improved (P. A. Baryshnikov). The enlargement of the sprayer arm "Zara" (Ia. A. Meisakhovich) has been worked out; the construction of one horse pollinator has been worked out L. A. Khoroshkevich); a new ventilated pollinator RO-3 (I. P. Iatsenko) has been constructed; the constructions of the poisoning machine D-1 and of the attractant preparator D-2 were worked out and the poisoning machine AB-2 has been improved (P. G. Davydov)

The majority of machines contructed by the laboratory are transferred for sulphur preparations.

In the zoological laboratory, a new, more effective compound for controlling mice like rodents (the complex salt of barium arsenate) has been found and a new method for control[redacted] by means of applying pills with insoluble poisons has been worked out (B. Iu. Falkenstein).

The institute of microbiology of the Academy of Sciences of USSR exhibited materials against "zakuklivanie" of crops (V. L. Ryzhkov, O. K. Sukhov and A. M. Vovk). The nature and the causes of this infectional disease were studied, the disease carrier has been separated, the diagnosis of the disease worked out, the species of wheat less infested by "zakuklivanie" were marked and the primary measures for controlling this disease were worked out. Simultaneously, the methods of cleaning the virus albumen and the study of the conditions under which the plant virus accumulates were worked out.

The All-Union Selector-Genetic Institute exhibited the achievements of the biological method in controlling the harmful eurygaster by means of utilizing hens and the Eurygaster egg-eater, telenomus (S. T. Matkovskii and V. I. Talitskii). These two measures are widely introduced into the producing practice of collective farms and show a very high effectiveness. Thus, for instance, Volnovakhskii, Novoprazheskii and Voznesenskii raion(s) of Ukrainian SSR which were threatened by eurygaster in 1940, correctly and timely utilizing hens for eradicating the eurygaster, acquired high yield. The main committee of VSKHV(ВСХВ) distributed 35 medals among the best agronomists, poultry growers and entomologists of these raion(s) who displayed examples of perfect organization of work in utilizing hens for the control of eurygaster.

The All-Union Biochemical Institute demonstrated its very valuable achievement in improving the quality of grain damaged by the eurygaster.

Applying the thermic treatment of the damaged grain and flour, the institute achieved quite a good quality of cereals from such grain.

The All-Union Institut of Grain and Allied Products of Narkomzag( ) the People's Commissariat of Supply (?) of USSR presented the basic achievements in the field of controlling grain pests during the period of conservation (P. D. Rumiantsev). The institute worked out the following measures: the application of natural low temperatures for control of granary weevil and grain mites(R. S. Ushatinskaia) and a new measure of grain drying for the eradication of grain pests (A. P. Gerzhoi); the method for determining the amount of chlorpicrin left in the grain treated by chlorpicrin has been worked out and an apparatus has been constructed for this purpose (N. I. Sosedov). All the accomplishments of the institute have a tremendous practical value and are introduced into production.

The Rostov Institute of Grain and Allied Products of Narkomzag (НАРКОМЗАГ) USSR worked out conditions for the ventilation of grain (V. V. Kalitaev and I. I. Rashutin), and designed a universal nomogram for guidance in selecting conditions and timing for grain ventilation. The institute worked out a ventilation equipment for nonmechanized granaries which ensures a considerable decrease of grain moisture without the latter (I. Ia. Bakharev and P. M. Dubinin).

The Ukrainian Institute of Socialist Agriculture (pavilion "Ukraina") discovered new compounds "insectol", "solvensid" and ground chalk for the control of grain pests in granaries and in the grain itself (A. I. Novinenko). A few types of thermelectors for the discovery of infestation of various products and of materials by mites and by several pests of provisions have been demonstrated at the show. The devices assist in fixing more precisely the degree of infestation and in carrying out simultaneously the group analysis of the species (P. K. Chornyshev).

The materials concerning pests and cotton diseases were presented especially widely in the branch pavilion "Cotton" and in the zonal pavilions of the republics. In the pavilion "Cotton" were demonstrated the accomplishments of scientific investigating organizations: Stazra (СТАЗРА) Station for Plant Protection, Union NIKHI (НИХИ) Scientific Research Agricultural Institute, the Division of Plant Protection AzNIKHI and VIZR.

VIZR prepared a project for centralized treatment with a mordant of cotton seeds against "gommoz" (V. K. Grushevskii) section ETSPG-1 which, according to government's decision, is accepted as the type for sulphur construction (40 sections) in cotton raion(s) of USSR.

The Station for Plant Protection of the Union Scientific Research Agricultural Institute (Supervisor S. A. Zhuravskaia) studied the cotton disease, wilt, and worked out a system of measures for controlling it (A. I. Solov'eva); a system of measures in controlling the web mite (I. G. Noskov and I. I. Stepantsev); a technological process of centralized treatment with a mordant of cotton seeds against "gommoz" which is practiced in cotton plants (A. A. Vasil'ev); constructed the newest tractor sprayer "OU-3" for the mechanization of pest control on cotton crops (K. I. Mirpulatov).

The Division of Plant Protection AzNIKHI (АЗНИХИ) Asia Scientific Investigating Agricultural Institute worked out the primary measures in controlling cotton viruses (S. M. Moskovets) and improved control measures after having worked out a system of measures in controlling the cotton owlet [corn earworm, Chloridea obsoleta] (V. G. Korobitsyn). The exhibit of the achievements of Stazra UNIKHI and OZRa AzNIKHI has been supplemented by a great amount of natural display which indicate the biology of cotton pests and diseases and also by detailed material in two albums.

The state department of plant quarantine NKZUSSR presented material in organizing systems of quarantine measures and not admitting the import and the spreading of foreign cotton pests. The presented material indicates the availability of widely developed and very valuable measures and achievements. The state department of plant quarantine ensured the protection of Soviet cotton growing against pests which is the whip of cotton agriculture in capitalistic countries (Supervisor A. N. Volkov). The quarantine department introduced into the cotton plants effective machine worm catchers (A. K. Markin), studied the fauna of the most dangerous cotton pests and, worked out a system of foreign quarantine (A. L. Efimov), organized a network of quarantine inspection with a highly qualified personnel. The material presented by the collective farms, by MTS (MTC)Machine Tractor Stations and by organizations which carry out the cotton pests control indicate that this part of plant protection is the best organized. In connection with this, the organizer of control of cotton pests and diseases, I. B. Naumov, has been distinguished among the foremost workers at the All-Union Agricultural Show of 1940.

The material of the brigade VIZR (Supervisor G. K. Piatnitskii) which worked out a series of new methods in controlling sugar beet weevil and which suggested a new system of measures tested under production conditions on a field of 400 hectares has been demonstrated. The brigade discovered and worked out a method of applying polichlorido for poisoning weevil in wells of edge grooves (D. M. Paikin), suggested acetate films for edge grooves (D. M. Paikin), worked out a new method of applying soluble insecticides in concentrated solutions (F. N. Kozlova) by means of utilizing the point of TSKTI (Ia. A. Meisakhovits) and worked out an improved, more effective system of chemical control (B. A. Dodonov).

Models and working examples of groove excavator constructed by A. T. Smol'ianinov and Volkov and caterpillar catcher by Ponomarenko are demonstrated in the pavilion and on the field.

Concerning the pests and diseases of vine among the accomplishments is shown the material of the Crimean Institute for Plant Protection, of the Ukrainian Institute for Plant Growing, of VIZR and of the state plant quarantine. The Crimean Institute (Supervisor G. M. Studenkov) worked out a method of determining the timing of treating vines against iodium depending on the incubation development of the disease (Ia. A. Seidametov), introduced into production the method of controlling the grape mildew which is of considerable assistance in the economy of chemicals and of labor power (M. N. Patenkov).

The Ukrainian Institute for Grape Growing worked out control measures against the two year old leaf rolling (P. I. Egorov). VIZR worked out a control method against pests and diseases of vine: phylloxera, leaf rolling, cockchafer, cicada, mite, etc., and composed a system of measures on vine protection against pests and diseases (Ia. I. Prints). The state plant quarantine organized and supervised the carrying out of antiphylloxera measures, worked out methods for inspecting vineyards and liquidating phylloxera nidi, constructed several types of movable and static cameras for the fumigation of planting material (I. A. Kazas). The quarantine work proved the possibility of the widest planting of "kornesobstvennyi" vineyard. In connection with this achievement, the entire territory of vineyards has been divided into three zones: grafted vine, protected zone and "kornesobstvennyi" vine. On the field of the pavilion was demonstrated the original example of four-rows sprayer of the Musychenko construction.

The mechanization of controlling agricultural pests and diseases has been presented mainly in the pavilion "Mechanization" and comparatively little on the field of fruit growing, vegetable growing, sugar beets and "New in Trees".

In the pavilion "Mechanization" upon two stands is presented the material of All-Union Institute of Agricultural Aviation of the civilian air fleet in controlling pests (locust, malaria, cotton, sugar beets, etc.) by means of the aviomethod. At the conveyor of the pavilion upon 17 stands are presented 17 machines produced by the plant "Vulkano", by Glavsel'masha (ГЛАВСЕЛЬ МАША) Main Agricultural Machine NKSM (НКСМ) People's Commissariat of Agricultural Machines: 1) pollinator "TN-3" fitted for the tractor "U-2"; 2) pollinator "KOP-2" with a side blowing; 3) pollinator KOP-2"; 4) horse-motor pollinator "KMP-1"; 5) sprayer "OU-3", 6) horse-motor battery sprayer "BO-1"; 7) sprayer "TP-12", attached to the tractor "U-1" or "U-2"; 8) motor sprayer "KM-2 Pioneer"; 9) knapsack diaphragm sprayer "DRO-3"; 10) the mixer of attractants "TS-2", fitted for the tractor "U-1"; 11) attractant thrower "AP-4", fitted for the freight automobile "GAZ-AA"; 12) machine "AB-2" for dry and wet grain treatment with a mordant against smut, and other machines.

On two stands are installed two airplanes "AP", equipped with an air-sprayer constructed by the engineer V. F. Stepanov and by air pollinator constructed by the engineer S. D. Popov. On the open field of the pavilion are installed: the movable dryer VIME for the drying of seed and provision grains (exponent - All Union Scientific Investigating Institute of Mechanization and Electrification of Agriculture) and stationary grain dryer "ZS-SKH" for the same purpose (exponent - the plant "Sickle and Hammer" of the Main Agricultural Machine NKSM).

The major part of the achievements of scientific investigation organizations has been already introduced into wide practice of agricultural production and the latter, having simultaneously and correctly applied the newest facilities and measures in protecting agriculture against pests and diseases, preserved high crops. A good illustration of such progress is the exhibit of a great amount of collective and state farms on which, among other agricultural measures, pest control occupies the most important place. This fact was beneficial in obtaining high crops. The Il'ich collective farm of Vasil'kovskii raion, of Kiev oblast', which applied the measures of controlling sugar beet weevil and the winter owlet [Agrotis Segetum] obtained an average yield of 269.1 centner per hectare during the years 1937-39. Derbentsk city raion, the state farm Dchemete of Krasnodarski krai and state farm "Reconstructor" which carried out measures in controlling pests and diseases ensured a high yield of vine.

The sunflower species Nr. 169 produced by the Institute of Grain Production of the Southeastern USSR, which is immune against sunflower moth, occupied a sowing field of more than 1.25 million hectares in 1939. The laboratory supervisor of the collective farm "13 years of October" of the

Belov raion, Comrad L. K. Frolov, applying the trichogramma upon a field of 786 hectares in controlling the winter owlet achieved the destruction of 90 o/o of the owlet eggs. The Bashkirian ASSR, widely applying the differentiating method of treating with a mordant the seed grains against smut (A. A. Meier), freed itself entirely from smut and obrained a great economy of chemicals.

The gas method of controlling the suslik which has been worked out by the Rostov station of plant protection (N. N. Arkhangel'skii) is the only radical measure of eradicating the suslik and is applied in USSR on an expansive scale.

The Stalin collective farm of Namangansk raion, Fergansk oblast', Uzbek SSR, which successfully carried out measures in controlling pests, obtained crops of cotton raw material at 38.5 centners from 1 hectare (I. Nishanov). Iangi-Iul'skii raion of the Uzbek SSR, after having organized the timely treatment with a mordant of cotton seeds decreased the infestation up to o.4 o/o, and the raion obtained the average cotton raw material 25.35 centners from 1 hectare. The Gorkii state farm (Moskva) which successfully carries out the control of pests and diseases of vegetable crops obtained a yield of 168 centner from 1 hectare in the open ground, 22.5 kg from the farms in conservatories, 8.48 kg from 1 square meter in conservatories (O. G. Galantsev). The Tadzik SSR which fully fulfilled the quarantine measures in protecting the most valuable species of cotton against foreign pests, is up to now free from these pests despite the infestation threat (K. E. Demokidov). The collective farm "Victory" of Voronezh oblast' carried out a system of measures in controlling smut and obtained a yield of grains of 20 centners from 1 hectare (F. I. Leonov).

Hundreds of such examples might be mentioned. Hundreds of collective and state farms demonstrate their experience in the struggle for better basic agricultural yield. Among them in each case data are given concerning that influence upon yield which is the result of the timely and correct control of pests and diseases.

The agricultural aviation, as a special application, and the educational personnel of agricultural schools occupied an important place at the All-Union Agricultural Show of 1940. Many foremost stakhanovites are indicated by those divisions. The best stakhanovites of agricultural aviation, I. V. Sazonov, Ia. M. Mikhailov-Senkevich and V. M. Titov have been awarded golden and silver medals. This high distinction indicates the scale and the significance of work carried out by agricultural aviation.

The Agricultural Institutes were represented by their best teachers who, along with their highly qualified educational work, carry out systematically the great scientific research in studying the biology and ecology of pests and diseases, in discovering new, more effective control measures, and also wrote a series of textbooks and manuals used as the basic references. The following educators are the participants at the show of 1940: V. P. Boldyrev, V. N. Shchegolev, N. N. Bogdanov-Kat'kov, F. Ia. BeiOBienko, N. A. Naumov, V. V. Iachontov, S. V. Vladimirskii, D. N. Babian, E. A. Kreiter, etc.

Well presented is the plant "Vulkano", which produces heavy machines for controlling agricultural pests and diseases. This plant is one of the first which for 15 years assimilated the production of complicated machines. This plant produced 30 machines of which 17 types are introduced in mass production. The plant presented at the show all the basic types of heavy industry produced by it (pavilion "Mechanization"). 23 best Stakhanovite workers are distinguished by the plant: N. I. Antonov, E. M. Varganov, S. O. Dizhe, E. A. Kopelvich, E. I. Krasovitskii, S. I. Novatortsev, B. I. Rez-Nekrasov, V. R. Tsimmerman, etc.

As is seen from the above survey of the most important exponents in plant protection at the show, the show of the newest achievements in 1940, unlike that of 1939, occupied an important place in all branch pavilions. But along with that, we must also indicate a few shortcomings. The method of controlling locust pests, mice like rodents and susliks, rust of grain, is missing at the show. These shortcomings should be filled and the indicated objects presented in a widely extended manner.

In many pavilions, the show could be considered satisfactory. As an exception, we may indicate the show of materials for individual pests and diseases, which were significant in agriculture in 1940. We may indicate the following pests: sugar beet weevil, harmful eurygaster, dusty smut of wheat and barley, "zakuklivanie" of grain, mice like rodents and several others. The show of materials concerning these pests and diseases is not less than the other, but, due to a great interest for them on the part of the visitors, the demonstrated material was unable to satisfy all the inquiries. The inquiries of the visitors concerning the measures and means for controlling these pests and diseases, as well as the technique of organization and the carrying out the control, are numerous and vary. In order to satisfy these inquiries, a widely developed show of materials on the biology and ecology of the mentioned pests and diseases, as well as methods in controlling them, is imperative. We have to admit that such part of the show was not provided at the Agricultural Show of 1940.

The second shortcoming could be considered the splitting of the achievements, i. e. the demonstration of the same problem in many branch pavilions. Such organization caused the disconnection within a series of problems and decreased the possibility of familiarizing the visitors with these problems. Thus, for instance, the visiting cotton growers who were interested in the problems of controlling locust has to find the material in that line in the pavilion "Grain","Mechanization", "Chemisation" and even in other pavilions. Such inconvenience in familiarizing the visitors limited them in time and besides, did not always provide with a well rounded consultation.

The consultation along the problems of plant protection against pest and diseases in the pavilions could not be ensured by qualified personnel because the number of pavilions in which the plant protection was presented amounted to 30. Therefore, it is necessary to make available in the future the clarification of many general questions in a special (extra) pavilion "Plant Protection" or in a separate room. Only under this condition, may the problems of plant protection be clarified most completely and thus could the All-Union Agricultural Show fulfill completely its greatest significance in the work of popularizing and introducing into production the new achieve ments in controlling pests and diseases, and to make the entire show more interesting, sound and profitable for the visitors by highly qualified consultations.

Among the inquiries expressed by the visitors at the show of 1940, we like to mention the following: the tech·ique of applying some of the devices and machines; construction and work of biolaboratories, the individual devices for controlling pests and diseases, etc.

It is quite obvious that only by demonstration (by the process itself in open spaces, in open fields) of machines, devices, methods of control, etc. could all the inquiries be answered. Such a demonstration of the achievements in plant protection in the open field is considered by the workers of the show as the most correct and most profitable measure of elucidating the demonstrated exponents. This measure should in the future occupy the leading place and its volume should correspond to all most important demands of production.

It is also appropriate to mention here the following situation: while in demonstrating the achievements of agricultural plant protection, the pavilions are able to afford a comparatively limited exposition field, such a limit is excluded for open fields. In order to extend the show of our material, we have to take into consideration this favorable condition and make full use of the possibilities during our preparations for the fair of 1941.

During the preparatory period for the fair of 1941, all the exhibitors (concerning the problems of plant protection) of the scientific and operating organizations should pay attention to the selection of progressive farms, which organized the work of plant protection, and to the applied measures in controlling agricultural pests and diseases in their farms. The exponents of plant protection should take into consideration that the demonstration of the progress of collective and state farms along with the achievements of science is one of the best, convincing and profitable forms of the show. We urge all the workers in plant protection, after having utilized all the methods of socialist contest and all the experience of the foremost workers of the fair, to take an active part in the fair of 1941.

End of Article

26 June 1951

178

Leningrad.
Institut zashchity rastenii.
....The principal pests and diseases of crop plants in the USSR(Survey for 1935)Leningrad, Lenin Academy of Agricultural Sciences, 1936.
431p 464 L542

Translated in part from the Russian
by R. G. Dembo

Table of Contents

Part IV

Pests and Diseases of Vegetables

Part V

Pests and Diseases of Hemp

Part VI

Pests and Diseases of Flax

Part VII

Pests and Diseases of Fruit

of crop plants.....

Appendix:

15 June 1951

Trans. 178
(In Part)
pp: 141-146
By:
R. Adelman

Kotova, E. P.

Rzhavchina zernovykh khlebov v
1934-1935 gg.

[Rust of Cereal Grains in 1934-1935].

In "The Principal Pest and Diseases of
Crop Plants in the USSR". Leningrad,
1936, pp. 141-146. (In Russian)

Institute of Plant Protection, Lenin
Academy of Agricultural Sciences.

CROWN RUST (PUCCINIA CORONIFERA KLEB.), P. 141

In the years of 1932-1933 crown rust was widely spread over the entire USSR. Oat crops of the western and central regions of the USSR were infected to a high degree.

The year 1931 is characterized by a comparatively weak development of oat rust.

In 1934, regardless of the large reserve of teleuto-stage /teleitostadii/ left over from crop waste of 1933, and the early appearance of aecidiostage on the cathartic buckthorn, the development of crown rust was slight in the central and south-western regions of the European /Soviet/ Union, which can be explained partly be summer droughts and partly by the early and short oat crop season of that year.

In 1935, the degree of crown rust noted, with minor exceptions, in the entire USSR was moderate and slight (see table 13)[1]. Considering that in 1935 meteorological conditions were analogous and, apparently, favorable for

1. For 1934, comparative data as to the degree of rust manifestation are cited in tables 13 and 14 only on the more characteristic points.

rust development, the reason for its weak development, as compared to 1932 and 1933, lies fundamentally in the earlier and shorter crop season, the same as in 1934.

Thus, Gassner's theory - age immunity of oats to crown rust - is here strongly substantiated.

In 1934, and particularly in 1935, in the central and southern regions which are rich in overgrowth of catharctic buckthorn, there was observed a very early ripening of aecidia and a mass appearance of aecidiospores before the oats entered the spike-forming phase which is more vulnerable to rust.

The relation of the degree of crown rust infection of oats to a late and protracted crop season can be seen plainly from the 1935 comparative data for Birobidzhan. Here the late crop of oats ("Pobeda" variety) was infected up to 40%, while the early-mid season /crop/ only 7% and the mid-late, 26.0%.

The reason for the protracted crop season in Biribidzhan can be explained by the unusually deep (up to 50 cm as against the normal 22 cm) blanket of snow in February and the abundant spring precipitation in April and May which exceeded by more than double the norm for many years. This resulted in extreme moisture saturation of the soil and prevented the crew from accomplishing the sowing on time.

STEM RUST (Puccinia graminis Pers.), p. 146

Stem rust of cereals in the USSR, as compared to the leaf rust varieties, has a smaller specific weight in point of area as well as in degree of manifestation and in economic importance.

In the USSR this rust variety is of greater significance to winter and spring wheat and to oats, of lesser - to winter rye and barley.

To spring wheat, stem rust is of the greatest significance in the Far East /DVK/ especially in maritime territory, to winter /wheat/ - in the southern part of North Caucasus, in the zones where there is sufficient and excessive moisture.

In other cereal growing regions, stem rust appears usually only at ripening time and, therefore, the damage it inflicts is minor. For the last five years the spread of stem rust was registered in the following regions: In 1931 stem rust attacked wheat crops of the entire south-western territory of the European [Soviet] Union, but its weight was insignificant due to the slight degree of manifestation. In the years of 1932-33 an outbreak of stem rust upon wheat crops was noted in foot-hill regions of Northern Caucasus and over a series of districts in the Ukraine.

Stem rust spread markedly in 1934 in the north-eastern and western regions of the European part of the Union. A weaker development of it was noted in the north-western and south-eastern regions of the Union, and its absence or very weak development - over the entire Ukraine, in the central regions of the European territory and in the Asiatic part of the [Soviet] Union.

Stem rust of barley spread, chiefly, over the southern regions cultivating the crop: North Caucasus, the Azovo-Black Sea Coast, the Ukraine, where a very intensive development of the disease was observed in 1932-33 as compared with 1931.

In 1935 stem rust was of relatively great significance to spring wheat, showed weaker manifestation on winter rye and winter wheat, and had no economic significance whatever for oats (see table 14).

Table 14

Infection of grain crops by stem rust during the period of waxy ripeness in 1935
(As per inspection data of the bases of VIZR All-Union Institute of Plant Industry)

Republics Kraia Oblasti	Regions	Winter Wheat: Development % in 1934	Winter Wheat 1935: Inspected areas per ha	Winter Wheat 1935: % of development	Spring Wheat: Development % in 1934	Spring Wheat 1935: Inspected areas per ha	Spring Wheat 1935: % of development	Winter Rye: Development % in 1934	Winter Rye 1935: Inspected areas per ha	Winter Rye 1935: % of development	Oats: Development % in 1934	Oats 1935: Inspected areas per ha	Oats 1935: % of development	Barley: Development % in 1934	Barley 1935: Inspected areas per ha	Barley 1935: % of development
Leningrad	Ostrovsk	-	125	10	-	3	38	-	163	57	43	220	100	0.8	98	66
"	Leningrad	0	16	21	-	5	22	15	95	22	3	84	5	-	-	-
Zapadnaia	Smolensk	-	334	24	-	201	63	-	486	30	-	100	25	-	50	32
"	Briansk	-	32	31	-	19	5	-	-	-	-	-	-	-	-	-
BSSR	Minsk	-	313	22	-	248	29	-	437	36	31	946	6	-	294	40
"	Gomel'sk	-	-	-	-	-	-	-	72	13	-	-	-	-	-	-
"	Zaozer'e	-	-	-	-	82	10	-	-	-	-	86	10	-	230	21
Moscow	Tul'sk	-	83	9	-	141	7	46	827	9	-	-	-	-	-	-
"	Shchekinsk	-	50	38	-	-	-	-	240	2	-	-	-	-	-	-
"	Laptev	-	305	17	-	-	-	-	459	13	-	-	-	-	-	-
Kirov	Izhevsk	-	-	-	-	-	-	-	470	23	-	150	0	-	-	-
"	Balezinsk	-	-	-	-	110	15	-	440	1	-	460	9	-	102	6
"	Kirov	-	-	-	-	-	-	-	-	-	-	11	9	-	-	-
Gor'ki	Gor'ki	-	287	17	-	333	6	-	448	14	-	707	5	-	63	0
Ivanovo	Rostov	0	184	6	0	36	19	0	350	3	13	300	0	-	-	-
TARTAR ASSR	Spassk	68	60	3	3	1,535	2	50	272	24	-	1,241	0	-	-	-
Sverdlovsk	Sverdlovsk	-	-	-	-	1,703	8	-	595	13	-	1,446	0	-	125	1
"	Perm	-	-	-	-	-	-	-	42	4	-	3,433	9	-	329	5
Bashkir ASSR	Ufimsk	-	-	-	2	1,879	32	32	2,583	19	20	1,196	24	-	-	-
" "	Meleyzovsk	-	-	-	0	1,685	38	34	1,774	5	-	-	-	-	-	-
Cheliabinsk	Cheliabinsk	-	-	-	-	2,750	0	-	100	0	-	-	-	-	-	-
Kursk	Belovsk	-	-	-	-	-	-	-	395	7	-	-	-	-	-	-
Voronezh	Tambovsk	-	187	8	-	236	24	-	1,201	20	0	351	9	-	-	-
Kibyshev	Luninsk	-	167	3	-	258	12	-	-	-	-	660	6	-	-	-
"	Kibyshev	-	-	-	-	-	-	-	-	-	-	158	0	-	-	-
Orenburg	Orenburg	-	-	-	0.3	95	100	-	-	-	-	-	-	-	-	-
Saratov	Saratov	-	-	-	-	864	15	-	-	-	-	15	1	-	208	-

Republic Kraia Oblasti	Regions	Winter Wheat: Development % in 1934	Winter Wheat 1935: Inspected areas per ha	Winter Wheat 1935: % of development	Spring Wheat: Development % in 1934	Spring Wheat 1935: Inspected areas per ha	Spring Wheat 1935: % of development	Winter Rye: Development % in 1934	Winter Rye 1935: Inspected areas per ha	Winter Rye 1935: % of development	Oats: Development % in 1934	Oats 1935: Inspected areas per ha	Oats 1935: % of development	Barley: Development % in 1934	Barley 1935: Inspected areas per ha	Barley 1935: % of development
Saratov	Krasno-Kutsk	-	-	-	-	6,528	14	-	5,490	1	-	331	8	-	699	[illegible]
"	Petrovsk	-	104	0	-	-	-	-	-	-	-	1,056	10	-	-	-
Stalingrad	Leninsk	-	-	-	0	359	5	-	869	0	-	-	-	-	6	[illegible]
"	Nizhne-Chirsk	-	-	-	4	1,791	6	0	1,185	6	-	-	-	-	-	-
Azovo-Chernomorsk	Tsymliansk	-	-	-	-	433	24	-	-	-	-	-	-	-	414	-
" "	Taganrog	-	646	19	-	177	61	-	-	-	-	-	-	-	674	[illegible]
" "	Krapotkin	-	818	34	-	-	-	-	-	-	-	587	6	-	-	[illegible]
" "	Maikop	-	539	20	-	-	-	-	-	-	-	-	-	-	1,089	[illegible]
" "	Prim.-Akhtar	-	1,024	26	-	-	-	-	-	-	-	-	-	-	-	-
" "	Slaviansk	-	404	26	-	-	-	-	-	-	-	-	-	-	-	-
" "	Anapsk	-	369	19	-	-	-	-	-	-	-	-	-	-	-	-
North Caucasus	Georgievsk	2	431	18	-	-	-	-	398	0	-	461	1	-	-	-
" "	Ipatovsk	-	100	0	-	-	-	-	-	-	-	-	-	-	-	-
" "	Buinaksk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ukrain.SSR Cher-nigov Obl.	Chernigov	-	40	11	-	5	28	-	1,922	38	-	1,562	24	-	332	[illegible]
" " "	Nov.-Seversk	-	7	8	-	117	36	-	27	7	-	278	34	-	-	-
Khar'kov	Khar'kov	-	587	9	-	-	-	-	1,227	7	-	-	-	-	45	-
"	Krasnograd	-	65	16	-	1,630	23	-	334	17	-	640	14	-	997	[illegible]
Donets	Stalinsk	0	1,014	17	0	1,063	3	0	1,088	1	0	658	0	0	879	[illegible]
"	Starobelsk	-	-	-	0.3	50	18	0	115	6	-	-	-	0.3	700	[illegible]
Dnepropetrovsk	Melitopol'	-	4,582	10	-	71	19	-	181	12	-	-	-	-	2,374	[illegible]
"	Zaporozhe	-	-	-	-	-	-	-	180	19	-	-	-	-	-	-
Vinnitsa	Kam.Podol'sk	7	1,047	467	-	-	-	-	-	-	-	469	1	1	514	[illegible]
Moldavian ASSR	Tiraspol'	-	1,785	10	-	101	38	-	20	13	-	-	-	-	446	[illegible]
Odessa	Kherson	-	370	3	0	40	28	0	58	23	-	-	-	-	568	[illegible]
"	Skadovsk	0	2,349	19	-	-	-	-	-	-	-	-	-	-	980	[illegible]
"	Kirov	-	2,063	15	-	-	-	-	151	15	-	288	1	-	-	-
Kiev	Kiev	-	744	15	-	-	-	4	904	16	-	1,273	0	2	528	[illegible]
"	Belo-Tserkov	0.3	3,202	49	-	-	-	0	391	41	-	764	9	-	1,221	[illegible]
"	Umansk	-	8	27	-	-	-	-	5	29	-	-	-	-	6	[illegible]

Republi Kraia Oblasti	Regions	Winter Wheat			Spring Wheat			Winter Rye			Oats			Barley		
		%	1935		%	1935		%	1935		%	1935		%	1935	
		Development in 1934	Inspected areas per ha	% of development	Development in 1934	Inspected areas per ha	% of development	Development in 1934	Inspected areas per ha	% of development	Development in 1934	Inspected areas per ha	% of development	Development in 1934	Inspected areas per ha	% of development
Crimean ASSR	Dzhankoi	7	1,263	11	-	-	-	-	-	-	-	-	12	-	1,089	2
Azerbaidzhan SSR	Geokchai	-	460	6	-	-	-	-	-	-	-	-	-	-	157	0
Armenian SSR	Leninakan	-	20	8	-	-	-	-	-	-	-	-	-	-	60	7
" "	Erivan	-	42	10	-	59	2	-	-	-	-	-	-	-	24	1
West-Siberia	Novosibirsk	-	-	-	-	-	-	-	80	41	-	-	-	-	-	-
" "	Tomsk	-	-	-	-	1,686	7	-	2,642	58	-	1,953	2	-	386	43
" "	Prokop'evsk	-	-	-	-	67	0	-	91	0	-	-	-	-	-	-
Omsk	Omsk	-	-	-	-	781	32	-	-	-	-	-	-	-	-	-
Krasnoiarsk	Minusinsk	-	-	-	-	16	0	-	-	-	-	22	15	-	-	-
East-Siberia	Sretensk	-	-	-	-	-	-	-	567	3	-	-	-	-	-	-
Far-Eastern (DVK)	Voroshilov	-	-	-	-	964	5	-	37	0	-	622	0.1	-	32	0
" " "	Blagoveshchensk	-	-	-	-	567	0	-	-	-	-	-	-	-	-	-
Kazakh ASSR	Urdzhar	-	15	2	-	-	-	-	-	-	-	-	-	-	-	-
Alma-Atinsk	Aulis-Atinsk	-	-	-	-	70	2	-	-	-	-	-	-	-	-	-
South-Kazakhstan	Kelessk	-	-	-	-	553	9	-	-	-	-	-	-	-	83	8
West-Kazakhstan	Uralsk	-	-	-	-	31	1	-	-	-	-	18	0	-	22	0
Karaganda	Akmolinsk	-	-	-	-	314	4	-	-	-	-	-	-	-	-	-
Kirgiz ASSR	Frunze	-	45	0	-	18	0	-	-	-	-	-	-	-	-	-
Uzbek SSR	Semarkand		20	0	-	-	-	-	-	-	-	-	-	-	-	-
Turkmen SSR	Bairam Ali	-	-	-	-	2	13	-	-	-	-	-	-	-	-	-

 .on

Sektor ucheta i raionirovaniia.
Prognosis of the anticipative development of the most prominent pests and diseases expected to damage field crops and forest in 1935. Leningrad 1935. 148 p. 464 L54

Translated in part from Russian by R. G. Dembo

179

Table of Contents

Leningrad. Institut zashchity rastenii.
Sektor ucheta i raionirovaniia.
Prognosis of the anticipative development of ...

II. Agricultural Diseases

1. Grain crops

18 June 1951

Zashchita rastenii ot vreditelei i boleznei
(Protection of plants from pests and diseases)
Ed. 3. Moskva, 1950. 640p. 464.4 B76 Ed. 3

Translated in part from the Russian by S. M. Monson

TABLE OF CONTENTS

SPECIAL PART

Pests and Diseases of Agricultural Plants

Boshian, G. M. On the nature of viruses and microbes. Medgiz, 1949

Williams, V. R. Principles of Agriculture. Sel'khozgiz, 1948

Gutner, L.S., Dobrozrakova, T.L., et al. Key to plant diseases according to external characteristics, Sel'khozgiz, 1937

Dobrozrakova, T. L. Handbook for practical study on phytopathology, Sel'khozgiz, 1949

Dunin, M. S. Immunogenesis and its practical utilization. Trudy of Timiriazev Agricultural Academy, issue 40, 1946

Efimov, A. L. Chemical method for controlling pests and diseases of agricultural plants. Sel'khozgiz, 1949

Lysenko, T. D. Agrobiology. Sel'khozgiz, 1949

Michurin, L. V. Work in four volumes. Sel'khozgiz, 1948-49

Chugunin, YA. V. and Uganova, O. N. Phenological calendar for the protection of orchards from pests and diseases. Krymizdat, 1946

Shchegolev, V. N. Plant protection from injuries caused by insects and other pests. Sel'khozgiz, 1949

Schegolev, V. N., et al. Key to insects concerning injuries caused to cultivated plants. Sel'khozgiz, 1935

Yachevskii, A.A. Handbook on phytopathological observations. Baskhnil, 1930
Handbook of an agronomist on plant protection. Sel'khozgiz,19

Briantsev, V. A.
Zashchita rastenii ot vreditelei...

Chapter Three

METHDS OF PEST AND DISEASE CONTROL. (p. 142-170)

General information on methods (p. 142)

Pest andisease control of agricultural plants is applied by agro-technil, chemical, physical-mechanical, and biological methods.

The a/-technical method of control produces conditions favorable to plant grov and interferes simultaneously with the development and propagation ofsts and inducers of diseases. Some agro-technical methods destroy ;s and inducers of diseases directly. This is achieved by adequatop rotation, agro-technical methods, the introduction of résistaarieties, etc.

Themical method of control consists in direct destruction of injurjnimal organisms by poisonous substances. With respect to diseathis method has primarily prophylactic significance.

hysical-mechanical method of control consists in the destruction of pnd diseases through changes in physical environment, removal and ıction of pests with the aid of mechanical equipment, and the iso of crops from pests by mechanical means (obstacles).

biological method of control consists in the destruction of pests bytural enemies.

; and disease control achieve their best results by the simultaneous ,ll methods. The principal task in organizing control is therefore ·lish a system for controlling diseases and pests applicable to ıt regions. With regard to many pests and diseases, combined measures ready been developed, such as those directed against smut of cereal crops, the beet webworm, European corn borer and pests and diseases of fruit crops.

AGRO-TECHNICAL METHOD (p. 143-152)

The application of agro-technical methods for controlling pests and diseases is based on the relationship between plants, parasites and external environment. Agro-technique transforms conditions of plant nutrition, temperature and moisture of air and soil, i. e. the basic factors in plant development. Proper agro-technique may therefore contribute to the growth of plants, increase their resistance to diseases and injuries and create conditions which will limit mass development of pests and diseases. The agro-technical method has fundamentally prophylactic significance. Frequently, however, agro-technical methods are used in destroying pests directly. Within the general system, this method represents one of the main links. The wide application of agro-technical methods and the mechanization of agricultural procedures on large areas is entirely feasible in a planned socialist economy.

In the majority of cases, this method does not require additional expenditures since it is primarily intended to produce crops.

By following Williams' teaching, as related to the grass field system of agriculture, the system in its entirety should be applied for adequate industrial results. Crop rotation, cultivation, of the soil, fertilization, are all included in this group.

GRASS-FIELD CROP ROTATION.

This basic element of the grass-field system in agriculture is of exceptionally great significance for the control of pests and diseases.

The introduction into crop rotation of a mixture of perennial legumes and cereal grasses improves the structure of the soil, enriches it with organic substances and thereby creates conditions for better plant development in all "wedges" under crop rotation. Under these circumstances resistance of plants to unfavorable conditions is increased, including their resistance to pests and diseases. In addition, perennial grasses contribute to the disinfection of soils. Soils planted with perennial grasses creat anaerobic conditions unfavorable to many injurious insects and micro-organisms.

Proper rotation and distribution of crops contribute to the reduction of pests and infection.

Rotation of plants and changes in external environment lead to reduction in the spread of disease and propagation of insects. In controlling the sugar beet nematode, for instance, the area infested by the latter may be made more healthful by introducing such crops as wheat, rye, corn, alfalfa, flax, chickory, and several others into crop rotation. These crops, by stimulating the exit of nematode larvae from cysts do not provide forage for them, which leads to the mass destruction of these pests. Oats should not be introduced into sugar beet crop rotation since this crop is affected by nematodes in a manner similar to sugar beets.

During adequate crop rotation infection of the soil by such diseases as fusarium, other diseases of flax and various species of rust is considerably reduced since these diseases are caused by special parasites, i. e. the kind adapted to one crop. With respect to non-special parasites (i. e. inducer of cotton wilt), the introduction into crop rotation of non-infectious crops (alfalfa, cereals) is most effective.

In establishing periodical crop rotation, the biological characteristics of individual pests and diseases should be considered. Thus the inducer of club root of cabbage is preserved in the soil for 4-5 years; potato canker for 13 years; cysts of sugar beet nematodes for 6-8 years. Consequently, the re-introduction of a crop may be planned accordingly.

The distribution of wedges is of particular importance in crop rotation. Planting of crops (attacked by the same pests) in immediate proximity should be avoided. When cotton fields adjoin leguminous fields, it is possible for the leguminous aphids to transfer from Cucurbitae to cotton.

To preserve summer wheat from infection by brown rust, summer and winter wheats should not be planted next to each other in particular seed plots since this species of rust winters on winter wheat and spreads in the spring to summer crops.

CULTIVATION OF THE SOIL.

Proper soil cultivation is essential for controlling pests and diseases of agricultural crops. Fall plowing of the soil consists in 1) disking and 2) deep fall plowing with plow and fore-plow.

In disking and subsequent deep fall plowing, many injurious insects and fungi parasites, settled in different vegetative residue, on surface and upper layers of soil are destroyed.

Disking of stubble, immediately following the removal of harvested cereal crops produces rapidly appearing stalks of volunteer grain which attract such pests as the Swedish and hessian flies. The latter lay their eggs in the young plant grown from volunteer grain; the development of the pests takes place subsequently on the same grain. Such diseases as yellow and brown rust of cereals may equally develop on stalks from volunteer grain.

During deep fall plowing this grain, infected by pests and diseases, penetrates into the depth of the plowed layer (20-22 cm), where under aneorobic conditions the injurious organisms perish.

Weeds and vegetative residue harboring infectious foci of various diseases and serving as propagation spots for pests are also plowed under. Many species of rust, wintering larvae of stem grain saw flies [Hymenoptera] or [Cephus pygmaeus L.], are destroyed along with eggs of [Oria musculosa Hb.] and other injurious insects.

Insects located on the surface or upper layers of the soil penetrate (in plowing) the lower soil layers and perish there because of their inability to break through thick particles of soil. This method of plowing is used to destroy caterpillars of the sugar beet webworm which winter on the surface [Loxostege sticticalis L.] and the pea moth, [Laspeyresia nigricana (Steph.)], etc. Deeply plowed-in sclerotia of ergot develops only in negligible quantities and the percentage of infested plants is thereby reduced.

Insects are also directly destroyed by soil cultivation. Pupae are particularly sensitive to mechanical injuries; they perish from minor injuries, such as rubbing their bodies against particles of soil. Plowing for this purpose is therefore recommended during the period of mass pupation of wireworms and other insects.

Many insects pupate in caves to facilitate their exit as adults from pupae. It has been established that after plowing and cultivating the formation of caves where pupae of the cotton ballworm [Chloridae obsoleta F.] and cabbage moths [Barathra brassica L.] winter, the number of butterflies are considerably reduced.

Cultivation by black fallow is particularly significant. The main object of black fallow, according to Williams, is to control weeds. Since weeds may serve as a habitat for insects, (the cutworm moth, for instance), cultivation by black fallow represents simultaneously an effective measure for controlling this harmful insect.

FERTILIZING AND ADDITIONAL FEEDING reduce mainly the severity of injury caused to plants by pests and diseases. In some instances fertilizers act upon pests directly or indirectly through changes in environment.

Fertilizers and additional feeding speed growth and accelerate the development of plants. It is known that many pests and diseases severely affect plants in the early stages of development. Pests such as [Tanymecus palliatus F.], [Ph. cruciferae Coeze.], and [Aphthora euphorbiae Schrank.] cause considerable injury to plants during the cotyledon stage and when the first leaves appear. The Swedish fly injures plants primarily in the stage of germination; anthracnosis and fusarium of flax, "root-eater" of sugar beets, rhizoctonia of potato seedlings, etc., represent serious threats to young plants. The sooner a plant passes the early stage of its development, the less harmful will be infestation by pests or disease.

Fertilizers and additional feeding may radically reduce injuries caused by [Chlorops pumilionis Bjerk], ("zelenoglazka"), of which the larvae eat lengthy furrows in the stalks of summer cereals. Through hastening the growth of plants tillering takes place before the larvae have a chance to injure them. Larvae die on bare stalks and the threat of this pest is eliminated.

Intensive growth generally curtails injuries to plants by harmful insects. This applies equally to disease. Wilt, browning and breaking of stems of flax, black scab of potatoes, phomopsis of cruciferae and sugar beet affect plants of weak development.

Potassium and phosphorous fertilizers increase plant resistance to diseases and thereby hinder the development of disease inducers. The introduction of these fertilizers represents one of the methods for controlling rust and fusarium of grain crops.

Other fertilizers change the chemical properties of the environment. Thus, lime, as an alkali fertilizer, creates unfavorable conditions for the development of fungi organisms, such as inducers of club root of cabbage, "root eater" of sugar beet, as well as of several species of wireworms, larvae of [Culicidae], etc., which usually develop in acid surroundings. In addition, there are fertilizers which react directly upon pests. Among these are super phosphates which when they come in contact with the bodies of slugs destroy them. In controlling disease, the introduction of microelements, such as boron, into the soil is significant. Lack of boron in soil causes decay of cores of sugar beet; and also reduces resistance of flax to bacterium.

PREPARATION OF SEED STOCK.

Seeds and seedlings are capable of transferring pests and diseases of agricultural plants. Thus seeds may spread smut of cereal crops, wilt, anthracnose and other flax diseases, and gummosis of cotton. Seedlings may spread phytophthora, black leg, and other diseases of potatoes.

Seeds may also carry into fields such injurious pests as the pea weevil, [Bruchus pisorum L.], clover seed chalcid, [Bruchophagus gibbus (Boh.)] pink worm, cottony cushion scale [Icerya purchasi Mask.] wheat nematodes, etc.; seedlings will carry phylloxera, strawberry mites, [Tarsonemus fragaria Zimm.], etc.

Many measures are required to provide healthful seed stock and seedlings. Along with physical-mechanical and chemical methods (which will be discussed below) agro-technical methods, such as cleaning and sorting, are widely used for this purpose. Cleaning and sorting eliminate sickly seeds, most frequently affected by disease, light weight seeds infested by pests, smut sori, sclerotium of ergot, seeds of injurious weeds, as well as residue of different parts of plants on which rust spores and other parasites may dwell.

Preparation of seed stock requires careful selection, sorting and rejecting.

PERIODS OF SOWING are significant as factors regulating the conditions of infection of agricultural plants by pests and diseases. In many instances they preserve plantings from mass injuries and infestation.

Thus, early planting of summer crops is the principal measure in controlling Swedish and hessian flies; [Chlorops pumilionis Bjerk.], elm pests (aphids), [Tetraneura ulmi Deg.], and many other pests.

The Swedish fly, which lays eggs on stems, having only 2 to 3 leaves, injures plants in the germination stage; plant injuries which occur in the tillering stage are less harmful, while injuries caused at the booting stage are practically not affecting yields.

Other insects, such as the hessian fly, while they are not selective in depositing their eggs, affect yield more if they infest plants in their early stages. Spring crops planted earlier go through the most dangerous phase of growth, that of germination, before the approach of summer and avoid the mass egg laying of the Swedish fly.

Infestation and development of diseases of agricultural crops equally depend upon planting periods. The majority of fungi require high temperatures for their development. Fusarium of cereals requires an optimal temperature of 12-22°; the optimum is lower for the host plant. Fusarium therefore develops less on early summer plantings than on later crops. Light infestation by rust of early flax and summer cereals may be also traced to the difference in temperature optimums. As to planting periods of cereals in the fall, it is advisable to keep to optimal periods in controlling rust, since temperature conditions are less favorable at that time.

Planting periods affect considerably the injurious activity of parasitic organisms. Early sowings mature earlier, and the duration of the activity of parasitic fungi upon plants is consequently reduced. Thus early flax produces smaller losses in yield from rust than late flax. To plant cauliflower early is essential to prevent bacterium since the development of bacterium will take place at a time when the plant is at a less susceptible stage.

Radical advancing of planting periods is important for the control of pests and diseases of some crops. The Academician Lysenko introduced summer planting based on the stage development of plants. This method is widely adopted for potatoes to control virus diseases and so-called diseases of degeneration (non-parasitic). Summer alfalfa suffers less from pests than do ordinary spring crops.

VERNALIZATION OF SEED STOCK.

This agricultural method, developed by the Academician Lysenko, speeds stages in plant development and contributes to more energetic, vigorous growth. Cereal crops from vernalized seeds possess vigorous root systems and are more resistant to pests and disease. Vernalization reduces the number of pests which attack plants in the early stages of plant development, such as the Swedish fly, which injures germinating seeds. In addition, vernalization cuts losses caused by pests and diseases the injuriousness of which is determined by the length of the vegetative period. Different species of cereal rust belong to this group, since they may affect crops throughout the vegetative period.

DESTRUCTION OF WEEDS.

The development of many pests and inducers of diseases is associated with weeds. This is understandable since prior to their transfer to cultivated plants pests developed on wild plants. Many injurious pests are still closely associated with wild vegetation. Thus sugar beet webworms, cutworm moths, stem borers, etc., lay their eggs on weeds even when cultivated plants are available; their caterpillars crawl onto agricultural crops and destroy them.

In the spring, prior to the appearance of cultivated plants, many pests, such as [Ph. crucifera Goeze], cabbage moths, cotton bollworms, [Chloridea obsoleta Fab.], red spiders, etc., feed and propagate on weeds.

After cereal crops are harvested and prior to the appearance of winter crops, wild cereals serve as forage to Swedish and hessian flies.

Many diseases, such as ergot, club root of Cruciferae, some species of rust, etc., by infecting cultivated plants, can simultaneously develop on wild grown species. In addition, some weeds [Thalictrum L.], ("vasilistnik"), and [Euphorbia L.], ("molochai"), etc., are the intermediate hosts of rust of cultivated plants. Weeds thus represent constant foci of infectious diseases. Hence, it is necessary to wage steady control over weed vegetation by cultivating the soil and caring for crops.

PERIODS OF HARVESTING affect the development of pests and their harmful activity. Timely harvesting of cereals in close periods reduces the amount of volunteer grain and thus limits the development of some pests and diseases. Early harvesting of flax reduces losses of yields primarily because the period of harmful activity of pests and diseases is reduced. Delay in harvesting leads to injuries of the stems of flax by flax fleas, [Aphthona euphorbiae Schrank.], since by that time the new generation of beetles appears in masses. Rust and other diseases of flax are prevented from causing much damage to flax when it is harvested early and losses in yield are reduced to a minimum. It is recommended to harvest flax (fiber) at its stage of yellow maturity.

USE OR DESTRUCTION OF POST-HARVESTING RESIDUE.

This is essential as a prophylactic measure since such residue serves as wintering abodes for many pests and vegetative parasites.

To make potato plantings healthier, plants affected by black leg, ring rot, etc. are removed. Cabbage and tomato seedlings and other vegetable crops, if infested, are destroyed in greenhouses and the diseased seedlings rejected when planted in open ground.

INTRODUCTION OF RESISTANT VARIETIES.

Resistant varieties are important in protecting plants from pests and diseases. Considerable successes have been achieved in the Soviet Union in the field of selection with regard to resistance to disease. By applying Michurin methods on a wide scale, scientists have produced many plant varieties resistant to disease. Some of these varieties have been already introduced into agricultural practice. Rust-resistant varieties have been produced among cereals. Among the most valuable resistant varieties of wheat are: Krasnodarka and Novo-Ukrainka 83. Many varieties of sunflower, produced by the Academician Zhdanov, are known for their resistance to "zarazikha," broomrape, [Orobanche cumana or O. ramosa]; among them are the varieties 8281 and 6432.

The best phytophthora-resistant varieties are the Kameraz hybrids, the variety 18883 (Moskvich), Krasno-Ufimskii and Uralskii. Many potato varieties are resistant against potato canker. Canker-resistant varieties, Berlichingen, Cobbler, Great Scott, Imandra, etc. are introduced in areas threatened with canker.

Among fruit and berry crops the varieties created by I. V. Michurin possess the highest degree of resistance to disease. The apple varieties "Borsdorf-Kitaika," "Safran," "Pepin," "Slavianka," etc., are resistant to scab and fruit rot. The gooseberry varieties "Cherny mavr," "Negus," "Shtambovy," are resistant to mildew.

There are also varieties resistant to pests. As an example one may cite the "panzer" varieties of sunflowers not affected by the sunflower moth. The panzer layer in the hull of seeds cannot be chewed through by caterpillars of this moth because of its hardness.

Pest-resistant forms of other cultivated plants are under further study. Among hard and soft wheats there are forms resistant to hessian and Swedish flies. Egyptian cotton shows stronger resistance to red spider than does American cotton.

PHYSICAL-MECHANICAL METHOD (152-160)

This method of control is based on changes in the physical environment and the application of mechanical means and attachments for direct destruction of pests or their prevention from penetrating a crop. Within the general system this measure is considered supplementary because of its labor consuming nature, although in some instances it acquires the significance of a principal method.

Among mechanical means of control are: hand picking of insects, removal of diseased plants, crushing and destruction of pests with the aid of various attachments, the erection of obstacles against the penetration of pests onto cultivated plants.

Manual gathering of insects represents the most primitive method of control and is used only when other more skilled methods are not available. Thus, manual picking and destruction of caterpillars of the cabbage worm, [Pieris brassicae L] is used when the cabbage head is formed because chemicals and poisonous preparations may not be applied at such time.

In controlling black leg of potatoes, cleaning of seed plots, i. e., the removal of infested clumps, is among the most essential measures. Pruning of infested branches, cleaning of bark, etc., are practiced to control pests and diseases of fruit trees.

Gathering of insects is aided by using different types of attachments. Winter nests of the pierid butterfly are removed from fruit trees by split sticks and steel brushes.

Many pests, such as beetles, are caught by shaking apple trees; [Curculionidae], [Meligethes aeneus F.], etc. Special bags are used for gathering insects; in orchards tarpaulin canvases are spread under trees. Insects are shaken off by hitting the tree trunk with wooden mallets. To protect the tree trunk, the mallet is covered with a cloth.

Caterpillar, butterfly, eurygaster and light traps, vessels filled with molasses, and other attractants are among the special mechanical appliances used.

TRAPS AND OBSTACLES.

Caterpillar and butterfly traps are set up to catch many pests. Bags of gauze are used to trap butterflies of the beet webworm.

The bags are conus shaped, attached to two vertical sticks, of which the ends are tied with cord. In pulling the cord, a frame of 1 - 1.5 x 5 m. in size is obtained; the length of the bag is 5 m. Butterflies are caught simultaneously in several bags. By going over the plot three times, one bag may take care of 6 hectares in one working day.

To catch caterpillars on sugar beet fields, horse-driven caterpillar traps of the Tarnovskii make are used. Their design is simple. A wooden square frame rests on two wheels in the front and one toothed wheel in the rear; to it are attached several troughs the width of the entire frame, which are movable; they are arranged so as to pass between rows; above the troughs are 5 tied wooden cross bars swinging freely. When these bars touch the plants, caterpillars fall into the troughs.

Eurygaster traps are of different kind: hand, horse- and auto-traps. Their construction is designed to shake eurygasters from plants and catch them in their fall. Auto-traps represent long scoops suspended on the sides and in front of the automachine. The reach of the dippers is up to 15 m. In moving, pests are shaken into the dippers when the leading edge comes in contact with plants. Their capacity is 50 - 150 hectares per day.

Horse-driven traps are constructed on wheels, have a reach of 7 - 8 m., and are equipped with a special reel placed so as to shake eurygasters directly into the dipper. The reel has 4 bars and is moved by transmission from the main wheel. The capacity of this equipment is 25 - 30 hectares a day.

Light traps are used against night butterflies. Their action is based on the positive phototaxis of insects. The principal parts of this trap consist in the strong light and attachment for catching flying insects. Special lanterns or electric lamps may be used as sources of light. To catch the butterflies, a barrel filled with water, to which kerosine or naphtha and other liquids poisonous to insects are added, is placed under the lantern. Insects flying toward the light beat against the walls of the lantern and fall into the liquid. Insects may also be caught with the aid of suction apparatus placed near the lanterns.

Traps may also attract by smell. Troughs filled with fermenting molasses attract many butterflies. These traps are widely used on sugar beet farms to control cutworm moths. Wooden or metal boxes one m. high are stood on two stakes dug in the soil. Molasses are half diluted with water; yeast is added to provide fermentation.

Trap belts to attract caterpillars of the apple scale, [Laspeyresia pomonella L.] are used in orchards. They are made of sacking, rags or wrapping paper, 8 - 10 cm. wide, in two layers, so that the width of the belt when spread measures 16 - 20 cm. The belts are tied to the trunks of trees after the latter are first cleaned of the old bark and lichens. Trap belts are used since caterpillars of this pest choose sheltered and shady spots for pupating. Belts are periodically examined and caterpillars picked and destroyed. At present, belts of beta-naphtha are also used. In contrast to trap belts, they are soaked in the chemical, and caterpillars perish when crawling into these belts. To prevent the burning of young trees, these are not used for this purpose. Root traps are also used to catch pests in orchards. They are set when the leaves begin to fall; the foliage is then swept close to the trunks of trees. Beetles of [Laspeyresia pomonella L.] and [curculio] are inclined to settle there for the winter. When the first frost appears, these heaps are burned.

Field slugs are cuaght when they spread above-ground on bark, heaps of grass, etc., on all of which these pests like to settle during the day.

Insects that move along the surface or within the upper soil layer are caught with the aid of trap ditches. These ditches, depending upon the type of pest, are dug at various depths. To trap caterpillars of cutworm moths and sugar beet webworms, they are 25 - 35 cm. deep, for beetles of sugar beet [Tanymecus palliatus F.], 35 cm., for locusts, 60 - 80 cm. In digging, the soil is thrown in the direction of the protected plot. Walls of ditches should be upright, slanting towards the bottom. Wells of a depth of 25-35 cm., with upright vertical walls, are dug at distances of 5-10 m. at the bottom of the ditch. The insects get into ditches and from there into the wells where they are crushed or poisoned by attractants placed in the wells. To control [Tanymecus palliatus F.], a number of small ditches with wells are, in addition, distributed throughout the plot. Trap ditches are distributed only at borders of plots.

Insects caught by any method should be immediately crushed, burned, dug under, or thrown into water mixed with kerosine. To control rodents, different kinds of traps are used to attract pests by poisoned food. (See deratization).

Mechanical obstacles are constructed to prevent pests from entering planted plots or even coming near individual plants. Protection ditches and glue rings are used for the purpose. The former differ from trap ditches in that they have upright walls on the side of the protected plot only. The ditches are dug with a plow and the walls subsequently smoothened with shovels. These ditches hinder the movement of caterpillars of cutworm moths, sugar beet webworms, etc.

Glue rings are used to protect fruit trees from different pests. The rings interfere with the movement of insects (caterpillars and non-flying adult insects) along trunks towards the crowns of the trees. Special glue is applied either directly to trees, previously cleaned of the old bark, or to paper, tightly tied to tree trunks. Glue rings of a width of 5 cm. are applied one m. high. The glue is manufactured in plants or prepared domestically. In the latter case, rosin oil and low grade olive oil are combined in the proportion of 2 parts of melted rosin oil to one part of the olive oil. The mixture is boiled 15 - 20 min. The low grade olive oil may be replaced by birch tar in the same amount. It is essential for glue to preserve its capacity for adhering, withstanding water and not dissolving in hot weather.

SPECIAL METHODS AND INSTALLATIONS FOR THE CLEANING OF SEEDS.

Solutions of sodium chloride or calcium chloride are used to clean grain of ergot, in the proportion of 2 to 3 kg. to 10 liters of water. The use of salt solutions is based on the difference in the specific gravity between ergot and grain. Ergot and infested grains, of which the specific gravity is lower than the solution, come to the surface and may thus be caught. The cleansed grain is rinsed with clean water and dried. This measure is not applied widely because of the labor involved and may be adopted, for instance, at regional seed farms, ("raisemkhoz").

Flax seeds, clover, and alfalfa are cleansed of dodder [Cuscuta europeaea] with the aid of an electro-magnetic magnet. Its use is based on the distinction in the structural characteristics of the epidermis of dodder and seeds of cultivated plants. Seeds of dodder, in contrast to flax, clover and alfalfa seeds, have a rough surface. In mixing seeds that have to be cleansed with pulverized iron, the latter clings only to dodder seeds. Under the influence of an electromagnetic magnet, dodder seeds covered with pulverized iron are separated from the rest of the seeds.

THERMIC METHODS.

Measures the destructive action which, with regard to injurious organisms, is based on the change in physical environment and belong to physical-mechanical methods of control. Among these measures are heating soil and grain, and the drying of grain.

Heated soil is used primarily to control fungi, bacterial diseases, and nematodes in greenhouses and hothouses on farms. The simplest method to heat soil is to scald it with boiling water or to heat it on iron griddles.

A more skilled method is to heat the soil by steam. The greenhouses are tightly covered with special wooden boxes which are turned upside down, under which steam is passed through pipes leading from a locomobile or steam kettle; pressure is 5 - 6, [illegible], which ensures heating of the soil to a depth of 10 - 15 cm. After treatment for 30 minutes, all fungi organisms and nematodes are destroyed.

This method is equally applied to disinfect empty railroad cars from storage pests.

The thermic method is widely applied in disinfecting seed and seedling stocks.

Grain heated in boiling water is the principal method used to control loose smut of barley and wheat. A detailed description of this method is given in a special article.

The most primitive method in heating grain is to submerge special pails or boxes filled with it into barrels of water of proper temperature.

Pails and boxes are equipped with a screened bottom to permit rapid access of water and an even degree of either heat or cold for the grain. The pails or boxes contain 20 - 25 kg. of grain. For heating grain, a thermometer and a clock represent essential equipment.

Installations of different design are used for thermic disinfection of seeds: KrymIZR, VIZR, the thermo-installation BGSS No. 1. The installation KrymIZR may serve as an example of the principle involved. Designed by Khodakovskii, it consists of a steam kettle installation with pipes (locomobile, steam kettle, etc.) and tubs with containers for the grain. (ill. 56).

The tubs filled with water are placed in two rows and connected through pipes with the steam installation. The necessary temperature is provided by steam passing through the pipes. The installation is regulated by valves. The containers with screened bottoms, holding 50 kg. of grain, are placed into tubs, 4 in each. Usually 6 tubs are used for preliminary heating of grain in water at 28 to 32°. One tub is set apart for heating water to 50 to 53° and another to cool water to 15 to 20°. The capacity of the installation (8 tubs) is 3 c. per hour. The plan is described separately.

Unfavorable conditions for the development of pests and diseases may be produced by changing the degree of moisture. Drying grain to its normal moisture (12 o/o) stops the development of storage weevils, storage mites, fusarium, etc.

Heating seed stock proves effective for the control of pseudo-mildew of onion. The tubers are treated for 8 hours at air temperature of 40°.

In treating greater amounts or large tubers, the exposure is lengthened to 16 and even 24 hours. In heating, the onions should be stirred in order to prevent steeping. This measure should be used in the fall and spring; in the latter case, one and half or two months before planting.

BIOLOGICAL METHOD (p. 160-165)

The biological method based on inter-species control consists in using natural enemies of pests to control the latter and is applied to injurious insects and rodents.

Predatory and parasitic insects, insect-poisonous birds, mammals, parasitic fungi and bacteria to control insects; predatory birds, mammals and bacteria for rodents. Against injurious insects, predatory and parasitic insects are primarily used. Several species of lady beetles are used among predatory insects.

The lady beetle Vedalia was successfully applied to control cottony cushion scales [Icerya purchasi Mask.] on citrus trees; while the lady beetle Cryptolemus is used against "floury" scales.

In 1927 at Sukhumi, cottony cushion scales (Australian) were accidentally brought in with imported tangerines; this pest severely threatened the production of citrus plants. To destroy it, it was decided to import from Cairo, Egypt, its natural enemy, the predatory beetle Vedalia. This pest, imported in 1931, was propagated and set loose among Sukhumi citrus orchards. It became quickly acclimatized and in the following year destroyed the focus of the cottony cushion scale.

In 1932 a lady beetle, Cryptolemus, was brought into the USSR from

Cairo, Egypt to aid in liquidating foci of "floury" scale, another serious pest of citrus crops.

Predatory beetles Vedalia and Cryptolemus are selected for their adaptability to definite species of insects, their rapid propagation and capacity of their larvae and adults to feed on scales at all stages of development.

Among parasitic insects [Aphelinus mali] is widely used to control the woolly apple aphid, [Eriosoma lanigerum Hausm.], a most dangerous pest in apple orchards in the Crimea, Central Asia and the Caucasus. The woolly apple aphid was brought into the USSR long ago, along with seed stock, and not having any natural enemies, it rapidly propagated and spread in southern regions, causing much damage to fruit crops.

The control of woolly apple aphids by chemical methods is not as effective, since the body of the pest is covered with a waxy film; other methods had proved equally unsuccessful. In 1926 and 1930 [Aphelinus mali] was introduced in the regions most populated by woolly apple aphids; it propagated rapidly, got acclimatized and almost completely cleansed vast areas of orchards of the pest. Thus the difficult problem of controlling woolly apple aphids was finally solved.

The success of [Aphelinus mali] is attributed to its fast propagation (9 generations), ability to propagate non-sexually and its high fertility (female lays 120 eggs). The female lays one egg in the body of the larvae and adult aphid. This produces a larvae which feeds upon its host. Pupating also takes place there, and the adult Aphilenus exits from the damaged aphid through an opening which it chews in the covering of its host.

Local parasites should also be used in the control of injurious insects, strenghthened by existing contradictions in biocoenosis. Trichogramma and telenomus, the former to control cutworm moths, sugar beet webworms, etc., the latter to control Eurygasters may serve as examples. These parasites, minute insects, belong to species that develop on hosts.

They are propagated in special laboratories, set up at collective farms. To propagate trichogramma, the eggs of the grain moth, [Citotroga cerealella (Oliv)], are used, which are placed among grain. Trichogramma is let out by the laboratory at the time the moths begin laying their eggs, when local trichogramma have not concentrated on plantings as yet. Trichogramma is distributed in quantities of 10 to 20 thousand per hectare.

For control with the aid of trichogramma, methods for propagating this pest should be worked out under similar natural conditions; particularly on large eggs of cutworm moths, which ensure better trichogramma growth. When propagated in laboratories, trichogramma are not adapted to natural conditions; in addition the small eggs of grain moths produce specimens of low fertility.

Telenomus is propagated at laboratories in the winter on eggs of Eurygasters gathered in the fall. This parasite is let out when Hemiptera begin their egg laying under natural conditions.

With regard to those birds and mammals which are natural enemies of pests and rodents, measures are taken to protect the farmer.

Among useful birds feeding on pests are:: rooks, starlings, wrens; on rodents, barn owls and owls.

Protection of useful birds is regulated by decrees prohibiting their extermination. To attract useful birds, preparations are made for their nesting and wintering. During the winter, when snow fall is heavy or ice covers the earth, the bifds are fed. They are also protected from predatory birds and sparrows; the latter are objectionable because they crowd birds out of their nests; sparrow nests are therefore destroyed, while other rapacious birds, like hawks, are shot.

To attract predatory birds, feeding on rodents in places where the latter accumulate in masses, bars with cross bars upon which the birds like to rest are set up in fields.

Chickens are used for exterminating injurious insects, [Eurygaster]; [Tanymecus palliatus F.] and snout beetles.

Chickens like to eat insects. One chicken may in a day consume more than 1000 Eurygasters. Bird farms are specially entrusted with this extermination task. The chickens are carried into the fields in special coops, where they stay overnight. The latter are provided with necessary feeding and drinking facilities. Additional feed of 40 to 50 g. of grain and mineral substances, chalk, charcoal are provided. The chickens are watched and protected from predatory birds and animals. They are transported from one infested field to the other. Chemicals are not applied on fields during that time. (Method recommended by T. D. Lysenko).

Among the rapacious mammals, the steppe pole cat (skunk) is noted for its destruction of ground squirrels. In regions where the latter prevail, hunting for pole cats is forbidden.

It has been long known that bacteria cause epidemics among rodents and insects, as a result of which pests perish in masses. In 1925, in the central zone of European USSR, caterpillars of cutworm moths were infected by bacteria; the result was that this pest failed to develop in succeeding years. Experiments in using bacteria to control injurious pests proved successful. The mortality of caterpillars of cabbage worms and moths after spraying with the Metal'nikov bacillus was high.

Bacterial methods in controlling rodents are used at present against rats, mice, and field mice. Merezhkovski bacteria are used to exterminate the two latter; Danich bacteria are applied against rats. The best results are obtained in controlling mice, while rat mortality never exceeds 60 o/o. This is the result of the immunity rats acquired to the disease, (typhus caused by bacteria).

The culture of bacteria is manufactured in special laboratories prepared on bouillion, then preserved in hermetically closed jars. In applying, flour is added to bacteria and the dough cut into pieces; these are then thrown into rodent habitats. This produces typhus infection. The epidemic is spread among rats when they feed on diseased and dead specimens. Bacterial methods require care and accuracy, both essential to prevent injury to domestic animals. The work should therefore be conducted only under the supervision of specialists in plant protection or veterinaries.

Fungi diseases of insects are equally factors limiting the development of pests. The disease, known as muscardine, causes mass destruction among

[Tanymecus palliatus F.] ("sveklovichny dolgonosik"); this control has as yet not been solved.

Of considerable interest is the biological method in phytopathological practice. It is based on the antagonistic relationship of different species of micro-organisms and is regarded as potential for the control of soil parasites.

Observations have established in this connection that micro-organisms-antagonists are factors limiting root decay of various crops, since by exuding toxic substances, they depress the development of parasitic fungi, such as Fusarium, Helminthosporium, Rhizoctonia, etc. Accumulation of antagonists in the soil depends upon various conditions. Factors that accelerate the mineralizing of vegetative residue (fall plowing, introduction of organic fertilizers) react favorably upon development and accumulation of antagonists. There is, consequently, opportunity for changing the composition of micro flora of the soil and making it more healthful through agricultural methods.

CHEMICAL METHOD (p. 166-168)

Chemical methods play a considerable role in the control of insects and diseases; they are based on the application of poisonous substances.

To these belong compounds which if introduced in small quantities into the organism or placed on its surface interfere with physiological processes and thus contribute to the destruction of the organism. Poisonous substances are of organic and non-organic origin.

The degree of poison or its toxicity depends upon physical-chemical properties of the substance, quantity, duration of action, and conditions under which it is applied.

Among physical-chemical properties the capacity of a substance to penetrate into a cell is of primary significance. This is achieved provided the substance is of liquid, gas or vapor form. Firm poisonous substances prove toxic only if transformed into liquids or gas by the external environment or the organism itself.

Different species of pests or vegetative parasites show varied reactions to poison. The red spider is sensitive to sulphur preparations and more resistant to such strong poison as hydrocyanic acid. The inducer of mildew is destroyed by sulphur, while copper preparations react upon it in a limited degree. The toxicity of the preparation depends also upon the quantity of the poison or its strength of concentration.

With regard to several injurious organisms, duration of the action of poison is important. Control of storage pests with dichloroethane produces favorable results if exposed for 96 to 192 hours. Cereal seeds treated with mordants should be kept no less than two hours under formaline vapors.

Organisms in different stages of their development show different resistance to poisons. Thus the dormant thick-walled stage of fungi (chlamydospores, oospores, etc.) are more resistant to poisons than mycelium and especially young spores. Different stages in insect development and age of larvae react differently upon poisonous substances. In controlling locusts, for instance, the dosage sould be changed depending upon the age of larvae. Poisonous substances are seldom used in pure form. Usually diluents are added to the main poisonous substance. This is done to change the physical properties of the poison or to reduce expenditure of the main compound.

Liquid compounds are usually prepared on water? Additional substances, such as soap, molasses, glue, talcum, lime and chalk are frequently added to powder-like preparations to increase the adhesion of poisons. Depending upon the objects for which poisons are used, the latter are divided into several groups, insecticides, fungicides and zoocides. Insecticides are poisons used to control insects; zoocides control rodents; fungicides control fungi diseases. Substances used in the control of mites and ticks are called acaricides; of bacteria, bactericides.

At present, there are many chemicals which affect animals and vegetative organisms alike, i. e. are preparations of combined action.

Poisonous substances are applied in different ways: by spraying, dusting, fumigation, mordant treatment, and poisonous attractants.

Spraying consists in applying poisons to the plant or to the surface of the body of the pest itself, in the form of solutions, suspensions and emulsions.

In dusting, substances are applied to the plant or the pest in powder-like form. Dusting and spraying are applied in the control of vegetative and animal organisms. Fumigation is a method of applying poisonous substances in gas or vapor form. This method is used to destroy injurious organisms in closed quarters (greenhouses, nurseries, storage warehouses, tents) and in the soil.

Poisonous attractants are applications of poisons mixed with attractant food items. They are widely used in the control of rodents, locusts, cutworm moths and many other insects.

Mordant treatment is a method of disinfecting seed and seedling stock with liquid and pulverized poisons; it is applied to control fungi and bacterial diseases.

Poisons should possess the following main qualities: 1. adequate toxicity with regard to injurious organisms; 2. non-injuriousness to plants (should not cause burning or dropping of leaves, reduce germination of seeds, etc.). In addition, other points are required of poisons; their chemical composition should be constant, simple to handle and prepare, belong to non-deficit available substances, be non-inflammable and if possible universal, i. e. applicable for a multitude of pests and diseases, and harmless to man and animals.

Insecticides and fungicides are applied in different concentrations. Under concentration is understood the poison content in a definite quantity of liquid or dry substance with which the poison is mixed. Concentration is usually expressed in percentage, i. e., in the proportion of the poison 100 units in volume or weight. In determining concentration, it is necessary to estimate whether the substance represents a quantity sufficient for poisoning the injurious organism and yet not react unfavorably upon the plant.

The quantity of insecticide or fungicide per unit of area, volume or specific object (tree, shrub) is called norm of expenditure. The latter may vary, depending upon the poison, the method of its application, the pest, the particular crop species, the stage and degree of plant development.

Chemical methods of control use special machinery. Sprayers, dusters, equipment for fumigation and mordant treatment of seeds, distributors of attractants. At present airplanes equipped with special apparatus are used in dusting, spraying and spreading poisonous attractants. Aviation offers the opportunity to apply destructive measures over large areas, in short periods and at minimal expenditure in labor.

Quarantine of plants in USSR (p. 168-170) [Not translated. For translation of this section of Ed. 2, which is almost identical, see Transl. 45].

TJH: 24 July 1951

CHAPTER IV

CHEMICAL SUBSTANCES IN CONTROLLING PESTS AND DISEASES. (p. 171-198)

INSECTICIDES (p. 171-187)

Insecticides are divided into three basic groups, depending upon their action upon insects: 1. intestinal insecticides; 2. contact insecticides; 3. fumigants.

Intestinal insecticides poison the insect by penetrating with food into intestines. These poisons are applied by spraying, dusting or in attractants. The action of contact insecticides upon the insect takes place through direct contact of the poison with the body of the insect; application is in spraying and dusting. Fumigants poison the insect primarily through the respiratory system; evaporating liquids are chiefly used as fumigants.

INTESTINAL INSECTICIDES are used in controlling chewing insects. When feeding on poisoned plants or attractants, the poison enters intestines first, then through their walls the hemolymph, and the organism thus gets poisoned. These poisons do not affect insects possessing a piercing-sucking apparatus which feed on plant juices, absorbing them from within the latter without touching upon external tissues containing the poison. Intestinal insecticides are used against these sucking insects only in exceptional cases, such as to control butterflies of the cutworm moth by the application of poisoned molasses.

The action of liquid intestinal poisons depends considerably upon its wetting and adhesive capacity. Wetting (moistening) determines the regularity of the spread of the liquid along the surface; adhesion creates conditions of more prolonged action of the poison upon the insect. In some instances, when the plant has a waxy film, a higher degree of wetting and adhesion is necessary. Adhesion is improved by the addition of soap. Molasses, starch, lime and other substances increase adhesion.

Liquid substances are usually spent in the proportion of 400-600 1/h.

In applying powder-like poisons, the degree of pulverization is on significance, i. e. the size of particles of the substance. Smallest particles are better in dusting and are retained by the plant in a larger degree.

Diluents are added to powder-like substances: lime, chalk, talcum, kaolin, sifted road dust; the diluent is taken in the proportion of 1:1 to 1:5 and even 1:10 (with regard to the poison). This proportion is determined by the construction of the dusting apparatus; the more perfect the latter is, the less the required amount of diluent. The expenditure in dusting amounts, as a rule, to 8 to 12 kg/h, which exceeds the amount of poison in spraying 7 to 10 times.

Among intestinal poisons the preparations arsenic, fluorine and barium are applied.

ARSENIC PREPARATIONS. Among the principal arsenic preparations are Paris green, "shchelkov green," sodium arsenite, arsenate and calcium arsenate.

PARIS GREEN [$Cu(CH_3COO)_2 \cdot 3\,Cu(AsO_2)_2$] represents a small-grained, crystallized powder of green color, insoluble in water, of high gravity. In chemical composition this preparation represents a dual copper salt of vinegar acid and meta-arsenate acids. According to standard, it should contain 51.5 to 53 o/o of trekhoaid of arsenate and 28 to 28.5 o/o of copper monoxide. Good Paris green should not contain over 3 o/o of soluble arsenate. The quality of Paris green is determined by its solubility in aqua ammonia. Paris green of good quality is fully soluble and produces a transparent blue liquid.

Paris green is primarily used in the form of water suspension with added lime. The latter is taken to neutralize the available free arsenate acid. The correlation of amounts of Paris green and lime in a mixture is 1:2.

The technique of preparation is as follows: for better wetting, Paris green is diluted with a small amount of water; in another vessel lime is slaked and diluted with water to produce milky lime. Both liquids are then poured into a barrel (wooden or clay) and the mixture diluted with the necessary amount of water. When the substances settle, the mixture must be carefully mixed before filling the apparatus.

For orchard spraying, Paris green is used in the proportion of 0.1 to 0.12 o/o, i. e. 10 - 12 g to 10 liters of water, with the addition of 20-24 g. of lime. In controlling leguminous pests, the proportion is 20 g. of Paris green (0.2 o/o) and 40 g. of lime to 10 liters of water. Against caterpillars of beet webworms, solutions of 0.15 to 0.2 o/o of Paris green and a double amount of lime are used.

Paris green is applied in powderlike form for dusting plants. Lime is taken in this instance in double the quantity used in Paris green. This method demands large quantities of poison and is seldom applied. Paris green is not used as a poisonous attractant for the same reason.

SHCHELKOVSKAIA GREEN is a green powder, resembling Paris green in its chemical composition and properties, but distinct by its smaller content of triple-oxide of arsenate (32 o/o) and copper oxide (no less than 17.5 o/o). Methods and instances of application are the same as with Paris green.

SODIUM ARSENITE is released in the form of a paste of black color, containing 51.5 o/o of triple-oxide of arsenate and 15 to 20 o/o moisture. The preparation dissolves well in water; it burns plants and its application is therefore limited. The technical preparation represents a mixture of medium and acid salts of meta, ortho, pyro-arsenate acids (Na_3AsO_3, Na_2HAsO_3, $NaAsO_3$, etc.).

Sodium arsenite is primarily used in attractants against locusts, cutworm moths, mole crickets, micelike rodents and other pests. Various attractant substances are drenched or wetted with the solution.

CALCIUM ARSENATE is a white or grey powder containing 70-72 o/o (no less than 62 o/o) of triple-oxide of arsenate, no more than 0.5 o/o of water-soluble arsenite; dissolves weakly in water. The technical preparation calls for a mixture of medium and acid calcium salts of meta, ortho-and pyro-arsenate acids [$Ca(AsO_2)_2$, $Ca3(AsO_3)_2$, $CaHAsO_3$, $Ca_2(HAsO_3)_2$, etc.] It is a strong insect poison which causes burns of plants. Widely used in controlling locusts on uncultivated lands by aviation-dusting, in the proportion of 3.5 to 4 kg./h.

Calcium arsenate may be used for poisonous attractants against locusts, caterpillars of caradrine, cotton ballworm and other pests.

CALCIUM ARSENATE is a white or grey powder insoluble in water or only lightly soluble. The standard preparation contains 38 to 42 o/o of 5-acid of arsenate, no more than 0.6 o/o of soluble arsenite. Technically, it represents a mixture of medium and basic salts of arsenite acids. [Ca_3 $(AxO_4)_2$, etc.

Applied chiefly in dusting. This poison is harmless to plants and burns are infrequent. May be used against many chewing insects. The expenditure amounts to 8 to 12 kg/h. on field crops and 10-15 kg/h. on fruit crops. For uniform distribution of the preparation, according to territory, a triple or quadruple amount of diluents (chalk, talcum, etc.) is frequently added. In spraying orchards and other crops against chewing insects, the preparation is used in the proportion of 20-30 g per 10 liters. To avoid burns resulting from an increased percentage of soluble arsenic, a double amount of lime is added.

Calcium arsenate is applied in poisoned attractants against cotton-ball worms and caradrines.

PREPARATIONS OF FLUORINE in controlling pests may frequently substitute for arsenic preparations.

Fluorine preparations are obtained from residues derived from processing super phosphates. The most prevalent among them are fluoring and sodium fluoride. These preparations are poisonous but to a lessor degree than arsenital or arsenous preparations.

SODIUM FLUORITE (NaF) is a white or grey powder, dissolving poorly in water (to 4.0 o/o). The preparation contains no less than 85 o/o and of insoluble mixtures no more than 5 o/o. Used in spraying and poisoned attractants. Since the solution causes burning of plants, some alkalines, i. e. potash or soda, should be added to it to neutralize its effect. Lime is not used in this instance because it reduces toxicity. Spraying with sodium fluoride controls caterpillars of the beet webworm, the beet weevil and other pests. The concentration of sodium fluoride is changed, depending upon the species of pest. For the beet webworm it is 0.5-0.7 o/o; for the beet weevil 1 o/o. Sodium fluoride is also used in preparing poisonous attractants, for caterpillars of the cutworm moth.

SODIUM FLUORIDE (Na_2SiF_6) is a white or grey powder, poorly soluble in water, keeps in storing. The standard preparation contains no less than 93-95 o/o of sodium fluoride, no more than 5 o/o of sodium fluorine and no more than 0.2-0.3 o/o of free oxide. Burning of plants is insignificant. This preparation is applied in spraying, dusting and in poisoned attractants. In order to dust the preparation more effectively, talcum, road dust, etc. are added; lime is not used, as it reduces toxicity.

This preparation is applied in dusting plants against beet weevils, beet webworms, borers, ballworms, and various species of fleas. Depending upon the development of plants, 8 to 12 kg/h of the preparation are used. Diluents are added in amounts five times those of the poison. Spraying of plants with sodium fluoride is applied against beet webworms, beet weevils, cabbage worms [Barathra brassicae L.]. For spraying, the concentration is 0.5 to 0.8 o/o. Poisoned attractants of sodium fluoride are applied against locusts, caterpillars of cutworm moths, cotton ballworms, caradrina, etc.

PREPARATIONS OF BARIUM. Barium chloride ($BaCl_2 \cdot 2H_2O$) is a crystallized substance of white color. Dilutes well in water. The standard preparation contains 94 to 98 o/o of barium chloride; possesses high hydroscopic properties; it is considered that the action of barium chloride used, as an intestinal poison on insects, consists in depriving tissues of water which leads to paralysis of the organism. The introduction into the intestines of moist food reduces the toxicity of barium chloride. This accounts for the high efficacy of the preparation in dry weather. Barium chloride also possesses contact action, particularly noticeable on insects of tender bodies. Applied to control beet weevils, caterpillars of beet webworms, borers, apple moths and other pests. 4 to 5 o/o solution of the solution is usually applied. In controlling apple moths, pierid butterflies, etc., a solution of 1.5 to 3 o/o is used. For better adhesion, mealy paste and molasses are added in the amount of 1 o/o.

In controlling sugar beet pests in aviation-spraying, a concentrated solution iso used.

CONTACT INSECTICIDES act at direct contact with insects. These poisons cause the burning of skin surfaces and the plugging of respiratory organs, or they penetrate through the skin and respiratory system into the organism.

Contact poisons may be applied against all insects at different stages of their development by spraying or dusting. These poisons are used most frequently on sucking insects, against which intestinal poisons are ineffective.

To improve the physical properties of these preparations, (wetting and adhesion), various substances are added.

The following belong to the group of contact insecticides: soap, mineral oils, organic synthetic preparations, vegetative poisons, alkali, carbonates, sulphur preparations, etc.

SOAPS applied in the control of pests represent salts of fat acids (hard domestic soap and liquid green soap). The insecticide action of soap consists chiefly in clogging the respiratory organs and penetration of the solution into the organism through the trachea. Green soap quickly dissolves in water; hard soap requires more time; soaps are used in the form of 2 to 4 o/o water solutions. Lately soaps are used chiefly as additional supplementary substances to improve the physical properties of liquid solutions in concentrations of 0.3 to 0.6 o/o.

SOAPY ALKALI are residues of the soap industry and have a content of 5 to 6 o/o of total alkalinity. Applied in controlling the red spider in the early spring. Weeds adjoining cotton fields and mulberry trees infested by the spider are sprayed for this purpose. A solution of 0.4 o/o is applied in spraying. Soapy alkali is first diluted in a small amount of warm water, carefully mixed and filtered; the filtrate is then diluted to the required concentration (0.4 o/o).

MINERAL OILS represent the product of distilled naphtha, coal and tar shales. They are derived primarily from residue of mazut (fuel oil). At first light oils are distilled, then medium heavy oils (spindle oils) and finally, heavy oils (machine oils). Limited and unlimited hydrocarbons enter into the composition of mineral oils. The former are harmless to plants; the latter, however, exert a harmful influence, though they are also more toxic in the treatment of insects. In treatments with sulfuric acid, the amount of unlimited hydrocarbons may be reduced.

The harmful action of oils upon plants is determined by the degree of their viscosity. Viscous oils are of greater danger to plants than oils of lesser viscosity. Mineral oils in their pure state may be applied in aviation-spraying when no more than 100 l/h is expended. Oils [illegible], in surface spraying are injurious to plants since they may cause burns.

Mineral oils are therefore usually used in preparing mineral-oil emulsions applied in controlling orchard and storage pests.

MINERAL-OIL EMULSIONS are prepared from mineral oils, emulsifiers and water and represent a liquid mixture in which oil reduced to minute drops covered by emulsifier is uniformly distributed in water.

In preparing emulsions various mineral oils are used which, from the point of view of the periods of their application, are divided into summer and winter. Summer oils are characterized by the content in them of a smaller amount of unlimited carbohydrates and lower viscosity and may be applied in the spring and summer. Winter oils are distinguished by the larger content of unlimited carbohydrates and higher viscosity, and are applied when trees are in their dormant stage, i. e. in the fall following leaf fall, and in the winter in the South.

Vaseline, transformer and diesel fuel belong to light oils; green, machine, spindle and solar oils to winter oils.

Soaps, clay and other substances may serve as emulsifiers. In this connection a distinction is made between soap-oils and oil-clayey emulsions.

In preparing soapy oil emulsions, liquid soap or soapy naphtha (obtained from naphtha and naphtha products) (10 kg.) is dissolved in warm water and the solution poured into the sprayer to which is added 70 g. of mineral oil. In multiple use a concentration of soapy-oil emulsions is formed in the sprayer. The emulsion is prepared on soft (river or rain) water; hard (well) water destroys the emulsion. Concentrates of emulsion are prepared at industrial plants. For a working emulsion the concentrate is diluted with water to 4 to 10 o/o of emulsion (in oil). The concentrate keeps long, while the working emulsion must be used the same day. In preparing oil-clayey emulsions the clay is diluted with water to a consistency of sour cream and is carefully mixed with oil which is introduced in small amounts.

In preparing the concentrate, 50 o/o of oil, 25 o/o of clay and 25 o/o of water are used.

The working emulsion is obtained by diluting the concentrate with water to produce 1 to 10 o/o of emulsion. In filling tho apparatus, the mixture is strained to remove rootlets, stones, etc. Any water may be used for oil-clayey emulsions, including hard water.

The shortcoming of these emulsions consists in their poor keeping quality, which requires the daily preparation of doses. For winter sprayings 4 to 10 o/o emulsions are used, for summer sprayings 1 o/o. Compared to apple trees, stone fruits crops are very sensitive to spraying with mineral oil emulsions.

These are used in the fall and winter in controlling scale insects, destroying wintering eggs of aphids, suckers, ring silkworms, caterpillars of the apple moth, and in the summer in destroying larvae of the first generation of San Jose scales, eggs of apple moths, etc.

CREOLIN is the product of distilled coal tar and peat. It is a dark liquid and after dissolving in water forms an emulsion of milky color. Applied as an emulsion to control cabbage and onion flies.

ALKALI. Caustic soda and lime are used to control pests.

CAUSTIC SODA (NaOH) is a hard, white substance; soluble in water; used in moist disinfestation of grain storing places by spraying. A solution of 10-15 o/o is used for the purpose.

Caustic soda acts upon mealy mites causing burns of their bodies. The substance has little effect upon storage mites and other beetles who have hard bodies.

LIME (CaO, unslaked lime, $Ca(OH)_2$ - slaked lime) is applied in pest control in fresh slaked state and in the form of lactic lime. Slaking of lime is done prior to use; long slaked lime is not applied since it loses its properties in the air. Lime-"pushonka" is applied to control field slugs by dusting in the proportion of 200 kg/h. Lime destroys slugs when coming in contact with them. In addition, this form of lime is used to control storage pests by painting warehouse floors.

"Milky" lime is applied in disinfecting storage warehouses and also painting fruit trees. To prepare this liquid, 2 to 4 kg. of unslaked lime is used to 10 liters of water.

Lime is also added to some compounds (Paris green, for instance) to neutralize free oxides, and as dry diluents in powderlike poisons.

Among carbonates, chemically pure chalk is applied to control storage mites and weevils. Grain is covered with powder for this purpose in the proportion of 3 kg. of substance per ton of grain. Only seed stock may be treated with chalk; it is considered that chalk reacts upon mites by reducing grain moisture.

SULPHUR PREPARATIONS are: ground sulphur, sulfuric concentrate, lime-sulfur solution (ISP), solbar.

GROUND SULPHUR is a yellow powder containing no less than 95 o/o of pure sulphur. It is used against the red spider on cotton plants and on vegetable and melon crops. Sulphur is usually taken in a mixture with diluents (lime-pushonka, tree ashes, forest dust) in the proportion of 1:1 and 1:2; expenditure of mixture is 30 to 90 kg./h.

The action of sulphur upon the spider consists probably in that under a strong sun it penetrates in the form of vapors into respiratory tubes where it forms poisonous substances in oxidation.

SULPHUR CONCENTRATE of the first variety is a powder containing 70 - 75 o/o of pure sulphur and 30 to 25 o/o of admixtures of lime or clay. It is applied in cases when ground sulphur is used.

Sulphur concentrate of the latter variety contains 20 - 40 o/o of pure sulphur; the rest are admixtures. It is applied without diluents and used chiefly in preparing ISO.

LIME-SULPHUR SOLUTION (ISO). Into its composition enter primarily semi-sulphides of calcium ($CaS.S_3$, $CaS.S_4$, etc.) This is a liquid of dark red color. Prepared industrially or domestically of sulphur concentrate of the second variety or sulphur and unslaked lime. The compounds are taken in the proportion of 2 parts of sulphur or the corresponding amount of sulphur concentrate, one part of lime and 17 parts of water. During slaking, sulphur is gradually added to the heated mass. To this mixture is added hot water which is boiled for 70 minutes. Water is continuously added as the mixture boils; this is discontinued 15 minutes before the end of boiling. The decoction is usually at 15 - 16^{0}, according to Boehme. For spraying, this solution is diluted with water to 0.5^{0}, according to Boehme, and is applied chiefly to control red spider on cotton plants.

SOLBAR (BaS plus S) is a powderlike preparation of dark grey color, a mechanical mixture of technical barium sulphur and ground sulphur. It does not dissolve in water completely. The liquid solution is of yellow, orange, or red color. Applied to control the red spider.

The solution is prepared by using 50 to 60 g. of solbar to 10 liters of water.

VEGETATIVE INSECTICIDES are obtained from plants containing poisonous substances, alkaloids and complex ether. They are toxic to insects and do not injure plants. Considering that some vegetative insecticides are available in raw resources in the USSR and others may be produced industrially, this group of poisons represents one of the most dependable in the control of pests.

By penetrating through the respiratory system and outer bodies into the organism, vegetative poisons cause the paralysis of motive centers.

Among vegetative poisons, anabasine-sulfate, nicotine-sulfate and pyretrum are significant.

ANABASINE-SULFATE $[(C_{10}H_{14}N_2)_2 \cdot H_2SO_4]$ represents a dark brown liquid which dissolves completely in water. The acting substance in anabasine is alkaloid contained in Anabasis aphylla L. ("ezhovnik bezlistny"). The standard preparation should contain no less than 30 o/o of basic anabasine. It is used in solutions and dusts. Anabasine-sulfate in solution form is applied to destroy aphids, larvae of suckers and other insects. The usual concentration is 0.15 o/o (of the preparation) with added 0.4 o/o of soap. As a rule, solutions of anabasine-sulfate should be prepared immediately prior to their use, since they quickly lose their toxic properties.

Anabadust represents a dustlike preparation saturated with various powderlike substances (lime, chalk, etc.).

Widely used in dusting against aphids and fleas on different crops (flax, hemp, vegetable crops).

Anabadust (5 o/o) is used against aphids; 5-8 o/o of anabadust, i. e. 5-8 parts of anabadust-sulphate and 95-92 o/o of powder are used against fleas.

NICOTINE-SULFATE $[(C_{10}H_{14}N_2)_2 \cdot H_2SO_4]$ is a vegetative poison obtained from makhorka and tobacco. This liquid is dark brown, soluble in water. The active part in the preparation is alkaloid nicotine.

Applied in liquid solutions and dusts. The technique in preparing the solutions and instances for their application is the same as for f anabadust-sulfate. In spraying, the usual concentration is 0.1 o/o (of the preparation) with 0.4 o/o of soap added.

RESIDUES OF TOBACCO INDUSTRY also find application in pest control. They are used in the form of tobacco extracts and tobacco dust. Tobacco extract is obtained by steeping makhorka dust, stems and other residue in water for 2 to 3 days. 800 g. of tobacco residue is used for 10 liters of water; the filtered extract is applied against aphids; for better wetting, soap is added in the proportion of 40 h. to 10 liters of the compound. Tobacco dust is used for fumigating greenhouses against aphids, thrips and mites; in orchards against apple suckers.

PYRETRUM is a vegetative poison, a grey powder prepared from crushed flowers of some species of camomile. Complex ethers, Pyretrin I ($C_{21}H_{30}O_3$) and Pyretrin II ($C_{22}H_{30}O_5$) represent the poisonous substances of this preparation. Pyretrum is most frequently prepared in the form of extracts. Prior to their use the extracts are diluted with water, the content of Pyretrin I is made to reach 0.02 o/o. Pyretrum may be used in powder form. Both Pyretrin I and II are unstable compounds. They decompose under high temperatures, moisture and light. Pyretrum, especially in powder form, should therefore be stored in closed containers in dry places. It does not burn plants and is not poisonous to men and livestock.

This preparation is applied against aphids, thrips, fleas and larvae of tender bodies.

SYNTHETIC ORGANIC PREPARATIONS. To this group belong DDT, Hexachloran and Tiophos.

PREPARATION DDT (Dichlordiphenyltrychlorethan); [$Cl_2(C_6H_4)_2$ $CHCCL_3$], is a powder- or waxlike substance, fatty on touch, of grey color, light specific odor, insoluble in water; dissolves in organic diluents,i.e. benzol, acetone, kerosine, vegetative and mineral oils; the preparation is distinguished by light volatility and great resistance to temperature, light and moisture. DDT is toxic with regard to many chewing and sucking insect and possesses contact and intestinal action. Applied chiefly in dusts in mineral-oil emulsions. 5 o/o dust (mixture of 5 o/o of technical DDT with 95 o/o of talcum or kaoline) in the proportion of 15 - 20 kg./h. is effectively used to control many agricultural pests. Mineral oil emulsion (1 o/o) with DDT (0.06 o/o), prepared on emulsifiers; fat clay is used to control pests of fruit crops. Lately, concentrated mineral oil emulsions with DDT have been produced industrially in the form of thick liquids (20 o/o of technical DDT, 40 o/o of spindle oil, 40 o/o of water and emulsifier), which prior to use are diluted with water (1:100). To avoid burning of fruit leaves, spraying should be done in the early morning or after 3 p.m. and not during the hot hours of the day.

The preparation DDT may be used also in the form of water suspensions for spraying. In this case 5 o/o dust (on kaoline) is mixed with water (2 kg. of dust to 100 liters of water). The efficacy from spraying with water suspensions is lower than from dusting with DDT. DDT is poisonous to bees; plants should therefore not be treated with the substance before blooming and during the blooming period.

In dusting orchards with DDT, where beehives are located, it is essential to observe precautionary measures. Prior to dusting, the entire blooming grass vegetation in orchards should be mowed and removed. Dusting should be done in the early morning. During dusting, the beehives should be closed for 3 - 4 hours and prior to their opening, the landing platforms carefully washed. To prevent caterpillars of mulberry trees (silkworms) from getting destroyed, dusting with DDT from airplanes is prohibited whenever plantings closely adjoin silkworm trees.

HEXACHLORAN or GKHTSG ($C_6H_6Cl_6$) is a grey powder of sharp, unpleasant odor, resembling mold; does not dissolve in water but in organic diluents. Relatively good resistance to temperature and light; decomposes in alkali. The substance is highly toxic, acts as contact and intestinal poison upon many chewing and sucking insects. Applied as 12 o/o dust at the rate of 10-15 kg./h. Good results are obtained from its application in the control of locusts, pests in fruit greenhouses and tree shelter belts. Effective also in the control of wireworms and larvae of beetles (cockchafers).

Hexachloran has limited application since it leaves an unpleasant odor on treated fruit and other parts of plants. On vegetables this preparation is used to control fleas and cabbage butterflies in the early stages of vegetable development, while on onions it cannot be used at all. It is not permissable to introduce the preparation into the soil directly under potatoes, root and melon crops to control soil pests. Nor is it applied in orchards and berry plantings. The action upon man and animals has not been sufficiently studied. Hexachloran is poisonous to bees, and plants may therefore not be treated with it before and during blooming. In working with hexachloran and DDT, as with other poisons, precautionary measures should be observed.

THIOPHOS (diethylnitrophynylparatiophosphate). Powderlike substance of light grey color. Applied in the form of 1 o/o dust prepared on talcum. Effective against many chewing and sucking insects, including the harmful Eurygaster. Poisonous to man and warm blooded animals.

FUMIGANTS, to these belong substances which act upon insects in vaporlike or gaslike form. Penetrate primarily into the respiratory system;

fumigants destroy the trachea, or by passing through the membrane into the blood (hemolymph) destroy the organism.

All presently applied fumigants are strong poisons injurious to man and domestic animals. They are chiefly used to control storage pests, ground squirrels, soil pests, and to disinfect seed stock.

Among fumigants, chloropicrin, carbon bisulfide, sulphur anhydride, dichlorethane, hydrocyanic acid, naphthalin and paradichlorobenzine are of greatest significance.

CHLOROPICRIN (CCl_3NO_2) is an oily, yellow liquid which evaporates in the air, of strong odor, causing tearing of eyes. Standard chloropicrin should contain no less than 96 o/o of this compound and no more than 0.01 o/o of free oxides. Its vapors are 5.67 times as heavy as air. Applied at temperatures no lower than 12^{o} and relative humidity no higher than 70 o/o. Used to control warehouse pests.

To control ground squirrels, wads of cotton saturated with chloropicrin are placed into their holes. The wads should be of a size absorbing 3 g. of chloropicrin, a dose adequate to kill rodents.

Chloropicrin is also applied to treat soil against soil pests and inducers of diseases. For the destruction of wireworms, chloropicrin is introduced into the soil, with special plows, in the proportion of 0.5 to one t./h., while against larvae of "marble" beetles Polyphylla fullo L. ("mramorny khrushch") it is introduced with an injector, in the proportion of 24 g. to 1 m^2.

Chloropicrin is one of the strongest poisons for man and domestic animals and should be handled under the strictest observation of precautionary measures and special instructions.

CARBON BISULFIDE (CS_2), a liquid of strong odor, evaporates in the air. Standard preparation contains 92-98.5 o/o of pure carbon bisulfide. Its vapors are 2.64 times as heavy as air. Liquid carbon bisulfide and its vapors are quickly inflammed when close to sparks of fire and cause combustion (explosions), a circumstance which calls for special vigilance. It is forbidden to open barrels by mechanical means, from sprayers, make fires or to smoke at distances of 30-40 m. from the fumigated place.

Carbon bisulfide may be applied to disinfest planting stock and seeds (in special quarters) since this does not reduce germination, and may also be used to fumigate the soil to destroy harmful pests (phylloxera, etc.). The chemical is not used to control storage pests in grain warehouses because of fire hazards.

One of the most poisonous substances to man and domestic animals; very dangerous in handling.

SULPHUR GAS (SO_2) is a colorless, stifling gas of strong odor; twice as heavy as air. Obtained by burning lump sulphur and applied to disinfecting quarters; not used for treating grain, since it spoils its taste and quality and reduces germination of seed stock.

Prior to fumigation, all metal articles should be removed from storage bins to prevent harmful effects by gas.

Burning of sulphur is done on iron pans above coal, placed on bricks covered with sand. Sulphur is used in the proportion of 40 - 80 g. per 1 m^3. Duration of fumigation is 36 - 48 hours. Since the gas is hazardous to man and domestic animals, precautionary measures are necessary.

DICLORETHAN ($CH_2CL - CH_2CL$) or chlor ethyline is a colorless liquid; its vapors are three times as heavy as air. Used in the control of pests in the proportion of 350 - 500 g. per $1m^3$ of room space; duration 96 to 192 hours. The chemical does not affect seed quality of grain and easily evaporates. It is also used in fumigating the soil to control phylloxera. In using dichlorethan anti-inflammatory measures should be observed since its vapors are easily inflammable.

HYDROCYANIC ACID (HCNN) is a colorless liquid, easily evaporating. Obtained from cyanides of natrium and calcium under the action of sulphuric acid. Hydrocyanic acid is strongly poisonous to pests, but does not injure plants. Received wide application in quarantine practice in disinfecting seeds and planting stock. Disinfestation of grain and its products by this chemical is prohibited in the USSR. Fumigation is usually done in hermetically closed quarters and vacuum apparatus.

Hydrocyanic poison is strongly poisonous to man and domestic animals and requires considerable precaution in its use.

CYANIC "PLAV" represents a dustlike or grainy preparation of dark grey color and consists of a mixture of cyanide and chloric salts of natrium and calcium. In the open air, under the influence of moisture (above 40 o/o), it exudes hydrocyanic acid. This preparation is used to poison holes of ground squirrels, disinfest empty warehouses and fumigate tents of citrus fruits.

Because of the strongly poisonous nature of the chemical, work with this compound requires experience.

PARADICHLORBENZOL (PDB), a crystallic, white powder; evaporates slowly, forming heavy vapors. Applied to destroy pests dwelling in the soil (larvae of marble beetles).

NAPHTHALIN ($C_{10}H_8$) has the appearance of white, shiny, rose or yellow scales of characteristic odor. Used exclusively in the control of storage mites and weevils.

Naphthaline, in this instance, is used in the proportion of 3000 g. per 1 c. of seeds and is carefully mixed with the latter. It may be used in small bags which are placed among grain, at distances of 0.25 to 0.5 m. . in the proportion of 0.20 - 0.30 kg. per ton of grain. Germination of seeds at a moisture no higher than 14 - 15 o/o is not affected by naphthalin. May be used to control the cabbage fly; 3 g. of naphthalin and 3 g. of sand are used per plant; the chemical frightens the cabbage fly away from plants and partly kills their eggs and young larvae.

ZOOCIDES (p. 187-188)

The insecticides sodium arsenite and calcium arsenite may be used as zoocides. Among the specific zoocides are barium carbonate, zinc phosphide, oryoide, (cryolite), etc.

BARIUM CARBONATE ($BaCO_3$) is a white powder, poorly soluble in water, applied to control rodents in warehouses; used in the preparation of attractants.

ZINC PHOSPHIDE (Zn_3P_2), a dark grey powder applied to control rodents by attractants. This preparation is poisonous to man and domestic animals; precaution has to be exersized in its use.

FUNGICIDES (p. 188-197)

are chemical substances used in the control of fungi and bacterial diseases.

Application of fungicides is based upon their poisonous action on fungi and bacteria.

In the majority of cases, use of fungicides is of prophylactic or preventive significance. The prophylactic action of fungicides consists in killing bacteria on plants, seeds, or spores of fungi, or more frequently on the nucleus (?) ("rostok") formed in spore germination whenever the substance touches their surfaces, and thus protects the plants from infection. Fungicides should therefore be applied prior to infestation. Treatment of an infested plant with chemicals is difficult and in some instances practically impossible. This is because parasitic bacteria and fungi develop within the tissue and are therefore inaccessible to the action of poisons applied to the plant surface.

Chemical control against plant diseases is applied during vegetation and the dormancy periods. Methods in applying fungicides vary: spraying, dusting, fumigation and mordant treatment. In chemical composition all fungicides belong to the following groups: 1. copper preparations; 2. sulphur preparations; mercury preparations; arsenate preparations and 5. mixed group.

COPPER PREPARATIONS; among the most widely used are: Bordeaux mixture and the preparation AB. New preparations, i. e./copper naphthenate and copper chloroxide have been used in practice in recent years.

BORDEAUX MIXTURE is a colorless liquid of blue color obtained from a mixture of copper sulfate ($CuCO_4$) with lime milk [$Ca(OH)_2$]. Copper sulfate and unslaked lime are usually applied in the proportion of 1 o/o,

i. e. 100 g. of every substance to 10 liters of water. Copper sulfate is dissolved at first in a small quantity of hot water, the solution then diluted with water to one half of the desired amount. In another vessel lime is slaked and then also mixed with one half of water in the desired quantity. The solution of copper sulfate and lime milk are poured together when cold. This produces a suspension of blue color which is ready for use.

Properly prepared Bordeaux mixture has a neutral or weak alkaline reaction. Its reaction is tested by litmus paper or an iron knife may be used for this purpose. When the reaction is acid, the blue litmus paper becomes red or the iron knife gets covered by a copper film.

Bordeaux mixture should be prepared immediately prior to its use, since during prolonged keeping (1-1/2 to 2 days) copper settles in the form of crystals and the liquid adheres poorly, nor does it produce any effect.

Bordeaux liquid is successfully applied in controlling many fungi diseases. The best results are obtained with peronospore fungi, i. e. phytophthora of potatoes, and imperfect fungi (inducers of scab, fruit rot of apples, etc.); it does not produce positive results in controlling mildew. Properly prepared Bordeaux mixture does not cause plants to burn. If the preparation is, however, used with an acid or strongly alkaline reaction, round brown spots form on the foliage and a brown net of corklike tissue on fruits.

1 o/o Bordeaux mixture is used most frequently. In early spring, spraying of fruit trees, the so-called "blue" spraying is applied, during which increased concentrations of Bordeaux mixture (2 - 4 o/o) are used. In

aviation spraying of vineyards, even 5 o/o Bordeaux mixtures may be used. The expenditure of Bordeaux mixture per one hectare of potatoes is 400 - 600 liters; for vineyards 2000 liters; per one fruit tree (adult) to 10 liters.

PREPARATION AB., proposed by the Soviet scientist, A. Borchardt, is a basic sulphur oxide salt of copper with a mixture of basic carbon oxides of copper salts.

The preparation is produced industrially. It is a blue-green or blue-grey powder, containing 15 - 16 o/o of copper; does not dissolve in water; the preparation must be of thin grind and not contain over 3 o/o of moisture. Used primarily in dry treatment of wheat and rye seeds against hard and stem smut. Non-vernalized and vernalized seeds are treated.

The preparation is used in a dosage of 2 kg./ton. It may be used in treating seeds of corn from covered smut and to protect seeds from molding in the soil, which may occur during long, cold springs. The preparation is used in the proportion of 1.5 kg./ton. Treatment may be given at any time, even 5 to 6 months before planting. This fungicide is also used in dusting plants to control phytophthora of potatoes, mildew of grapes; cercospora of sugar beets. The expenditure per one hectare amounts to 10 to 30 kg. of the preparation, depending upon the crop.

COPPER NAPHTHENATE is a hard substance of dark green color. Prepared by pouring 10 o/o solution of copper bisulfate into a boiling 10 o/o solution of soap naphtha. The resulting naphthenate of copper flows to the surface of the liquid; the chemical does not dissolve in water but in mineral oils.

It is applied in the form of clayey mineral oil emulsions for the production of which copper naphthenate and mineral oil are taken in the proportion of 1:10, i. e. one part of copper naphthenate to 10 parts of oil. For summer spraying of plants, copper naphthenate is used in dosages of 0.1 to 0.3 o/o, while in the late fall and winter seasons, the dosage is 0.6 o/o.

This preparation proved highly efficient in controlling apple scab, grey rot of stone-fruit crops, and other diseases.

Because of the solubility of the chemical in oils, it penetrates deeply into the wood, which makes it preferable to other copper preparations.

COPPER CHLORIC OXIDE? is basically a mixture of the following compound: $3Cu(OH)_2 \cdot CuCl_2 \cdot H_2O$. This dustlike powder, ranging in color from light green to turquoise blue, does not dissolve in water. The preparation will dissolve in a liquid solution of ammonia, producing a liquid of deep blue, blue or light green color. The chemical is a new effective preparation and may be applied to control diseases of various crops in place of Bordeaux mixture.

SULPHUR PREPARATIONS. To this group belong sulphur, lime-sulphur decoction (ICO), sulphuric concentrates, solbar, sulphuric-lime mixture, sulphur oxide and a paste of sulphuric gas (colloid sulphur).

SULPHUR finds wide application in controlling mildew of various crops by dusting. It is used for this purpose in grey color or ground sulphur. The best effect is obtained in controlling oodium of grapes. Good results are obtained in the control of rust.

The action of sulphur upon fungi in dusting is connected with high temperature (30° and above). According to many researchers, vapors of sulphur form, which determine toxic properties. It is believed that the harmful action upon fungi is the result of hydrogen sulfide forming because of the repreoititation of sulphur in the presence of green parts of plants or microorganisms.

Despite its clearly pronounced fungicide properties, sulphur may not always be used due to its negative reaction upon several crops. The foliage of gooseberry plants falls off after dusting with sulphur; on melon crops sulphur causes burns; lump sulphur is used in the disinfestation of quarters (greenhouses, storage warehouses) by burning it; the norms of expenditure are 50 to 60 g./m^3 per unit.

SULPHUR CONCENTRATE (applied in dusting grapes against oodium). The lime-sulphur decoction is applied chiefly in controlling many parasitic fungi preserved on branches of fruit trees or shrubs during the winter. In late fall, winter and early spring, ISO is sprayed in concentrations of 3 - 5 o/o, according to Boehme. During the summer ISO is used to control mildew, scab, rust of apples and pears (1° according to Boehme), anthracnose of Cucurbitaceae (0.5°).

SULPHUR-LIME MIXTURE is prepared from sulphur and lime. The mixture of these substances is prepared, as in the case of ISO, in slaking of lime but without subsequent boiling. Unslaked lime and sulphur are taken in equal quantities,--1.5 kg. 100 liters of water. Of weak-firing quality, this preparation may be used in summer sprayings to control mildew on various cultivated plants.

SOLBAR is applied in the control of mildew of cucumbers and brown spot of tomatoes in protected ground. Cucumbers are sprayed with 1 o/o solution of solbar, tomatoes with 1.5 - 2 o/o solution. Solbar may be used to control mildew of hops and other crops.

SULFURIC ACID (H_2SO_4) finds application in the control of gummosis of cotton and lodging of seedlings of forest genera in nurseries. Cotton seeds are treated with technical sulfuric acid (oxide) of a gravity of 1.80 - 1.84. Its expenditure is 2 - 2.3 kg. per 10 kg. of seeds of pilous varieties, or 1.5 to 2 kg. per 10 kg. of non-pilous varieties. Following treatment, seeds should be washed in water. For mordant treatment of the soil in nurseries, technical sulfuric acid is used in the proportion of 30 - 60 ml^3, diluted in 6 - 12 liters of water, per $1m^2$ of plot.

PASTE OF GAS SULPHUR, the so-called colloid sulphur. This preparation presents a substitute product in the chemical industry and is obtained in purifying koks or generator gas from hydrogen sulfide. The paste is applied to control mildew of Cucurbitae, oaks, etc., by spraying. It dissolves in water. In spraying oaks, 0.25 to 0.50 o/o suspension is used; for cucumbers 2 o/o.

MERCURY PREPARATIONS. The preparations NIUIF -1, NIUIF -2 (Granosan), and the bacteriocide of Zbarsky are used to control disease.

MERCURIC CHLORIDE ($HgCl_2$) are white soluble crystals; this is a poison of the first order, of high toxicity with regard to fungi and particularly bacteria. It is applied primarily in treating seeds of vegetable crops, cabbage, cucumbers, tomatoes. The usual concentration of the solution is 0.1 o/o, i. e. one part of mercuric chloride to 1000 liters of water. This solution is applied to all vegetable crops, except tomatoes, which require a weaker solution 0.03 o/o, (i.e. one part of the chemical to 3000 parts of water). Seeds are kept in the solution for 5 to 15 minutes, (depending upon the crop), after which a careful cleansing in water is necessary; otherwise, germination is reduced.

Mercuric chloride produces positive results in treating potato tubers and controlling various species of scab. The strong toxicity of the chemical limits its application, however; it is used upon special instructions.

NIUIF -1 $[(C_2H_5Hg)_3PO_4]$ is a mercuric organic preparation (ethylmercurphosphate). The liquid is of raspberry color; the strength of the solution frequently 1.3 o/o. It is used as a disinfectant of:

Seeds of vegetable crops from various diseases and seeds of wheat and barley against hard smut, fusarium and helminthosporiose. To disinfect seed, a solution in the concentration of one part of 1.3 o/o of the preparation to 400 parts of water is used; seeds of wheat are moistened with the solution and left to steep for 15 minutes, then dried.

To treat barley seeds, these are kept in the solution for 10 minutes, then dried. Ten to 15 liters of the solution are used for one centner of grain seeds.

NIUIF -2 (Granosan); into the composition of this preparation enter ethylmercurichloride (C_2H_5HgCl) of a concentration 2 - 3 o/o. The rest is talcum. This chemical may be used in dry treatment of seeds of flax, wheat, oil or other crops to control various diseases.

BACTERICIDE OF ZBARSKII is a mercuric-organic preparation of which the active element is phenilmercurinitrate. It is a white powder; applied in treating seeds of vegetable crops. To prepare the solution, 1.2 g. of the preparation to 10 liters of water are taken. Seeds are kept in the solution for 10 - 15 minutes; 2 to 3 batches of seeds may be treated in the same solution. In treating seeds of carrots (from black rot), prior to storing, the same solution is used as in treating ordinary seeds; root crops are kept in it for 30 minutes.

All mercuric preparations are poisonous and precautionary measures have to be strictly observed for that reason.

ARSENITE PREPARATIONS. Among fungicides of this group, protars (PD) and calcium arsenate are applied.

PROTARS (PD) is a grey powder consisting of calcium arsenate $[Ca_3(AsO_3)_2]$ and the diluent, talcum. According to standard, the preparation should contain 9 - 11 o/o of triple oxide of arsenate and no more than 1 o/o of moisture. It is applied in the dry treatment of seeds of grain crops, flax, clover. The expenditure per ton is: for cereals one kg.; for flax 1.5 kg.; clover 2 kg. Cereal crops may be treated one month prior to planting, flax 2 to 3 days before sowing; clover 1 and a half to two months before planting. Vernalized seeds should not be treated by this preparation.

CALCIUM ARSENATE $[Ca_3(AsO_4)_2.2H_2O]$ is applied to control mildew of gooseberries and melon crops by spraying. It possesses high toxicity with regard to fungi and plants and concentration should therefore be weak (0.04 o/o).

MIXED GROUP. Here belong all fungicides not entered in the above 4 groups.

FORMALIN is a transparent, colorless liquid of sharp odor, which strongly affects mucous membranes. In chemical composition formalin is a water solution of ant-aldehyde (CH_2O); according to standard, commercial formalin should have 40 o/o. A white, cottonlike settlement is observed during long storing and especially low temperature. The solution has lower toxicity with regard to fungi and reacts negatively upon plant germination. It may be dissolved by heating (not to the boiling point) or by adding hot water, or a solution of caustic soda.

SODIUM (Na_2CO_3) is taken in the proportion of 8 h. per one liter of formalin, while caustic soda (NaOH) is added in the amount of 4 g. Soda is dissolved in warm water; next equal quantities of soda solution and spoiled (settled) formalin are taken and mixed together. The diluted formalin is kept in a warm place until the settlement disappears. In adding improved formalin, one should consider that it is twice as weak as the ordinary one. In preparing the solution, it should consequently be diluted with water reduced twice in amount, as against that used for 40 o/o formalin.

Formalin is widely used in treating seeds of cereal crops against various species of smut. It is also used to treat cotton seeds from gummosis; potato tubers from different species of scab and black leg; seeds of vegetable crops and forest genera. In addition, formalin proves a good disinfectant of the soil, vegetable storage bins and grain warehouses.

Treatment with formalin of seed and planting stock is done by moist, semi-dry and "desorbtion" methods. Moist treatment requires a solution of 1:300, semi-dry - 1:80 or 1:100. The desorbtion gas method consists in that seeds are mixed with peat, soil and sawdust, saturated with formalin. These substances are used in the proportion of 0.75 o/o, depending upon the weight of the grain.

In order to forestall injury to seed germination by formalin treatment, rules on dosages, duration, and conditions of treatment should be strictly observed. Reduction in/the germination of treated grain is observed if the latter is sowed, when not sufficiently dry, in dry or moist and cold soil. Under those conditions germination is delayed, seedlings are weak and succumb more rapidly to the negative action of formalin. In warm, moist weather seed germination proceeds normally, and the effect upon germination is insignificant.

Lime chloride [$3CaOCl_2 . Ca(OH)_2 . xH_2O$] is a white powder, occasionally small-lumped, has the odor of chloride. According to standard, the chemical should contain 32-35 o/o of chloride. In the open air, under the influence of carbonic acid moisture and particularly high temperatures, the content of chloride is lowered. Lime should therefore be kept in well-covered containers in cool places. The chemical is used to disinfest soil, storehouses, nurseries. Since it does not dissolve in water, a decoction is made from it to be prepared the day of application.

In disinfecting nurseries and warehouses, lime chloride (decoction) is taken in a concentration of 3 to 4 o/o. Walls, stellage and other wooden parts of quarters are sprayed. The room is then kept closed for one to two days and then aired to eliminate the odor of chloride.

LIME (CaO) is widely used in the control of plant diseases. It is applied in the form of freshly slaked lime or lime milk, or combined with other elements as a compound part of various fungicides (Bordeaux mixture, ISO, lime-sulphur mixture, etc.).

Lime milk containing 20-30 o/o of lime is applied in painting fruit tree trunks (in the fall and spring) and to disinfect storage places. Slaked lime in powder form is applied to control various rots of root crops in storage, particularly "kagat" rot of sugar beets. Root crops are uniformly covered with lime before being placed in storage or are treated with lime milk. The norms of expenditure of lime are: in dusting, 0.4 o/o; in using lime milk, 0.25 o/o, depending upon the weight of the root crop, i. e. 4 to 2.5 kg. per one ton.

Lime is also used to control some soil parasites. Club root of cabbage, root-eater of sugar beets and other diseases require the introduction of lime into the soil to reduce its acidity which contributes to the development of these diseases.

FERROUS SULFATE HEPTAHYDRATE ($FeSO_4.7H_2O$) is a crystallic substance of green color, soluble in water; used in controlling wintering fungi parasites on fruit trees and shrubs by spraying in the fall and early spring. It is usually applied in a concentration of 3 to 5 o/o.

SODIUM CALCIUM WATERLESS (Na_2CO_3) is a crystallic substance of white color, well soluble in water. Applied in 0.5 o/o solution to control mildew of gooseberries.

POTASSIUM MANGANATE ($KMnO_4$); this preparation is used to treat seeds of tomatoes (from virus diseases) and woody genera. In treating tomato seeds, 1 o/o solution is used; for seeds of woody genera, 0.5 o/o and 3 o/o solutions are used.

ACETIC ACID (CH_3COOH) is applied to treat seeds of woody genera in concentrations of 0.5 o/o (for pines, spruces, ashes) and 1 o/o (for pines, spruces and maples). Seeds are dipped for 30 minutes; after moistening, the seeds are rinsed in water and dried.

MANNER IN STORING POISONS AND MEASURES OF PRECAUTION IN APPLYING THEM.

(p. 197-198)

1. Poisons should be stored in dry quarters with roofs, doors and windows in good repair, no less than 100 m. away from domiciles.

2. Quarters should be locked and under watch; the key kept by a person responsible for their storing. Barrels of water and sand should be held in readiness close to storage in case of fire.

3. Poisons are placed in closed containers on shelves or supports and provided with labels marked "poison".

4. Food products, forage, and articles having no relation to the poisons should not be kept in the same place.

5. People having no concern with the matter should not be permitted into the quarters.

6. All poisons arriving for storage should be weighed immediately and registered in a special book. The disbursement of poisons is done by written permit by the agrononist, the chairman of the collective farm of his substitute, or the director of the state farm, and be issued only to people responsible for the work, in strict observation of the weight.

7. Containers in which poisons are issued should be labeled "poison."

8. Transportation of poisons is permissable in containers which are in good condition.

9. All work in connection with poisons is organized under the supervision of agronomists.

10. Those handling poisons should be familiar with them and the necessary precautionary measures.

11. Those handling poisons should wear uniforms, glòves, eyeglasses, respirators, and while dealing with gaslike substances, be equipped with anti-gas apparatus.

12. Workers handling poisons should not remain on the job longer than 6 hours and while working on dry mordants, no longer than 4 hours, the remaining time to be devoted to other tasks. Minors are not allowed to handle poisons, nor are pregnant women and nursing mothers.

13. While handling poisons, eating, drinking and smoking are prohibited. After work, the face and hands must be carefully washed.

14. The medicine cabinet should contain an assortment of anti-poisonous substances, as prescribed by special instructions.

15. After the completion of the work, remainders of poison that may have been accidentally spilled should be picked up and the places where preparations were handled, dug. up.

16. The last mordant treatment should be given no later than 25 to 30 days prior to harvesting.

17. Livestock should not be let out into pastures treated with poisons prior to 20 to 25 days after treatment.

End of Chapter.

TJH: 8 August 1951 (p. 35-67)

67 ~~35~~

Briantsev, V. A.
Zashchita rastenii ot vreditelei i boleznei
(Protection of plants from pests and diseases)
Ed. 3. Moskva, 1950. 640p. 464.4 B76

Transl. 180: Plant Protection.

CHAPTER SIX (p. 255-341, in part)

PESTS AND DISEASES OF CEREAL CROPS p. 255-313.

Cereal crops are injured by pests and rodents and affected by various diseases. There are many multi-poisonous and special species among injurious insects which damage exclusively cereal crops. Among multi-poisonous insects the following are noted: Locusts, cutworm moths, wireworms, and among special insects the injurious eurygaster, grain flies, saw flies, etc. Among the most harmful rodents are ground squirrels and mice. The most widely spread diseases among cereal crops are: smut, rust, ergot, fusarium.

PESTS OF CEREAL CROPS (p. 255-281)

Hessian Fly (Mayetiola destructor Say). a fly of the Itonididae family; injurious to summer and winter wheats, rye and barley.

It is widely spread and causes particular harm in the Ukraine, Northern Caucasus, Crimea, Voronezh and Kursk oblast(s). The pest does not propagate as freely to the north of these areas, although in warm years it's effect is felt even at Kirov, Leningrad and other northern oblast(s).

The flies winter as adult larvae in a pseudo-cocoon on winter plantings and wild growing crops. They pupate in the spring. Adult flies usually fly out when they are in their booting stage. Males and females are already sexually mature. They do not feed and live only several days, during which time coupling and egg-laying takes place.

Eggs are laid on the upper side of leaves of cereal crops. One female lays an average of 200-250 eggs; these develop in 4 to 7 days. Larvae crawl into the leaf base, do not penetrate into the stem, but suck on it from the outside, protected by the leaf base; develop in about 30 days, and pupate at the base of the leaf where they formerly fed. Under normal conditions the adult pest leaves the pseudo-cocoon in two weeks. During vegetation the hessian fly may produce 2 to 5 generations. The number depends upon meteorological conditions. In dry weather larvae do not pupate and pass into a prolonged dormant state which terminates when precipitation sets in. Dormancy reduces the number of generations; in such years only spring and fall generations are produced, while when moisture is adequate four to five generations may be produced in the southern areas. In the former case (2 generations), the first spring generation develops on spring and winter crops and the second fall generation on winter crops. Where there are several generations, the first develops on spring and winter crops, the second on summer crops, the third, flying out after harvesting and prior to winter crop germination, develops on self-sown plants, and if the period is lengthy, another generation yet may be produced on these plants; the last generation develops on winter crops.

The nature of injury and harm done by the hessian fly depends upon the stage during which the plant was infested. Young infested plants stop in their growth, become dark green, their stems thicken, the foliage widens, and frequently wrinkles. Non-tillering shoots usually perish; mature shoots only lose the affected stems; whenever the main stem is damaged, yield is reduced or no tillering takes place among these plants. If injury is caused during the booting stage, stems continue in their development but may subsequently bend and even lodge. This also leads to a reduction in yield; lodging also interferes with mechanized harvesting of grain. Wheat, particularly soft wheats, are affected most, along with other cereals, except oats. Uncultivated plants, especially Agropyrum, may also serve as forage for pests.

Unfavorable meteorological conditions and parasites interfere with the propagating of the hessian fly. "Dry winds" cause eggs to dry out and this leads to the destruction of pests in large quantities. Parasites also destroy during some years 100 per cent of the pest population.

METHODS OF CONTROL:

1. Early planting of spring crops, to permit the germinating stage to end by the time the adult pest makes it's appearance; plants may, however, be also infested in subsequent stages, although the injury is greatly reduced.

   With regard to winter crops, it should be borne in mind that very early plantings became severely infested and later plantings are affected in lesser degrees. Very early planting of winter crops should therefore be avoided. Since late plantings in some regions, produce low yields, they should be undertaken only in cases of mass pest propagation with special permission by local land organizations; plantings of winter crops should be generally undertaken in periods that ensure maximum yields.

2. Timely harvesting to prevent self-sowing.
3. Immediate removal of the harvest.
4. Stubble cultivation followed by deep fall plowing, prior to the appearance of shoots of winter crops. Stubble cultivation contributes to the appearance of weeds and volunteer grain, on which the third and fourth generations of the hessian fly develop. Shoots of infested fallen grain are destroyed by subsequent deep fall plowing, prior to the

appearance of flies from pseudo-cocoons, thus preventing their attack upon winter crops.

If early plowing is not possible on all fields, stubble cultivation should be undertaken first on plots which adjoin fields intended for the planting of winter crops.

5. Application of all agricultural practices (vernalization, fertilization, good soil cultivation, additional feeding) against a background of grass crop rotation, to ensure the most favorable conditions for plant growth.

6. Destruction of Agropyrum, which serves as one of the major habitats for pests on fields and boundaries. Fields should therefore be well cultivated and boundary areas plowed over.

7. Fields under crop rotation should be arranged in such manner as to keep plots under spring wheat and barley away from those planted under winter wheat and rye. The greater the distance between planted areas, the smaller the number of pests that will fly from winter over to summer crops in the spring.

8. Application of chemical methods of control to destroy eggs and larvae. Contact poisons are used; spraying with anabasine-sulfate (0.15 per cent) and soap (0.4 per cent), sodium fluoride (0.75 per cent) and soap (0.4 per cent). Dusting with anabadust (5 per cent) or anthracene dust prepared in the proportion of 1 kg. of anthracene oil or 2 kg of raw anthracene to 20 kg of lime-"Pushonka". The dusts DDT and GKHTSG are applied against adult flies, and used in the early stages of plant development. Chemical methods of control are applied primarily on particularly valuable plantings of soft spring wheats.

MILLET FLY, Stenodiplosis Panici Rodd., also belongs to the Itonidae family. Small fly; length of body 2-3 mm; larvae are wormlike, colorless; gradually acquire a round shape and orange spots on their bodies. The pupae is open, not encased in pseudo-cocoon. This pest is widely spread in all areas where millet is grown and may in years of mass propagation destroy up to 90 per cent of this crop. Larvae winter in the damaged grain of cultivated and barnyard millet and pupate in the spring. The adult fly comes already sexually developed, does not feed and lives only 2-3 days. Following coupling, the female lays it's eggs before blooming, or at the very beginning of the blooming stage; the crop cannot be injured after this. A female may lay about 100 eggs; 3-4 days later larvae appear which feed on the ovary of the plant and the inner surface of flowering films. One grain may hold 3-4 larvae; as a result of the injury, the ovary is destroyed and the grain empty. Larvae develop in a week and change into pupae which show in the grain shortly before the adult pests fly out. The entire development lasts 14-16 days. The fly produces 3-4 generations in areas of the central belt of European USSR (Voronezh oblast').

Wintering larvae remain among empty grain; dormant larvae of preceding generations may winter along with them among fallen grain of cultivated crops and barnyard millet, or residue.

METHODS OF CONTROL:

1. Improvement of seed stock; this is achieved by careful sifting of millet in threshing and by treating seeds with naphthaline which kills the larvae. When treated with formaline (wet method), the seeds that come to the surface must be rejected since they usually contain larvae.
2. Early and close planting which reduces the degree of injury caused by the fly. The latter infests early plantings only lightly, while flies

of succeeding generations appear at a time when the blooming period is at it's end and infestation is no longer harmful.

3. Regular planting of seeds to ensure uniform crops.
4. Multiple weeding; barnyard millet should be destroyed all over.
5. Timely harvesting to prevent spilling of grain.
6. Deep plowing with foreplows to destroy the supply of larvae which wintered in fallen grain. It has been established that the fly has difficulty in reaching the surface of the soil even through a depth oa 2 cm.
7. Use of husk (chaff) and all residue before spring, since 50 per cent of wintering pests are usually found in them. When infested residue is fed to livestock, larvae are destroyed in the intestines of animals. Steaming of husk destroys larvae already at 60°.
9. Planting of millet at some distance from fields of previous years to make the flight from basic foci more difficult.

SWEDISH FLY, Oscinosoma Frit L., belongs to the family of cereal flies (Chloropidae). It is a small black fly of metallic shine; length 2 mm; eggs are elongated, cylindrical, white, length to 0.06 mm. Larvae white, length 4-5 mm.

The Swedish fly injures cereal crops. It is widely spread but the zone of its steady propagation and injury is in regions of moderate climate. The pest is therefore noted as particularly dangerous in forest and forest-steppe belts, as well as in mountain regions of the Caucasus, Altai, etc. It may cause considerable damage in steppe regions only in years of moderate temperature and increased humidity during the spring and summer.

Larvae of the Swedish fly winter on winter plantings and wild grown uncultivated cereals. Pupating takes place in the spring, the flies usually making their appearance at the time shoots of spring crops of later plantings come up. The female lays its eggs on shoots having 2-3 leaves and, beginning with the tillering stage, on young stems with 2-3 leaves. Larvae penetrate into the stem and feed on the embryo of spikes (ears) and the base of the upper leaf; as a result, the latter wilts and yellows. The entire development of larvae takes place within the stem; during tillering, the second flight of the pests begins, accompanied by egglaying on young stalks; larvae, deposited on stalks, penetrate into the grain and feed on it's content; they also pupate there.

During the third flight (in northern regions), the fly lays it's eggs on winter crops; in the south there may be additional generations during harvesting and before the appearance of shoots of winter crops. During that period the pest develops on self-sown grain, and produces 1-2 generations. The pest produces 5 generations altogether, depending upon the latitude of the locality. Normal propagation occurs at 18-30°; a temperature of 35° depresses the pest and temperatures below 18° prevent egg-laying.

Swedish flies injure primarily spring crops and are particularly damaging to wheats and barley. In years of a prolonged warm fall, they may also injure winter crops. The degree of their injury is determined by the stage of plant development at the time of infestation and the vigor of tillering. Plant injury is most severe when it occurs at the germination stage.

Injured shoots of inadequate vigor in tillering, usually do not recuperate and are destroyed; plants still capable of tillering produce new shoots; this delays plant development and cuts into production, 50-70 per cent.

When plants are infected during the tillering and subsequent stages, injuries are less harmful. In such cases, yield is reduced 10-40 per cent.

Injury of shoots (stalks) in the steppe belt region occurs seldom, since eggs laid on stalks perish from lack of moisture and dry winds; because of the rapid hardening of the endosperm, larvae is unable to develop normally. This type of injury is prevalent in remote northern regions.

Yield reduction depends also upon the varietal characteristics of crops. Grain varieties of greater tillering vigor and more rapid germination development are more resistant to injury, as well as those where plants have pubescent stems and leaves and closely attached coleoptiles, which the fly is unable to penetrate to lay eggs in.

METHODS OF CONTROL.

1. Early planting of spring crops.
2. Timely removal of harvest, to avoid fallen grain.
3. Stubble disking cultivation followed by plowing. This method is of little significance in northern regions where harvesting ends late and where crops from fallen grain do not develop before the planting of winter crops.
4. Planting of more resistant varieties.
5. Application of all agro-technical measures against a background of grass crop rotation. Early maturing of spring crops lengthens the period between harvesting and planting of winter crops, causing the Swedish fly to get into unfavorable conditions during the latter part of summer. As shown by experiments, chemical methods of control, (dusting with DDT and GKHTSG at early stages of plant development) prove most effective against adult flies.

GREEN-EYE Chlorops pumilionis Bjerk. belongs to the family of cereal flies Cloropidae. Injures primarily barley and summer wheat, to a lesser degree, winter wheat and rye, and very seldom, oats. It may feed also on uncultivated plants.

A fly of yellow color with three black bars on it's back; has green eyes; length 55 mm. Eggs are white, ribbed, 0.08 mm. long; larvae white, cylindrical with rounded ends; length 7 mm.

The green-eye is widely spread but the area of it's greatest damage is in regions of high humidity and moderate temperature; considerable injury is frequently observed in White Russia, Smolensk, Orlov, Kalinin, Moscow, Leningrad, Vologda and Gor'ky oblast(s).

The green-eye winters as larva and pupates in the spring. Flies appear usually two weeks later. Eggs are laid singly, chiefly on upper leaves. One female may lay an average of 140 eggs; larvae penetrate the leaf sheath and live on the upper part of stems, injuring the developing stalk; they pupate right there. Flies of the second generation appear before harvesting and lay their eggs on winter crop shoots. In the forest and steppe-forest zones the flies live very long in a dormant state, before the appearance of winter crops.

Larvae which develop on winter crops remain for the winter inside plant stems. When early infested, internodes are close and stems swell. The injured plants growth is retarded and it perishes. If infestation is late, larvae occasionally gnaw elongated furrows into the stalk itself; this causes the latter to tiller only in part, or not to tiller at all, and to produce a low yield. If infestation is very late, the stalk manages to tiller and the exposed larvae perish. This does not affect the yield.

Methods of Control:

1. Early planting of spring crops.
2. Use of early tillering varieties; many larvae are destroyed during early tillering, before they have an opportunity to cause any damage.
3. Stubble cultivation followed by deep plowing; this measure is of particular benefit in forest and steppe-forest regions.

4. Application of all agro-technical measures and grass crop rotation to strengthen and accelerate plant growth.

GRAIN BEETLES belong to the family of Scarabaeidae.

Among them the most injurious are "zhuk kuz'ka," Anisoplia austriaca Hrbst. and "zhuk-krestonosets," A. agricola Poda. A. austriaca Hrbst. is spread in the steppe zone down to the Volga and also found in the steppe regions of Altai krai. A. agricola Poda has a larger area of distribution; it extends to Moscow oblast' in the north, is found beyond the Volga in the East and populates Western Siberia.

These beetles were of major significance before the revolution; annual losses between 1910 and 1917 amounted to 774.9 thousand tons of grain. At present these are much reduced.

Adult beetles usually appear during tillering of winter grain and first feed on it, then pass on to summer crops. If at the time of their appearance winter crops have not yet tillered, beetles feed first on grain of Agropyrum and other uncultivated plants. This goes on for one month. The beetles are active in sunny hot weather, when they fly and feed voraciously; they are inactive on cloudy or rainy days. The pests feed on immature soft grain of wheat and rye; their gnawing causes one part of the grain to fall to the ground; one beetle devours and drops 50-90 grains, i.e., destroys 3-6 stalks. 40 beetles per 1 m^2 . will cause a complete loss of the harvest.

While spring crops mature, females penetrate the soil down to the moist layers and lay their eggs, usually at a depth of 15-20 cm. One female lays an average of 30-40 eggs. Their development takes about 20 days. Young larvae feed on plant roots; after wintering feeding continues, larvae feed even more intensely and are capable of gnawing through young shoots of grain crops, sugar beets and other plants. When population is dense (10-15 larvae per 1 m^2), plantings are thinned and empty spots taken over by weeds. In May larvae pupate at a depth of 10-15 cm of the plowed layer. Adult beetles appear 16-17 days following pupation. The development of beetles takes two years. Depending upon this biological characteristic, large and small numbers of grain beetles appear alternately in different years.

METHODS OF CONTROL:

Agricultural and mechanized measures are applied in control,-

1. Stubble disking and deep fall plowing immediately after the harvesting of spring crops, in order that the layer of soil containing eggs be turned over once. The layer dries out, and eggs are destroyed since they are sensitive to loss of moisture.
2. Cultivation of fields under crop rotation and in-between-row cultivation during mass pupating of pests; many pupae are destroyed in the process, as they are most sensitive to mechanical injuries.
3. Early planting of summer crops and application of all agricultural technical methods that accelarate growth and ripening, which reduce the harmful activity of beetles.

Catching of beetles with special traps.

GRAIN GROUND BEETLE, Zabrus tenebrioides Goeaze of the Carabidae family. Injures shoots of winter wheat and rye.

The beetle is black, 14-16 m long; larvae dirty-white, length 25 m. Distributed in southern steppe regions; damaging in the Ukraine, Crimea, Krasnodar and Stavropol' krai(s).

The beetles appear at the end of June and early July and feed on mature grain of winter and summer crops. After harvesting, beetles gather in shocks and feed on the grain. Females lay their eggs on the same plots, among fallen grain, at a depth of 5 cm.; 15-20 days later larvae appear; they live in holes close to plants.

Larvae feed on foliage, which they pull into their holes. Injured leaves look shredded; in the fall larvae pass over to infested plots of winter crops and continue to feed there; they winter in the soil. In the spring they do not endanger winter crops since the latter have had time to develop and become more resistant, but they cause injury to spring crops which they attack. By the end of May and early June all injury ends in connection with pupating, which takes place in the soil; this stage lasts about 3 weeks.

METHODS OF CONTROL:

1. Planting of winter crops only on fields under crop rotation, prepared for winter and inter-tilled crops, i.e., on plots freed from weeds on which the pest may develop.
2. Prevent self-sowing after harvesting; this is achieved by timely removal of the harvested grain, and the use of grain catchers on combines. Sheaths should not remain long in the fields.
3. Immediate removal of hay that remains after harvesting with combines.
4. Stubble cultivation followed by early fall plowing; this reduces infestation by larvae.
5. Application of poisons of intestinal action to destroy larvae on winter crops; dusting with calcium arsenate (8-10 kg per 1 h.) or sodium fluoride (10-12 kg per 1 h.). Poisoned attractants may also be used to control larvae; they are placed at the bottom of boundary ditches dug around plots infested by the grain snout beetle.

LEAF BEETLE, Lema Melanopus L. a small beetle of the Chrysonelidae family, particularly injurious to spring crops, oats and barley, partly to hard wheat.

Green-blue in color, of metallic shine; length 4-4.5 mm.

Widely distributed in European USSR and Siberia. Frequently damaging in steppe and forest-steppe regions.

Beetles which have wintered feed in the spring on foliage of shoots of spring crops, eating alongated holes into them; females lay their yellow eggs, 3-7 pieces in a row; eggs develop in two weeks; larvae are bare at first, then get a covering of brown slime. They injure foliage, eating the tissue without touching the epidermis on the under side. The larvae stage lasts 2 weeks; pupating takes place in the soil; mature beetles remain in the soil for the winter.

The pest injures spring crops; it does not harm winter crops because of their rapid development during the spring. Soft wheats are not injured in view of their pubescent leaves. When infestation is severe, entire plants and not only leaves, dry out. The greatest damage is caused by this pest during years of dry spring seasons, when yields are reduced 50 per cent and over.

METHODS OF CONTROL.

Dusting and spraying with poisons of intestinal action. Calcium arsenate is used for dusting (8-10 kgh); for spraying, Paris green (0.12-0.16 per cent) double addition of lime or calcium arsenate (0.1 per cent), and four times the amount of lime.

STEM GRAIN SAW FLIES, of the Cephidae family. Injurious primarily to cereals. The most dangerous are: grain saw fly, Cephus pygmaeus L. and black saw fly, Trachelus tabidus F. The grain saw fly is black and has wide yellow rings on it's body; length 8-9 mm; the black saw fly is also black, but has elongated brown yellow stripes along the sides of it's body 7-8 mm long.

Larvae are legless, have pronounced heads.

The grain saw fly is distributed throughout European USSR; extend in the north to Liningrad oblast', Siberia and Central Asia; the black saw fly covers a narrower area, i.e., the steppe belt of the Ukraine, Northern Caucasus and Crimea. The pests cause their greatest damage in the steppe regions of European USSR. Their development takes in one generation. Flight usually coincides with the beginning of tillering of wintering crops. The black saw fly appears 2-3 weeks after the grain saw fly. Shortly thereafter, females lay eggs upon the upper part of stems, selecting plants of tall and developed stems. The female "saws" an opening into the upper part of the stem and lays one egg inside. Altogether 35-40 eggs are laid in a corresponding number of stems. Larvae appear on the 5-6 day and feed inside the stem. They gradually move towards the lower part of the stem, gnawing on internodes and filling the interior with excretions and rot. Upon reaching the basic part of the stem, larvae gnaw it from the inside and form a cork below of remnants of hay. Under this cork they spin a long firm cocoon in which they spend the winter. Pupating takes place there in the following spring. The injured stems break and fall off. Larvae in cocoons remain in the stubble after harvesting.

The grain saw fly injures primarily winter crops, while the black saw fly, appearing later, causes damage to spring crops. Their damage consists in:

1. Reduced yield of grain because of injured stems.
2. Loss in harvest in view of lodging of stalks.
3. Deterioration of forage quality of infested hay. The yield is reduced 10 per cent or more.

METHODS OF CONTROL:

1. Early planting of spring crops; of similar significance are other agrotechnical methods which contribute to plant growth and ripening of crops.
2. It is necessary to avoid reducing norms of planting, since thin plantings are more affected by saw flies.

3. Cultivating on stubble and deep fall plowing; 60-70 per cent of the pests are destroyed even when plowed under 18 cm.

HARMFUL EURYGASTER, Eurygaster intergriceps Put.

Grain crops are injured by several species of bugs, among which the above is of major importance. At it's adult stage the pest has a developed breast plate which covers the entire belly; length 10-12 mm; distributed primarily in the steppe zone. Greatest damage is caused in the Ukraine, Crimea, Rostov, and Voronezh oblast(s), Krasnodar and Stavropol' krai(s), and the republics of Central Asia. Injured primarily are wheat and rye, more seldom barley and oats. Feeds also on uncultivated plants (Agropyrum, rye grass).

The pest periodically appears in masses, causing great damage to cereal crops. Following 1901-1902, mass propagation occurred in the years 1938 to 1943 and again in 1949.

Adult bugs winter under fallen leaves in forests, tree shelter plantings and orchards, and in mountainous regions of Central Asia.

In the spring, at a temperature of 18-20°, the bugs appear from their wintering abodes and fly into the grain fields. They remain in the fields between clods of soil until permanent warm weather sets in. During this time they suck the juice of stems at the stems bases. As soon as the air is warm they crawl upon the plants and suck the upper parts of stems.

Eggs are laid at different intervals, depending upon the development of sexual maturity. The female lays 14 eggs at one time, and may in one month lay a total of 100-150 eggs. Larvae are born on the 8-16th day; they crawl onto the stalks and suck the juice of the grain; development lasts 35-40 days. Adult bugs appear early in June and also suck on the grain.

During harvesting and even before it, the bugs migrate into the woods; in mountainous regions of Central Asia they fly into the mountains, i.e., places of lower temperature and higher humidity. Here they live for awhile in the open and occasionally fly short distances. In the fall, when the temperature is 6-7°, they hide under fallen foliage or upper humus layers where they winter. A particularly large number of bugs settle on forest clearings. In the winter they stand temperatures of 7°; a lower temperature reduces their viability, and they perish at 16-17°. Snow cover ensures normal wintering for the pest. Radical reduction in temperature following winter thawing without snow cover, completely destroys all wintering Eurygasters. They also are destroyed in forests, whenever their wintering hideouts are flooded during spring river floods.

Feeding conditions reflect upon the numbers of Eurygasters. If they complete their feeding at harvesting, they go wintering in a normal state. If, however, the main mass of bugs is in it's 3rd or 4th stage of larvae development, which happens when their flight from wintering places is delayed, they transfer onto unsuitable crops after harvesting, such as millet, or are compelled to feed on uncultivated plants. This leads to considerable destruction of larvae, and while one part of them may reach the adult stage, they go wintering in a weakened condition; such pests do not survive the winter well and perish in large numbers, while the survivors are unfertile.

The degree of injury caused by Eurygasters depends upon the stage of plant development. When plants are injured during the tillering stage or prior to the booting stage in the spring, injured stems yellow and die off.

Sucking of juice reduces grain weight, germination, and spoils the baking qualities of it's flour; if grain is injured prior or during ripening, only it's hull will remain; injury caused when grain is fully matured ~~affects~~ it's weight least; when punctured in a few places, its weight is reduced 20 per cent; loss in germination is due primarily to direct puncturing of the embryo.

Flour processed from injured grain is of poor quality. Dough is loose and the bread low and of poor quality. This is because the bugs in puncturing the grain introduce along with saliva, ferments which loosen the gluten.

METHODS OF CONTROL:

1. When Eurygasters winter in large numbers in forests, fallen leaves, together with the pests are gathered into piles 1 m. high and covered with a 20 cm layer of soil. Excessive moisture and heat destroys the bugs. This method is applied in exceptional cases, because gathering of foliage lowers frost resistance of trees.

   In the mountains of Central Asiatic republics wild growing grass vegetation in which the pest settles is burned with good results.
2. Catching of bugs on plantings during tillering with the aid of special manual, horse and automobile traps.
3. Application of biological method of control of harmful Eurygaster. Chickens are let out into the fields in the spring and summer after harvesting, and particularly in the fall on locations where pests winter. The parasite, Telenomus is let out to infect eggs of eurygasters. Special laboratories for propagating this parasite have been established at state and collective farms.
4. Dusting with DDT of plantings infested by bugs. Other species of eurygasters may also injure cereal crops, the control of which proceeds along the same line.

CEREAL APHID, Toxoptera graminum Rd.

Grass green in color; distributed in the steppe zone and frequently damaging in the Ukraine, Rostov oblast', Nizhnee, Povolzhie, Caucasus, Central Asia, Far East. It injures wheat, barley, oats, even millet, rice, and among forage grasses, sorghum. It also feeds on uncultivated crops.

Eggs winter on plant leaves of winter crops, less frequently on plants from fallen grain and uncultivated crops. Larvae born in the spring soon transform into females called "osnovatel'nitsy", founders. These produce larvae parthenogenetically; in 7-15 days these are transformed into female-virgins. The latter continue to produce larvae parthenogetically and continue the process. The pest produces in such manner 15 and more generations in one vegetative period. Beginning with the second and third generations, winged females appear among the wingless virgin-females, the so-called female dispersers, which in their flights settle on plantings of cereal crops. These female dispersers propagate in the same manner as do female-virgins.

In the fall a new form of aphids makes it's appearance among the last generations, female-"polonoski" (sex-bearers), which produce larvae parthenogenetically and of which one half is transformed into sexual females, the other into males. After mating, females lay 2-4 eggs at the base of leaves of cereal grains, which remain to winter. Virgin females bear 25 to 73 larvae, while fertilized females are capable of laying only up to 12 eggs.

The number of aphids is usually reduced in July because of high temperatures and the propagation of rodents and parasites.

The grain aphid settles in the open on leaves of cereal crops and frequently forms colonies. The leaves yellow and dry as a result of their sucking. If severely infested during the booting stage, plants will not tiller and if infested during tillering, yield is considerably reduced. Degree of injury depends also upon the conditions of plant development. On well cultivated and fertilized plots, plants develop better and suffer therefore less injury; yields are also less affected.

After harvesting, aphids propagate on forage and uncultivated plants and those grown from fallen grain, moving eventually over to shoots of winter crops.

METHODS OF CONTROL:

1. Early planting of spring crops and use of early varieties.
2. Fertilization, soil cultivation, vernalization and the entire complex of measures directed towards strengthening and acceleration of growth of cereal crops.
3. Control of "padalitsa", plants from fallen grain, (which serve as "reservations" for aphids from the time of harvest up to the appearance of shoots of winter crops), by cultivating stubble, followed by early and deep fall plowing.

WHEAT THRIPS, Haplothrips tritici Kurd. Adult insects are black; larvae red; this thrips is distributed in steppe and forest steppe zones.

Larvae winter in the upper layer of the soil and also close to plant roots. They awaken in the spring when the temperature is 8° and transform into nymphs. When winter crops begin to tiller, adult thrips make their appearance, settling first on winter and then flying over to spring crops. Larvae feed on grain and stalk scales, sucking their juices. Larvae of the last "age" go wintering. Injured grain is reduced in weight; one thrips reduces weight 3.9 per cent; 3 thrips 15.8 per cent; 5 thrips 30.6 per cent.

METHODS OF CONTROL:

1. Early planting of spring crops. Deep fall plowing.

OATS THRIPS, Stenothrips Graminum Uzel. Adults and larvae have yellow-grey coloring. Distributed all over where oats are grown. Injures oats; feed also on uncultivated plants ("ovsuig").

Adult insects winter in the soil at a depth of 75 cm. Thrips settle on oats 2 to 3 weeks prior to tillering, inside the rolled upper leaf which covers the panicle. Eggs are laid in the tissue of stalk scales. The female lays about 100 eggs. Larvae suck the stalk and flowering scales, then disappear in the soil where they first transform into nymphs, then into adult insects. Sucking spoils the quality of oats for forage, injured scales become colorless.

METHODS OF CONTROL have not been developed yet. It is believed that early planting reduces injury.

WHEAT NEMATODE, Tylenchus Tritici St.

Injures wheat and rye. Of wormlike shape, almost colorless; females 5 mm long, males 2.5 mm in length.

Distributed in the Crimea, Northern Caucasus, Trans-Caucasia, Central Asia.

Larvae of wheat nematode winter in galls, which resemble grain, and are carried into the fields with planting stock.

Under the influence of moisture and warmth larvae enter the soil, whence they penetrate into plants. Because of toxic excretions, harmful to plants, nematodes delay the development of the latter, cause leaf roll and deformed stems. Severely weakened plants perish. When the flowering bud ("tsvetochnaia pochka") forms, nematodes penetrate it and fertilized females lay their eggs there. One female may lay 25 thousand eggs. Larvae feed on the inner tissues of the bud; the injured flowering bud in developing produces a gall, externally resembles grain, but is infested by hard smut. Mature, ripened gall is filled with larvae of namatodes; these are resistant to the external environment and may be preserved for 9 years; neither heating to 50^{o}, nor freezing destroys them.

METHODS OF CONTROL:

1. Substitution of injured seed stock by healthy material, free from nematode galls.
2. Cleansing of grain from galls by passing it twice or three times through

"triers". Since larvae do not perish in passing through the intestines of domestic animals, residue is fed to cattle in steamed form.

3. Timely harvesting to prevent dropping of galls in the soil. Installation of grain catchers is compulsory in grain removal.
4. Storing of infested grain separately from healthy grain.
5. Return of wheat or rye to the same fields not any earlier than in 3 to 4 years.

DISEASES OF CEREAL CROPS (p. 281-313)

SMUT. Affects all cereal crops. By destroying the principal crop, i.e., grain, smut causes great damage.

According to VIZR, average annual losses from smut between 1930 to 1935 represented 12.8 millions of centners of 1.8 per cent, while in 1941 losses from smut did not exceed 1 per cent. The cut in losses was obtained as a result of government measures for the control of smut.

The disease is spread all over. It affects various parts of the plant, mostly the stalk. The injured tissue is destroyed and transformed into a black, dustlike mass of spores. Two types of smut are distinguished according to the nature of the injury: Hard and loose smuts. Hard smut destroys the content of the grain, while the hull is preserved which releases the spores only when the hull is destroyed. This usually takes place during harvesting and threshing. Loose smut, however, destroys both content and hull of the grain. Spores are therefore dispersed not only during harvesting but also during vegetation. Smut is produced by parasitic fungi of the Basidial class (order of smut). All species of smut are specialized and adapted to individual crops.

Table 7.

PRINCIPAL SPECIES OF SMUT

CROP	SPECIES OF SMUT	INDUCERS
	Hard or wet....	Tilletia tritici Wint., T. levisKuhn
WHEAT	Loose....	Ustilago tritici Jens.
	Stem....	Urocystis (Tuburcinia) tritici Korn
RYE	Hard or wet	Tilletia secalis Kuhn
	Stem	Urocystis (Tuburcinia) occulta Rabh.
OATS	Hard or covered	Ustilago levis Magn.
	Loose	Ustilago avenae (Pers) Jens.
BARLEY	Hard or stone	Ustilago hordei (Pers.) Kellerm. et Sw.
	Loose	Ustilago nuda (Jens.) Kellerm. et Sw.
MILLET	Loose	Ustilago panici-miliacei Wint.
CORN	Blistered	Ustilago zeae Ung.
	Loose	Sorosporium reilianum (Kuhn.) McAlp.

HARD OR WET SMUT OF WHEAT is spread all over and injures soft wheats most. Symptoms become visible only when the grain ripens. Injured stalks differ from healthy ones in that they are smaller in size and shape. Scales are far apart; the grain swollen, of round shape. During the period of milky ripening, the grain is blue-green in color. During the period of waxy ripening, injured stalks remain green longer and stand erect because of their light weight. Diseased grain contains a black mass of spores enveloped in the grain hull. Diseased grain has a strong "herring" odor, hence its designation "smelly smut".

During harvesting and especially threshing the "bags" are destroyed. Spores fall partly on grain and hay and also contaminate machinery and containers; they in part penetrate the soil. "Bags", which are not destroyed, are mixed with the grain. In this form hard smut is preserved during harvesting until planting. Planting material therefore represents the principal focus of infestation by hard smut. In planting, the spores enter the soil where they develop. Basidiospores produce secondary conidia which infest the wheat germ. Hard smut of wheat is caused by two species of parasites: Tilletia tritici Wint. and T. levis Kuhn. Both species produce similar injury. They differ in the construction of spores: T. tritici has round spores with thick netlike cover (epidermis), T. levis elongated or irregularly round spores of thick and smooth hull (cover). The former type of smut is more widely spread in the USSR.

The principal measure of control is cleaning and treating grain.

LOOSE SMUT OF WHEAT. Inducer - Ustilago tritici Jens. Found all over, particularly in the principal wheat grown regions, Northern Caucasus and the Ukraine. Loose smut, as does hard smut, does not show on vegetative parts of plants. First symptoms of infestation appear at tillering. Infested plants tiller usually earlier than healthy plants. All parts of an injured plant are destroyed, i.e., germ, scales, awns, only the stalk is preserved. Occasionally partial destruction is observed when only individual stalklets are destroyed. The spores are dispersed, get onto the flowers, germinate and infest the germ (embryo). Mycelium does not develop in the grain and remains within the latter until the following year in the form of embryo mycelium. There are no external symptoms indicating the presence of the parasite, although occasionally one notes the sickly grain. Infested grain develops normally; the mycelium of the parasite develops simultaneously with the growth of the plant and reaching the stalk forms a loose mass of spores. Individual spores are small, slightly bristly.

Since infection by loose smut of wheat is contained within the grain, only the heating treatment is applied to disinfest seeds. This method consists in saturating grain alternately with warm and hot water, at precisely established temperatures and periods. The technique used in heating is mentioned below:

STEM SMUT OF WHEAT IS KNOWN IN THE CRIMEA OBLAST', AZERBAIDJAN, TADZHIK, UZBEK, KIRGHIZ, AND TURKMENISTAN SSR.

Stem smut appears primarily on stems and leaves, infesting stalk scales. Leaden grey elongated strips which later burst, appear first; a black mass of spores issue from the tissue. Strips are most frequently observed on upper leaves. The stalks of diseased plants are undeveloped, sometimes do not tiller and dry out. Occasionally stems and leaves bend and roll because of their irregular growth. The inducer of stem smut /Urocystis (Tuburcinia) tritici Korn/ is characterized by its structure of spores. They are gathered into balls which consist of 2 to 5 central cells of brown color and numerous light yellow periphery cells which form a continuous layer.

Stem smut is spread by spores which remain on the surface or within the soil, and partly on straw. Control of stem smut of wheat consists in treating the seed and in quarantine measures.

STEM SMUT OF RYE. Inducer - Urocystis (Tubercinia) occulta Rabh. Stems and sheath are primarily affected. Elongated dark strips are seen on these first, then cracks, fnom which the spores appear in the form of black powder. Stalks of infested plants develop poorly, do not produce seeds and yellow prematurely. Balls of spores of U. occulta consist of small number of cells, compared to U. tritici. One to two central dark colored cells are surrounded by a small number of light brown periphery cells.

The disease is spread chiefly by seeds on which spores are preserved. Hay of diseased plants may also serve as a source of infection. Infestation takes place during germination, up to the appearance of the first leaf. Stem smut of rye is spread all over; in many oblasts (Leningrad, Pskov, Moscow) infestation is severe. Treatment of seeds and agro-technical measures are applied to control it.

HARD SMUT OF RYE. Inducer: Tilletia secalis Kühn. In type of infestation and manner of transmittance, it resembles hard smut of wheat. Spread in Kursk and Voronezh oblast, Povolzhie, including Gorki oblast, and others. This smut develops more severely under increased moisture of the soil. Control consists in treatment of seeds.

LOOSE SMUT OF OATS. Inducer: Ustilago avenae (Pers.) Appears during the period of panicle development. The ovary (germ) and the rest of plant parts are destroyed, transformed into a black-olive powder. Scales are affected completely and in part. Spores settle on flowers of healthy plants and immediately germinate. During this period the mycelium infests only the flowery scales in which the parasite remains until the following year in a dormant state. A large part of spores gets, however, onto the surface of the grain during harvesting and threshing. Infestation of plants takes place at the stage of germination ("prorostka"). Mycelium, preserved in flowery scales or on the surface of grain penetrates into the newly formed oat germ.

Loose smut is distributed all over.

Since spores of this fungus are preserved on the grain surface or on scales, without penetrating into the ovary, control of this species of smut is possible only by external disinfection of seed. The latter is therefore treated with formaline or NIUIF-2.

HARD OR COVERED SMUT OF OATS. Inducer: Ustilago levis Magn. Frequently found simultaneously with loose smut.

Hard smut of oats, in contrast to loose smut, destroys the ovary (germ) leaving scales intact. The mass of spores sticks together, forming firm clumps which do not disperse and remain under the scales. The dark spore mass shines through the thin films of seeds and infested panicles are therefore easily discerned. In threshing infested seeds are destroyed and individual spores get under the scales or on their surface where they remain throughout the winter.

METHODS OF CONTROL: The same as with respect to loose smut of oats.

LOOSE SMUT OF BARLEY. Inducer: Ustilago nuda (Jens). Kellerm. et Sw.

The stalk is affected and all its parts fully destroyed. This species of smut is discovered during tillering. Infestation takes place during blooming, as in the case of loose smut of wheat. Spores infest the germ. The infested grain develops normally but the mycelium inside it is preserved. As the grain develops, the mycelium also grows and reaches the stalk. This species is widely spread.

HARD OR STONE SMUT OF BARLEY. Inducer: Ustilago hordei (Pers.) Kellerm.et Sw. Distinguished from loose smut by type of infection and its biology. Hard smut destroys only the content of the grain, while the outside hull (film) is preserved. The spores of the fungus do not disperse during vegetation and remain in the form of a hard mass under the epidermis. In threshing, the spores contaminate healthy grain, and stay on its surface or under the epidermis throughout the winter. Infestation of grain takes place during germination. Hard smut is found more often in southern areas. Control is by treating the seeds.

LOOSE SMUT OF MILLET. Inducer: Ustilago panicimiliacei Wint. Affects the inflorescence which is transformed into a brown dusty mass covered by a thin white film. There are instances of partial infestation of the panicle. Infested inflorescence usually does not show from the sheath of the upper leaf. Smut contaminates the grain during harvesting; plant infestation occurs during germination of seeds. Smut of millet is widely spread, and control of this species is by treating grain.

BLISTERED SMUT OF CORN. Inducer: Ustilago zeae Ung. Affects all parts of a plant; stems, leaves, panicles (sultan), cobs, even the roots. Swellings of different size appear on all these parts, filled with a black mass of spores, covered by a whitish-grey film. The swellings are round on stems, elongated on leaves, distributed along veinlets.

In cobs individual grains are usually infested, which swell and are filled with a black pulverized mass. Individual flowers are infected in panicles.

The outer cover of swellings bursts and spores enter the soil where they develop, forming basidiospores. The latter are transported by the wind to plants and infest them. Only young tissue is infested. Spores winter in the soil and in harvest residue. Blistered smut is spread in all regions where corn is raised, especially areas of higher temperatures and lower humidity (steppes of the Ukraine). Principal measures in the control of this disease are grass crop rotation, gathering of residue and other agro-technical methods. Treatment of seeds is of significance only in new regions where corn is produced.

LOOSE SMUT OF CORN. Inducer: Sorosporium Reilianum (Kühn) McAlp.

Appears only on inflorescence, cobs, or panicles; infested plants do not fruit and frequently appear depressed. Infested organs are completely destroyed and remain covered by dried hull. Spores disperse upon ripening, getting onto healthy cobs or into the soil. In the winter, spores remain in the soil and on seeds. Infestation takes place in the spring during seed germination. Loose smut of corn is spread primarily in humid regions. Controls are practiced by dry treatment of seed stock and the application of agro-technical measures.

BIOLOGICAL CHARACTERISTICS OF DIFFERENT SPECIES OF SMUT

Method of transmittance of infection and period of infestation	Species of Smut
Spores are preserved on the surface of grain. Infestation during germination of grain.	Hard smut of wheat; Stem smut of wheat Hard smut of rye Stem smut of rye Hard smut of barley Hard smut of oats Loose smut of millet Loose smut of corn
Mycelium preserved in grain tissue. Infested during blooming.	Loose smut of wheat Loose smut of barley
Mycelium on scales. Infestation during grain germination.	Loose smut of oats
Spores are preserved in the soil and on residue Infestation during the entire vegetative period.	Loose smut of oats

METHOD FOR CONTROLLING SMUT is a complex of organizational, economic, agro-technical and special measures conducted according to plan. The principal task of all anti-smut measures is the establishment of seed funds, not infested by smut, and their careful preservation from infestation during vegetation and storage.

The execution of this task can be achieved by the following measures:

1. 100 per cent treatment of all seed stock.
2. Application of the entire complex of agro-technical measures designed to reduce the percentage of smut infestation.
3. Storage of seed stock in disinfected containers and warehouses.
4. Careful disinfection of all agricultural machinery and equipment.

Measures for smut control are directed primarily towards improving the sanitary condition of planting material, as the principal focus for spread of smut. Depending upon the method of grain infestation, disinfection may be chemical or thermic. No matter how the grain is disinfected, however, it should first be cleaned; this will eliminate sickly, undeveloped seeds and smut "bags".

Treatment of seeds by chemicals is applied against those species of smut that are preserved in the form of spores on the surface of grain or under its scales. There are 4 methods of treatment: wet, semi-dry, dry and desorption-gas method.

WET TREATMENT is applied for glumaceous cereals (barley, oats and millet), occasionally to wheat and rye. The principal chemical used in wet treatment is formaline, applied to control hard and loose smut of oats, hard smut of barley, loose smut of millet, and in regions of seed growing farms and seed plots, for treating hard smut of wheat, stem smut of rye and wheat.

Wet treatment with formaline consists of three successive operations:

1. Saturation.
2. Curing ("tomlenie")
3. Drying of seeds.

Formaline is used in a solution of 1 part of 40 per cent formaline to 300 parts of water (1:300). Seeds are saturated with the aid of the machines AB-2 and PU-1 or by hand. In the latter case, seeds are usually treated in piles. The grain is poured in layers approximately 30 cm thick, upon a cleaned and disinfected floor or canvas, saturated with formaline; additional formaline is poured from a water can and the mixture worked over with shovels. Saturation of seeds may also be done in baskets, sewn in bags. The baskets, filled with grain, are dipped for 3 to 5 minutes into barrels containing a formaline solution. Smut "bags" which come up to the surface are removed and destroyed. Treating seeds in baskets is particularly recommended at regional seed farms and seed plots of collective farms, since this method completely cleans seeds of smut "bags" and clumps of spores.

Grain saturated by this or any other method is piled in heaps, covered with canvas or bags, saturated with formaline. The pile remains in this condition for two hours. In this period of time formaline vapors kill all smut; the operation is known as "tomlenie zerna", curing of seed.

The grain is dried under a shed, preferably in a draft, and under no circumstances in the sun, since this may lead to deficient seed germination. Seeds are spread in a thin layer and are turned over several times. To avoid secondary infestation of smut, the grain is poured into containers (bags, canvas) disinfected with formaline.

Wet treatment should not be applied any earlier than 2-3 days before planting. 100 liters of formaline solution are required for one ton of seeds, i.e., 330 g. of 20 per cent formaline. Vernalized seeds are treated by repeated saturation in a formaline solution of 1:300.

Semi-dry treatment was introduced in place of wet treatment because of the advantage of not requiring drying. Only glumaceous plants may be treated in this manner (barley and oats). Non-glumaceous crops (wheat and rye) cannot be treated by semi-dry method, since the strong solution of formaline used for the purpose reduces germination of seed unprotected by glume. In semi-dry treatment formaline is used in the proportion of 1:80. The expenditure per 1 ton of grain amounts to 30 liters for oats, 15 liters for barley. Seeds are saturated in piles or by the machines AB-2 and PU-1. When applied in this manner, a knapsack sprayed must be used to ensure the thin spread of the liquid. Saturated seed is subjected to curing for 4 hours. No drying is necessary. Seed is treated no earlier than 5 days prior to planting.

Dry treatment consists in dusting grain with powderlike preparations. Prior to treatment, the grain must be thoroughly dried, its moisture not to exceed 15 per cent. Dusting of grain with poisons is done with the aid of AB-2, PU-1, PSP-0.5 machines or in specially equipped barrels; treatment by ordinary (primitive) methods in piles, etc., is not permissible. The chemicals NIUIF-2 (Granosan), AB, PD, and in some areas (Leningrad, Pskov oblast(s)) also Ceresan and Germisan, (sulphur preparations), are applied in treating grain.

This method is used to control hard and stem smut of wheat and rye, and loose corn smut.

Barley (against hard smut), oats (against hard and loose smut) and millet may also be treated by the dry method; the preparations AB and PD (protars) are used only for naked grain varieties, while sulphur organic chemicals are also used for glumaceous varieties of these crops.

Table 9.

DOSAGES OF PREPARATIONS (in kg/m)

Preparations	Wheat, Rye	Corn	Oats	Barley
Preparation AB	2	1.5	-	-
Protars (PD)	1	-	-	-
NIUIF-2 (Granosan)	1	1	2	1.5

In using NIUF-2 in treating millet a dosage of 1 kg/t of seed is required. Vernalized seeds treated by dry method (prior to vernalization) should use only the preparation AB. Treatment with AB may be applied 5 to 6 months before planting; PD - no earlier than 1 month, sulphur organic preparations, 3 days before planting.

Grain treated by dry method may not be used for consumption or forage of livestock.

The dry treatment method has considerable advantages over the wet method:

1. It may be mechanized.

2. Does not require curing or drying.
3. May be applied a long time before planting (if AP and PD are used), thereby not interfering with the period of intensive labor during the planting season. The shortcomings of the dry method consist in the poisonous nature of dry preparations, and the resulting danger in their use.

Desorption-Gas Method, developed by Professor Strakhov, consists in applying sawdust, soil or peat, saturated with formaline. These substances are taken in the proportion of 750 g per 1 centner of grain (0.75 per cent).

Heating of grain is applied to control loose smut of wheat and barley, i.e., those species of smut that keep the infection within the grain. Heating of seeds is done by successive saturation in warm and hot water.

Wet heating of grain consists in 4 successive operations:

1. Preliminary saturation of grain at 28-32° for 4 hours.
2. Active heating of grain in hot water at 50-53° for 7-10 minutes.
3. Cooling of grain in cold water.
4. Drying of grain.

Preliminary saturation is applied to bring mycelium out of its dormant state, since it then becomes more sensitive to increased temperature. Subsequent heating of grain in hot water acts fatally upon mycelium. Cooling of grain is essential to retard the physiological processes which could have started in heated grain. Drying of grain should be performed with care, since moist grain in getting into dry soil rapidly loses its germination capacity. Special installations are applied for heating grain, or barrels and pails with strainer bottoms are used. Grain may be heated at any time before planting, provided it is followed by careful drying. No chemical treatment is required once seeds were heated. Heating of grain may be done simultaneously with vernalization. In that case preliminary saturation in warm water is substituted by the type of saturation used in vernalizing. The amount of water used is calculated at one centner of seeds of 13 per cent moisture content;

1. For summer hard late-ripening wheats - 33 liters.
2. For soft and hard late-ripening crops - 31 liters.

If seed moisture exceeds 13 per cent, one liter of water per centner is eliminated for every per cent above 13 per cent. Saturation is performed in three stages during 24 hours. Since the temperature in a pile of seeds must be 10-12°, the process takes place under shelter, in well ventilated barns. After the third saturation, moistened seeds are kept in piles for 36-48 hours. They are then subjected to active heating at specific temperature. If the amount of germinated seeds exceeds 3 per cent, active heating is not used to prevent loss of germinating capacity.

AGRO-TECHNICAL AND ORGANIZATIONAL-ECONOMIC METHODS play an important role in the control of smut.

Preservation of viability of spores in the soil and duration of infestation of seed germs depend upon environmental conditions.

Professor Strakhov's studies of smut showed that in controlling soil processes by agro-technical and economic methods, it is possible to accelerate the destruction of smut spores and thus contribute to the disinfestation of the soil. Germinated spores of smut perish rapidly in moist soil at a temperature of 10-20°, especially if manure or mineral fertilizers are added; germination is not affected in the process.

Such factors as good soil cultivation, adequate choice of planting periods, high quality grain, etc., which contribute to rapid seed germination reduce the amount of infestation among plantings.

Grass crop rotation represents another basic measure in the control of several species of smut. Infestation by stem smut of wheat and rye is preserved not only in seed stock but in residue of plants. Blistered corn smut is spread primarily through the soil, penetrating it directly or through residue. Grass crop rotation, which does not permit repeated planting of crops on the same plot, leads to healthier soil. In considering biological characteristics of blistered corn smut, it is imperative to destroy the foci of infection during vegetation. For this purpose the smut lumps are cut off and destroyed twice or three times during vegetation. In Siberian conditions, where winter temperatures are very low, the method of stubble planting of wheat, developed by Lysenko, proved most effective in the control of loose smut of wheat. In planting on stubble, shoots of winter and spring wheats (latter planted in early October) are able to withstand low temperatures in the winter, while the mycelium of loose smut which develops in the shoots is killed off by frost. The introduction into practical agriculture of varieties of grain crops, resistant to smut, belongs to the effective measures in controlling smut. Relatively resistant are the wheat varieties Gordeiform 27 (to loose and hard smuts), Krasnodarka (to loose smut); Pervenets (to loose smut), oats Verkhniacheskii 53, Sovietskii; corn Hybrid of Kuban 135 (to loose and blistered smuts).

With respect to stem smut of wheat the following measures are applied:

1. Seed material in regions where stem smut of wheat is spread are treated with formaline by the wet method and the preparation NIUIF-2.

2. The transport of seeds, hay and residue of harvests is prohibited from infested regions to uninfested; within boundaries of infested regions the export of these products is prohibited to other farms, from farms where plantings of wheat were infested.

3. At infested farms healthy seed stock must be substituted for infested planting material.
4. Disinfestation by formaline of containers, machinery, transport equipment, grain warehouses, and all articles that were in contact with infested material is compulsory.
5. Infested stubble is destroyed.
6. Wheat may not be planted after wheat.

RUST OF CEREAL CROPS.

Rust affects all cereal crops and is widely spread. It injures all above ground parts: foliage, ovaries, stems, stalks; develops on scales, awns, occasionally on the hull of seeds. The disease shows in the form of pustules, ranging in color from orange to black, depending upon the stage of development of rust and its species.

All species of rust inducers developing upon cereals have different hosts. Some species form a teliospore stage on shrubs (barberry, buckthorn), others on weeds; uredo and telio-stages of all species develop on various cultivated and uncultivated crops. Uredospores develop in several generations, causing mass infestation of crops. Teliospores serve for wintering, although they are of no significance to some species. Meteorological conditions affect rust to a large extent (temperature, moisture, precipitation), as well as agro-technical factors.

Despite the fact that rye does not destroy grain, it causes considerable damage. Infestation by rust may take place throughout the vegetation period. In developing upon the green parts of plants, rye destroys the assimilation processes and consequently reduces the accumulation of nutritious substances in plants. In addition, because of injured tissue, breathing and evaporation are accelerated in diseased plants. All living processes are therefore disrupted; diseased leaves die prematurely; when stems are infested they break and lodge; grain remains undeveloped; is usually sickly and of reduced germination. As a result of this action by rust, yields of grain and hay are sharply reduced. Because of the poor development of the root system in infested plants, their drought resistance is lowered. Rust also reduces frost resistance of plants, which is explained by the small accumulation of reserve carbon in infested wintering plants. The degree of losses depends upon the spread of the disease, partly upon the period of infestation. The earlier a plant is infested, the greater are yield losses.

Among the most prevalent species of rust of cereals are:1.Stripe rust, which affects all cereals; 2. Brown leaf rust of wheat, Puccinia triticina; 3. Yellow leaf rust of wheat, barley and rye. 4. Crown rust of oats. 5. Brown rust of rye. 6. Dwarf rust of barley.

STRIPED OR STEM RUST.

Stems and interior of leaves are primarily affected; more seldom stalks (awns, scales, sheaths of stalks), occasionally leaves on shoots of winter crops.

Inducer of disease: Puccinia graminis Pers. It's teliospore stage develops on common barberry. In the spring bright orange spots with fruiting fungus, in the form of yellow pustules, appear on the foliage and inflorescence of the plant; the pustules are covered with minute cups, teliospores. On the upper side of the spot are seen small black dots, spermagonia.

Teliospores when ripe are carried by the wind and infest cereals on which uredo and teliospores develop.

The summer stage or that of the uredospore, is observed on cereals only after blooming, at the end of June, in July in the form of elongated rust-brown pulverized pustules. These float together and form elongated stripes on stems; hence the name.

The winter stage of rust (teliospores) arrives at the end of the vegetation period and produces elongated black pustules which run together into black stripes. In contrast to other species of rust of cereals, the formation of teliospores of striped rust is accompanied by the disruption of the epidermis as in the uredo-stage. Individual teliospores on legs, of pin-like shape, dark-brown, with one partition, their upper end thick. Rust winters in the teliospore stage on stubble of cereal crops, and in the spring infests barberry again. It has been observed that teliospores that remained on hay, distributed on the soil or tied in stacks, are not preserved over the winter. Striped rust has several specialized forms adapted to specific species of crops.

On cultivated cereals the following forms are found:

P. graminis f. secalis - on rye, barley and Agropyrum.

F. tritici - on wheat and barley.

f. avenae - on oats, less often on Phleum L. and other forage crops.

Striped rust is spread all over, and is particularly severe in regions having humid, warm climates. Among areas chiefly affected by striped rust are the Northern Caucasus and the Far East, where uncultivated barberry and "magonia" are largely concentrated.

In regions where an intermediary host is absent, striped rust may make its appearance in a summer infection (uredospores) derived from other areas and wintering rust from wild-grown plants. Striped rust, if strongly developed, may lead to large losses in yields.

Among the basic measures used in the control of striped rust are agricultural practices designed to reduce the amount of wintering infestation on plant residue (disking, fall plowing) weed destruction and intermediate hosts - barberry and "magonia".

BROWN RUST OF WHEAT. Injures foliage and leaf sheaths.

Inducer of disease: Puccinia triticina Eriks. It has two forms, one, widely spread, especially in European USSR, the other, local in Eastern Siberia. The two kinds differ in their biology. The teliospore stage of the former may develop on Thalictrum L., a weed of the Ranunculae family, a local, East Siberian species, and Isopyrum L., a weed of the same family. The summer stage appears on wheat in the form of oval or round brown pustules, disorderly spread on the leaf lamina. Teliospores (wintering stage) have pustules of darker color.

The parasite winters primarily as uredo-mycelium on winter crops, infested in the fall by uredospores. In the spring the latter develop on infested winter wheat and carry the infection over to spring crops. In a similar cycle of development, neither teliospores, nor the aecio stage are of significance; consequently the host, Thalictrum L., also does not play any role. The development of the East-Siberian form of rust takes place, however, with the participation of Isopyrum L. This form depends upon teliospores, as the wintering stage, which is preserved on residue.

Brown rust of wheat belongs to the most injurious species of rust. The disease is the result of thinned plantings of winter wheat which occur because stalks infested in the fall winter poorly and are destroyed.

By infesting wheat at an early stage, brown rust is responsible for a considerable reduction in yield. Thus when wheat is completely infested during the tillering stage, the yield suffers considerably. If infested at the blooming stage losses are smaller. Brown rust is widely spread but causes especially large losses in southern regions. In considering the characteristics of the development of this disease, it is necessary to point to basic agricultural measures which protect winter wheat plantings from infestation;

these are: Early disking, followed by fall plowing. Resistant varieties are important in controlling brown rust.

YELLOW RUST: it's inducer: Puccinia glumarum Er. et Henn. It has specialized forms adapted to wheat, rye, barley.

This rust develops in early spring until late fall and injures every above ground part of plants; foliage, stems, parts of stalks, occasionally grain. The spring stage of yellow rust has not been established; uredo and teliospores develop on the crops. Uredospores appear in the form of very small, lemon-yellow pustules, distributed in elongated rows. Chlorotic spots frequently appear on leaves in infested places.

Teliospores are black pustules covered by an epidermis; they are distributed in long rows; winter on winter plantings in the form of uredomycelium in the tissue of plants. Uredospores may also winter on grain. In the spring uredospores develop on infested winter plants and subsequently cause mass infestation of winter and spring crops. High humidity and temperatures between 13 and 16° contribute to the development and spread of yellow rust.

Yellow rust has a limited area of distribution. It is found on wheat in the Crimea, the mountainous regions of Northern Caucasus and Central Asia, and several regions of Southern Altai. The disease also appears in Leningrad and Moscow, as well as other oblast(s) of the non-black earth belt.

Methods for controlling yellow rust are the same as those applied for brown rust of wheat.

CROWN RUST OF OATS. It's inducer: Puccinia coronifera Kleb.

Foliage and sheath are affected. The aecio stage of the parasite develops on an intermediate host buckthorn, [Rhamnus cathartica L.] from which it transfers to oats. The summer stage appears in the form of elongated or round orange pustules, surrounded usually by light green tissue. Towards the end of summer, black pustules, covered by leaf epidermis, replaces them. Piles of teliospores usually form a ring or half a ring around the injured tissue. Teliospores have characteristic outgrowths in their upper cell, which led to the designation "crown rust". Teliospores are preserved on stubble and hay. In the spring they infest the intermediate host, buckthorn, on which the aecie stage develops. In Northern Caucasus, Rhamnus pallasii serves as an intermediate host. Crown rust appears on oats late, after blooming, which is primarily due to the circumstance that this species of rust invariably passes through a host plant, where it develops during one and a half to two months. The species is not infrequently found also on "ovsuig", oat-weed, [Avena fatua L.]

Crown rust is widely spread and of particular significance in the forest-steppe zone where the development of rust is stimulated by brushwood (weeds) acting as intermediary host, and favorable meteorological conditions (high temperature and precipitation). Its damage is limited to loss in yields, the increase in the "plenchatost' " of oats, and reduced absolute weight of grain. Principal methods of control are: Removal and destruction of residue of infested plants; destruction of intermediary host; proper choice of planting periods; resistant varieties.

BROWN RUST OF RYE.

Infests foliage and leaf sheaths; infestation lasts throughout the vegetation period. Inducer is the parasite Puccinia dispersa Eriks., which develops chiefly in the uredospore stage. Clumps of uredospores appear as brown pustules dispersed in disorder along the tissue. Towards the end of vegetation black pustules appear in places of infection, covered by epidermis. These are teliospores. Their main mass develops in the fall and basidiospores developed from them immediately infest the plant hosts, ox-tongue of the family [Boraginaceae], and the weeds of the family [Anchusa L. and Lycopsis L.]. The aecio-stage which develops on the host in the fall does not affect the spread of rust. Brown rust of rye usually develops on them and both uredo-mycelium and uredospores winter. In the spring, rust spreads through uredospores. Thus brown rust of rye is biologically close to brown rust of wheat. Control is therefore the same for both.

DWARF RUST OF BARLEY.

Injures foliage and leaf sheath. Small light yellow pustules of the uredospores of the parasite Puccinia anomala (simplex) Rostr. are formed in the above parts of plants. In contrast to yellow rust, which is also found on barley, pustules of this species are dispersed in disorder. Uredospores are gradually replaced by dark heaps of teliospores, covered by epidermis. The latter are frequently unicellular and of irregular shape. Aeciospores develop on the intermediate host [Ornithogalum L.] of the Liliaceae family. This species of rust can develop without a host as well, since uredospores and uredo-mycelium winter on winter plantings.

Dwarf rust is chiefly spread in southern zones, and regions of winter barley. Control is basically the same as for brown rust of wheat. Wherever possible, intermediate hosts should be destroyed.

COMPLEX OF MEASURES FOR CONTROLLING RUST OF CEREAL CROPS.

Of major importance are agro-technical and economic measures, the introduction of resistant varieties and destruction of intermediate hosts. AMONG AGRO-TECHNICAL MEASURES, those methods aiding in the destruction of foci of infection are the most important, i.e., infested stubble and self-sown grain. Many species of rust winter on stubble, while self-sown plants on which rust may develop from the time of harvesting to the germination of winter crops, represent danger to the latter, serving in a form of intermediate host. In order to prevent self-sowing, harvests have to be removed promptly and carefully. To destroy self-sown plants and stubble, early soil cultivation is necessary, along with disking, followed by deep fall plowing. Disking should take place prior to germination of winter crops, to preserve plantings from rust which may transfer from self-sown plants. This measure is of particular significance for brown and yellow rust of wheat which winter on winter crops. Complete destruction of self-sown plants and post-harvest residue is attained by deep fall plowing. Many agro-technical methods are based on ecological conditions, such as increase in plant resistance, and are carried out in order to reduce the damage caused by rust. Periods of planting, primary fertilizers, additional feedings, vernalization, weed control, etc., are all significant in this connection.

Early and vernalized plantings of spring crops are less injured by rust, since they go through the early phases of development under conditions unfavorable to rust. Different species of fertilizers, especially potassium-phosphates or complete mineral fertilizers increase plant resistance to rust. AMONG ORGANIZATIONAL-ECONOMIC MEASURES, grass crop rotation and sensible distribution of fields in crop rotation are most important. Grass crop rotation results in healthier crops and reduces the amount of infestation in fields. Since every farm usually has plantings of spring and winter wheats, these should not be allowed to adjoin each other; winter wheat usually serves as a focus for rust from which infection may spread to summer crops.

The introduction into industry of rust-resistant varieties is a most effective manner for controlling rust. At present large areas are planted with resistant varieties. Among these are: the wheat Novo-Ukrainka 83 (brown and yellow rust), Krasnodarka (brown rust), Odessa 13 (brown and stem rust), Lesostepka 74 (brown), Lesostepka 75 (brown and stem) Lutescens 17

(Ukraine, all species of rust), Garnet, Gordeiform 10, 189, etc.; among barley, Odessa 9(stem rust), Odessa 14 (dwarf rust); among oats - Verkhneiacheskii 53 (crown and stem rusts), Sovietskii (crown and stem rusts), Moskovskii A-315 (crown and stem rusts); among rye - Viatka (stem and brown rusts).

The destruction of intermediate hosts represents one of the major methods in the control of stem, dwarf and crown rusts. Shrubs (barberry and buckthorn) are dug up and destroyed by an application of common salt or arsenic preparations. Salt is introduced in the amount of 2-8 kg, under the plant, depending upon the size of the shrub. Chemical substances are applied in early spring when plants are greedily absorbing all soil solutions.

ERGOT.

Injures the majority of cultivated and wild growing crops, particularly rye. This disease appears on stalks or in the panicle in the form of black horns, replacing grain. The horns are sclerotia, in the dormant stage of the fungus Claviceps purpuree Tul. During harvesting the greater part of sclerotia drops and winters in the soil. One part remains with the grain and during planting penetrates the soil. In the spring wintered sclerotia develop in the soil, form fruiting bodies in the shape of violet heads on legs. These heads contain large quantities of bags of spores. By the time rye is in bloom, the spores are ripe and spread by the wind. Upon falling onto a flowering plant, the spores grow and cause infestation; two to five stalklets are usually affected in each stalk. The first symptoms of the disease are observed during blooming. The conidial stage of the parasite develops in infested stalks and simultaneously a sticky secretion, the so-called "honey-dew", is revealed. Insects, attracted by this liquid transport it along with spores onto healthy plants and thus spread the infection. Ergot may also be spread by wind and rain. Mycelium develops in infested spikelets, fills the ovary and gradually changes into a black horn. Horns may vary in shape and size and occasionally are larger then grain. Mass development of ergot on cereals is aided by high humidity in the period preceding blooming and throughout it, when sclerotia develops and infests plants. The duration of the blooming stage also affects the percentage of infestation by ergot. In years of rainy and cloudy summers, ergot causes severe losses.

Ergot is spread all over, especially in humid regions. It may develop steadily and severely in locations of high precipitation in the spring and during early summer. Among these are Leningrad, Smolensk, Kalinin, Ivanov, Arkhangel'sk, Yaroslavl' and Kirov oblast(s), the Karelian-Finnish SSR, White Russian SSR and Udmurt ASSR. Occasionally ergot is also observed in Vologda, Gorkii, Sverdlovsk and other central oblast(s), and in the Tartar ASSR. Ergot is seldom found in the Ukraine and the majority of central oblast(s).

Ergot impairs yields of cereal crops because in addition to horns, forming in place of grain, the latter remains undeveloped in the rest of spikelets of an infested stalk. The main loss consists however, in the mixture of poisonous substances in flour and the resulting danger of poisoning man or animals. Poisoning by ergot is accompanied by convulsions, dizziness and vomiting; the disease is called "zlaia korcha", "holy fire". Seed grain of the first grade does not admit horns, while for the second grade 0.05 per cent is permissable.

METHODS OF CONTROL.

1. Cleansing of grain of horns of ergot with the aid of fans, "triers", and complicated grain cleaning machinery. A special method of cleaning grain of ergot consists in dipping it in a solution of sodium chloride or potassium chloride of 20-30 per cent. Horns float onto the surface of the

solution and are removed. In order not to affect grain germination, it should be rinsed afterwards in clear water and dried. Ergot horns are widely used in medical practice and manufactured for this purpose.

2. Planting of clean varietal seeds in condensed periods, in order to avoid a prolonged blooming period and thereby reduce the percentage of ergot.
3. Timely removal of yields, since in delayed harvesting horns drop and the soil is contaminated. Since ergot is concentrated along boundaries of fields, grain has to be gathered separately and yields stored away from boundaries.
4. Disking and subsequent deep fall plowing following harvesting. In this manner horns penetrate into a considerable depth and are no longer able to develop fruiting bodies; infestation is therefore not possible.
5. Weed destruction from which ergot may transfer to rye.

"P'IANYI KHLEB", "drunken bread"; this is applied to infested grain which develops stupefying properties and poisons men and animals. This disease is most frequently found to affect wheat, occasionally rye, oats and barley. In the ripening stage rose-red or pale-rose films appear on scales of spikelets, and even on the grain itself. This disease is caused by fungi of the genus Fusarium, chiefly F. graminearum Schw. Mycelium penetrates into the ovary; the infested grain remains undeveloped, gets sickly, germination is lowered. Mycelium develops in other parts of the plant as well, but does not show on the surface. A light colored film on infested grain represents mycelium and the conidial spore bearing of the parasite. These fungi are characterized by scythe-like multi-cellular conidia. Occasionally the "bag" stage develops on infested spikes in the form of dark colored spots. Infestation of grain may take place during storing if humidity is high. Here the danger is even greater than in the field, the grain may completely lose its capacity for germination. The disease is transferred ~~with~~ by infested seeds and through the soil; infection is retained on residue of infested plants. Humid and warm weather (above 70°) contributes to the development of the disease, although low temperature (3-4°) does not interfere with the development of the parasite.

The disease is chiefly spread in the Far East and is also found in Western, North-western and other regions.

METHODS OF CONTROL.

Among the basic principal measures for controlling "drunken bread" are the production of healthy seeds and the creation of conditions preventing plant contamination.

1. Timely removal of harvests, its rapid threshing; careful drying and storing at normal humidity (12-14°) to prevent infestation.
2. Cleaning and segregating seeds to eliminate diseased and sickly grain. Disinfestation of grain is done thermically and chemically. Seed stock is heated in hot water in the same manner as in the control of loose smut of wheat. For chemical disinfection of seeds sulphur preparations NIUIF-1 and NIUIF-2 (Granosan) are applied. The preparation NIUIF-1 is used in a concentration of 0.25 per cent; saturation is done for 15 minutes. One ton per 100 l. of solution is used. Granosan is applied in a dosage of 2 kg/t of seeds. In cases of severe infestation, food grain is also subjected to heating by dry heat at 80°.
3. Destruction of stubble and various residue in order to reduce the degree of infestation in the soil; deep fall plowing.
4. Grass crop rotation; wheat and other crops should not succeed cereals infested by fusarium.

5. Introduction of potassium and phosphorus fertilizers which accelerate growth and ripening of plants, thereby reducing infestation by fusarium.
6. Early periods of planting summer crops.

SNOW MOLD is a disease known under this designation which affects winter wheat and rye. It appears in early spring following snow thawing on shoots of winter crops in the form of delicate weblike film of grey or white color. Leaves acquire a rose tint. Infested plants rot or dry out, the fields carry bare spots. Rose pustules form on decayed plants or individual leaves, which represent the conidial spore bearing of the parasite Fusarium nivale Ces.

During the vegetation period conidia may infest seeds. If infestation penetrates into unripe grain, especially prior to its forming, germination of seed stock is seriously impaired. The disease is distributed by infested seeds. A considerable part of the infection remains on decayed plants and in the soil.

This disease is found in regions of the non-black earth zone where high humidity and acidity of the soil contribute to its development. Meteorological conditions in the fall and winter determine the development of the disease in the spring. In instances of prolonged warm autumns when snow falls upon thawed soil, or following high precipitation during the winter, conditions for the wintering of plants are unfavorable and weakened and depressed plants are infested by fusarium.

METHODS OF CONTROL:

Agro-technical measures are chiefly applied to control snow mold to improve conditions and increase the plant's resistance to infestation.

1. Grass crop rotation with fall plowing and pre-planting cultivation of the soil.
2. Introduction of organic and mineral fertilizers; early spring harrowing

and additional feeding of winter crops.

3. Cleansing, segregating and treatment of seeds (see "drunken bread").
4. Introduction of measures in early spring designed to speed thaw of snow (plowing, distribution of peat over the surface of snow in places of mass accumulation, etc.)

HELMINTOSPORIOSE are diseases known under this designation and caused by fungi of the genus Helminthosporium sativum P.K. et B. affects wheat; it is characterized by dark colored multi-cellular spores. Various forms of the disease are known: root rot, brown spot of leaves, black germ of grain, etc. When infested, the seeds loose their capacity for germination and if they develop, the plants are weak and decay in a short time. Infestation of seeds takes place during blooming and the succeeding period of grain formation. The focus of root and forage infestation is in the soil and residue from infested plants.

On barley, helminthosporium appears in the form of striped spottiness on leaves and leaf sheaths, less frequently on parts of stalks. Elongated spots are formed on infected tissue. At first they are brown, then their centers gradually lightens, while the borders remain dark in color. The infested leaf lanina is torn into several narrow stripes, the tissue dies, assimilation is reduced, affecting the development of the entire plant. Infested plants appear depressed; stalks remain undeveloped, grain is sickly and of low germination, and when severely infested, plants do not tiller at all. Grain may also be infested directly during the ripening.

Striped spottiness is caused by Helminthosporium gramineum. Spore bearing, as a dark film, is formed on various infested parts. This film consists of unbranched dark colored conidia bearers, filled with large conidia of lateral partitions. Mycelium and conidia winter on seeds and their surfaces and on infested residue of plants in the soil.

Various helminthosporium affect weakened plants for the most part. The disease is therefore strongly developed on soils poorly cultivated and fertilized; unfavorable ecological conditions, specifically low soil temperatures (10-12°) excessive humidity and increased acidity of the soil are other contributing factors.

METHODS OF CONTROL:

1. Of decisive significance are agro-technical measures: disking, deep fall plowing, good soil cultivation before planting, application of complete fertilizers; high quality seed stock.
2. Cleaning and segregation (processing) of seeds.
3. Treatment of seeds with chemicals (NIUIF-1, NIUIF-2) or thermically, as against loose smut of barley.

SCLEROTINIA.

This parasite develops only on winter crops and causes spring destruction of shoots. The disease is apparent on shoots of winter crops in the early spring, immediately following snow removal. Infested plants are covered with a grey cottonlike film. Foliage and stems decay, the plants get brown and dry out. Foci of destroyed plants form in the fields. With the beginning of the warm weather the disease stops; one part of the infested plants survives and continues to develop, occasionally even forming spikes. The inducer: Sclerotinia graminearum Elenev, is a bag-like fungus of the order discomyces. In the spring sclerotia form on infested plants in large numbers aside from mycelium. They may form on stems and leaves. In the summer the development of sclerotia stops. In the fall they resume their growth and produce the bag stage, apothecium. Ascospores infest all shoots of winter crops in the fall, but the symptoms of the disease become apparent only in the spring.

Thus the parasites winter on the plants and undeveloped sclerotia may be retained throughout the winter in the soil. The disease develops strongly on humid, acid soils of low temperatures (1.2-12°). It is spread in the northern-eastern part of the non-black earth belt and is observed at Kirov, Vologda, Molotov oblast(s), Udmurt, Mariisk and Bashkir ASSR, and in the northern regions of Gorkii oblast'.

METHODS OF CONTROL:

1. Drainage and liming of severely moist and acid soils.
2. Early and deep fall plowing of fields, especially those infested by sclerotia. This measure interferes with the growth of sclerotia and prevents infestation of winter crops.
3. Good cultivation of the soil prior to planting.
4. Introduction of complete amounts of manure and other organic fertilizers (compost, green lupines) to ensure the normal development of plants and reduce their degree of infestation.
5. Spring harrowing and additional nitrogen feeding of winter crops in early spring.
6. Repeated plowing in the spring, of fields where winter crops had perished and their planting under summer crops since these are not affected by sclerotia.
7. Selection of frost resistant varieties of winter wheat and rye. These varieties are equally resistant to sclerotia.

AMF End of Section.
August 23, 1951.

Briantsev, V. A.
Zashchita rastenii ot vreditelei i boleznei (Protection of plants from pests and diseases) Ed. 3. Moskva, 1950. 640 p. 464.4 B76 Ed. 3

Transl. 180a: Plant Protection

Translated in part from the Russian by S. F. Monson

CHAPTER SEVEN

PESTS AND DISEASES OF TECHNICAL CROPS. (p. 342-429)

PESTS AND DISEASES OF COTTON PLANTS. (p. 342-358)

Among multi-poisonous insects injurious to cotton are primarily locusts, [Acridodea]; ballworms [Chloridea obsoleta F.]; [Laphygma exigua Hb.]; sugar beet webworms [Loxostege sticticalis L.]; cutworm moths, [Agrotis segetum, Schiff], and other chewing insects; wireworms and [Tenebrionidae]. The specific cotton pests are aphids and red spiders. Among the most dangerous diseases are gummosis, wilt and leaf roll.

PESTS OF COTTON PLANTS

COTTON APHID (or leguminous aphid), [Doralis frangulae Kalt.]

Injures cotton, legumes and other crops.

The wingless females are green; head, center and back black; legs yellow with black tips; length 2 mm.

This pest is widely spread, injurious to cotton chiefly in old cotton regions; the wingless females and larvae frequently winter; develop on weeds in the spring. The first generations produce wingless females and only subsequent ones produce winged migratory females which attack cotton and other crops.

The female produces 40 to 60 larvae and forms colonies of aphids on foliage. The cycle of development of one generation is completed in 15 to 20 days. An entire vegetation period produces 15 to 20 generations. Median moisture and relatively moderate heat contribute to aphid development. During the summer months (July-August), the number of aphids is therefore reduced, compared to spring months, and only in September are favorable conditions for mass propagation again available. In addition, the summer produces many lady beetles which destroy aphids. When the cotton plant reaches maturity, aphids transfer their activity to weeds where they winter under lower leaves of plants. The pest propagates exclusively by parthenogenetic method.

Aphids feed on foliage sucking its juice. The injuries they cause in the spring produce leaf roll and the foliage dries out. Beginning July, when quantities are smaller, injured plants usually recuperate if given proper care.

In the fall the pest injures cotton plants not so much by sucking juices as by contaminating fibers with liquid, sugar-like excrements. Soiled fibers stick and lend themselves poorly to processing, reducing the quality of output. This contamination is called "white shira." Saprophytes (fungi) may settle on contaminated, soiled fiber and cause "black shira."

METHODS OF CONTROL.

1. Weed control;

2. Destruction of aphids by contact poisons. In spraying solutions of anabasine-sulfate (1 liter of water 0.5 gram of 25 o/o preparation) or nicotine-sulfate (1 liter of water of 0.4 gram of 40 o/o preparation). The expenditure is 750 to 3000 liters per hectare, depending upon the stage of cotton development.

Dusting is done by anabadust (3 o/o) or nicodust (2 o/o), in the proportion of 50 to 60 kg. per hectare in irrigated areas and 20 kg. per hectare in non-irrigated. When cotton balls form, spraying is not permissible since it may spoil the fibers.

3. All agro-technical measures (fall plowing, fertilization, irrigation, etc.), which ensure better growth and plant development in the spring, reduce injury caused by spring generations of aphids.

4. Plantings of legumes on which aphids propagate profusely should be removed from cotton plantations.

In addition to the cotton aphid, other species of aphids also injure cotton plants.

RED SPIDER, [Epitetranychus urticae Hanst.], one of the most dangerous cotton pests belongs to the order of spiders.

This is a small spider; it has an "undivided" body and 4 legs; color green-yellow in the fall and orange-red in early spring. On both sides of belly are black transparent points; eyes carmine-red; length 0.25 to 0.45 mm. Larvae 6-legged, green-yellow, nymphs 8-legged and distinguished from adults by smaller size.

The red spider belongs to the multi-poisonous pests, capable of feeding on many plants of various genera, except cereals. Feeds also on woody genera, such as peach trees, mulberry and nut trees. Injurious in high degree to cotton, legumes, cucumbers and soya.

Distributed in all regions where cotton is planted. Particularly harmful in old cotton growing regions of Central Asia and TransCaucasia.

Appears in the spring at temperatures of 12 to 13°. At first feeds in wintering abode, usually on weeds, waste lands, along roadsides, reservoirs, boundaries. From weeds transfers to crops when adjacent to the latter, may be carried by wind, or water from reservoirs, if the latter contain weeds. Mulberry and other trees, if grown in immediate proximity to cotton or along reservoirs may serve as foci of infestation.

The red spider assembles first on weeds and settles next on cotton plants. Its most intensive settlement on cotton takes place in July and August when all wild vegetation is burned. It settles on the lower part of leaves and covers them with a thin film. The foliage acquires a marble coloring and on some varieties of cotton the injured tissue gets red. The injured leaves dry and fall off.

During the vegetative period, 12 to 15 generations of red spiders may develop, depending upon meteorological conditions. The development from egg to adult stage is completed in 10 to 23 days. Transformation of red spiders is complicated and accompanied by lengthy periods of dormancy prior to every stage of development. Females pass through the following stages: eggs, larvae, nymphs, deuto-nymphs and adult spider. The cycle of male development lacks the deuto-nymphs stage.

Adult red spiders live 18 to 35 days. During that time females lay an average of 140 to 180 eggs. The eggs are laid on leaves where all remaining stages take place. The number of spiders on cotton increases up to August, and beginning September is reduced because of unfavorable weather conditions. In September and October the spider goes wintering, crawls into the earth, fallen leaves and other post-harvesting residue.

It is the fertilized females which winter and this explains the appearance of pests in early spring; males and nymphs winter in insignificant quantities, while larvae perish altogether.

The development and propagation of red spiders depend upon temperature, moisture, and availability of forage plants.

Optimal temperature is 29 to 31°, the rapidity of its development then being maximal; eggs develop into adult spiders in 7.5 to 9 days;

mortality is relatively small. Fertility of females is highest at this temperature.

Optimal moisture varies between 35 to 55 o/o; at this degree development is best, fertility highest and mortality among specimens lowest. High moisture (humidity) depresses development and propagation of red spiders.

Food has equally its effect upon the life and fertility of pests. Fertility varies, not only depending upon different species of forage plants, but even the latter's varietal characteristics. Thus in feeding on American cotton varieties, a red spider will lay an average of 107 to 158 eggs; on Egyptian cotton the number is considerably lower, only 24 to 61 eggs. In addition, the spider lives much longer on American cotton than on Egyptian.

Because of loss in injured foliage, plants lack a sufficient amount of nutritious elements for the production of generative organs, and loss and malformation of balls takes place. The degree of injury depends upon the condition of plant and variety, as well as upon the degree and time of its infestation.

Under poor agricultural care, growth is retarded and loss in yields higher among diseased than normal plants. American cotton varieties are more susceptible to injuries than Egyptian varieties. If infestation is early, (May - June), cotton yields are reduced further than if infestation is late, (July - August). The highest degree of injury caused by red spiders is felt in years of mass propagation.

METHODS OF CONTROL. Red spider is controlled by agricultural techniques and chemical measures, among which are the following:

1. Harvesting and burning for fuel of post-harvesting residue and subsequent deep plowing. In this case all weeds and different wastes are

plowed under, to prevent the pest from wintering on them.

2. Destruction of weeds in the spring on boundaries, reservoirs and wastelands adjoining cotton plantations. Weeds are cut off for this purpose, gathered in heaps and burned. It is advisable to spray the weeds before with soapy alkali (0.4 o/o) in order to destroy the pests.

3. Careful weeding on plantations to prevent the spider from accumulating on plots.

4. If mulberry and other trees adjoin cotton plantations, fallen leaves should be gathered and burned in the fall and early spring and prior to budding trees sprayed with the preparation ISO (0.5 o/o), solar oil (1 o/o), or soapy alkali (0.4 o/o).

5. Grass crop rotation and the entire scale of agricultural techniques (fertilization, irrigation, etc.) are essential for growing healthy, vigorous plants, since the red spider primarily affects weak plants.

6. Destruction by chemicals.

a) Dusting with ground sulfur in the proportion of 10 to 30 kg. per hectare, with double quantity of pulverized diluents (talcum, sifted road dust, etc.) or sulfur concentrate in the proportion of 30 to 75 kg. per hectare; increased dosages are used for dusting cotton in later phases of development.

b) Dusting with ISO (lime-sulfur decoction) of a strength of 0.5°,
Boshme
according to Bome, and at rate of 750 to 3000 liters per hectare.

b) If sulfur is lacking, spraying with soapy alkali (0.4 o/o) is substituted.

If aviation method is used, dusting with mixture of ground sulfur with pulverized lime (3:1), at the rate of 20 kg. per hectare.

Chemical control should be used as soon as the red spider appears;

repeated treatment is applied depending upon re-appearance.

In order to destroy all sucking pests (red spiders, aphids and thrips) on cotton, sulfur-alkaloid solutions and dusts are simultaneously applied.

Sulfur-alkaloid solutions are prepared from solutions ISO and anabasine or nicotine-sulfate. For 10 liter of ISO, of a strength of 0.5°, 5 grams of 25 o/o anabasine-sulfate are added by constant mixing, or 4 g. of 40 o/o nicotine-sulfate; or for 10 liter of ISO of 1°, an equal amount of anabasine-sulfate solution or nicotine-sulfate. The former is soluble in water at rate of 1 g. to one liter, the other 0.7 g. to one liter. Sulfur alkaloid solutions are used at the rate of 750 to 3000 liters per hectare.

Among "organizational-economic" measures, the following are of consequence: destruction of boundaries and enlargement of fields; removal of cotton plantations from leguminous plantings; destruction of wastelands close to fields.

PINK BALL WORM, [Pectinophora gossypiella Saud.].

There are cotton worms in other countries that cannot be found in the USSR. Among these are the pink ballworm which causes great damage to cotton in many countries. It has been established that pink ballworm is spread by seed stock and raw material. Quarantine measures are introduced to prevent the penetration of the pest.

The pink ballworm is the caterpillar of the cotton moth, a small butterfly of grey-brown color; the caterpillar is colored pink to meat-red.

At present this pest is spread in Egypt, America, some countries in Asia, Australia, and many islands in the Pacific and Atlantic Oceans.

It is also found in southern Turkey. Special vigilance is required to prevent its penetration into the USSR.

Its development proceeds in the following manner: in the spring the butterflies fly out and lay eggs on different parts of the cotton plant.

The caterpillars chew the buds and eat their content. The injured buds wilt and produce ugly flowers. Later, caterpillars penetrate into the cotton balls where they feed on the unripe fibers and seeds.

Caterpillars braid cocoons in seeds; the latter are then joined by a web. Caterpillars, when in a dormant state, can stay in seeds for 2-1/2 days, which is significant for the spread of the pest.

PRINCIPAL QUARANTINE MEASURES.

1. Every imported cotton fiber is directed through definite points where bales are examined, fumigation is compulsory and the destination and route of the freight are designated.

2. Import of seeds of cotton plants and other Malvaceae and Indian hemp, [Apocynum cannabinum] are allowed only by special permission of the Quarantine Service of the Ministry of Agriculture, Department of Agricultural Plants. Imported seeds are subjected to careful examination (analysis) and fumigation.

3. The Quarantine Service of Agricultural Plants examines residues of cotton, which arrive from quarantine sections of the USSR at special plants which process raw material.

DISEASES OF COTTON PLANTS

GUMMOSIS OF COTTON. Bacterial disease; affects the plant during the entire vegetation period, appearing in various forms. The first symptoms of gummosis are observed on the second and third day after germination on cotyledons in the form of oily dark green spots of round or elongated shape. When base of cotyledons is injured, the disease is transferred to the petiole and stem.

Gummosis produces oily dark green spots on foliage, bordered by veins; this accounts for the name of the disease "edgy spottiness of leaves." The spots are frequently elongated, appearing like leaks distributed along veinlets. This represents non-developed lamina. It affects leaves throughout the vegetation period. The injured cotyledons and foliage are covered with sticky excretions which later dry out and appear like grey films. The cotyledons and foliage get brown and dry out.

The most dangerous form, "stem gummosis" appears on stems during the budding stage. The disease usually begins between infested petioles, leaves and stem. At first, oily dark spots or leaks appear; they gradually grow and cover the entire stem. Injured stems and branches become thin and brown, yellow resin exudes from the tissue and congeals in drops and films. The stem is frequently misshapen, breaks at the infected spot and the plant perishes. When the upper part of the stem is infected, there is no break, but the plant is dwarfed, retarded in growth, frequently does not produce buds and ovaries, and occasionally perishes. The disease stops at the blooming stage; injured spots cicatrize and leave only dark strips. Gummosis subsequently appears on balls and fiber. On balls it forms typical spots or ulcers which exude resin. When balls are severely infected, they become deformed and do not open when ripe or open only in part. The fiber is sticky, brown and decays. The infection spreads from fiber to seeds. There are instances of bacteria penetrating from the calyx to seeds.

The inducer of gummosis is the Bacterium malvacearum E. F. Sm. Bacteria are preserved in seeds, primarily on their epidermis, the raw cotton wool and post-harvested, non-decayed residue of diseased plants. Rain plays an important role in distributing the disease during the vegetation period. Wind also spreads bacteria. Insects equally contribute to the spread of infection since they not only transfer bacteria mechanically but by causing injuries contribute to the latters' penetration into the plant. The most common manner in which bacteria penetrate into tissue is through apertures.

Meteorological conditions influence the development of gummosis. Rain, dew and moisture of the air (above 70 o/o) contribute to the spread of disease and infection of plants. The influence of temperature is less noticeable since the inducer of gummosis is highly resistant to high temperature (80 to 85° in dry surroundings) and low winter minimums. Optimal temperature for infection is 35 to 36°.

Gummosis injures all varieties of cotton, especially the Egyptian varieties. The group of Sea Island varieties (Egyptian cotton) is, however, resistant to the disease.

The disease has a wide distribution; is found in all cotton growing regions. Its harm is greatest in regions of adequate precipitation in the first part of the summer. Among such regions are the south of Tadzhikistan, Tashkent oasis, Southern Kazakhstah, eastern Azerbaidjan, Northern Caucasus, Ukrainian SSR. All forms of gummosis are observed in these regions. In many sections of the Ukraine, Crimea and Trans

Caucasia, where the foliage form of gummosis prevails, losses from this disease are smaller compared to the regions of the first group. Development is light in the majority of regions of Central Asia.

METHODS OF CONTROL. Control is conducted by applying special measures approved by the Ministry of Agriculture of the USSR.

This system applies chemical methods of control and agricultural techniques intended primarily towards making seed stocks more healthful. The principal measures consist in:

1. Mordant treatment of seeds. Formaline, which is chiefly used, is taken in the proportion of 1:90, i. e., one part of 40 o/o formaline to 90 parts of water. The solution, 35 to 40 liters, is applied to one centner of American varieties (pubescent seeds); Egyptian varieties (non-pubescent seeds) require 25 to 30 liters. The expenditure of formaline is 2.5 to 4.0 kg. per ton. Formaline is applied manually (from barrels) or by the machine PUM-1. Seeds are kept in the solution for 10 minutes, are softened for 3 hours and then dried. Tare (packaging) is also disinfected. Soaking of seeds in formaline, if done by machine, also lasts three hours.

Strongly pubescent seeds treated with formaline are passed through the machine twice, to provide ample soaking.

In order to destroy all external and possible internal infection, seeds at cotton refineries are treated by fumigation or sulfuric acid. The formerrmethod was developed at the Ukrainian experimental cotton station. It consists in treating seeds with formaline vapors after preliminary heating at high temperature. Seeds are placed in a drum (cylinder), heated and kept for 5 minutes at 70°. They are then treated by formaline vapors in the same drum for 7 minutes. The seeds are next transferred to other quarters and left for 24 hours to soften.

The sulfur acid method consists in treating seeds first with sulfur acid in a "linting" machine and rinsing in water afterwards. The chemical destroys the pubescence of seeds completely. Moist seeds are next treated with a formaline solution in the machine PUM. Seeds are fumigated in a special drying machine at a temperature of 160 to 190°.

2. The introduction of resistant varieties. Under Azerbaidjan conditions the most resistant varieties are Nos. 2966-1, 4768-1, Az 68, Az29, M-78, etc.

3. Separate harvesting, storing and cleaning of raw cotton, gathered from plots severely infested with gummosis.

4. Prohibit the use for planting of seeds from plots infested by the ball form of gummosis; such seeds undergo technical treatment.

5. Careful gathering of all post-harvest residues (guz-pai) in the fields and their subsequent use for fuel. Storing of residue in specially designated places, away from locations where seeds were treated and stores of agricultural implements.

6. Deep fall plowing of plots destined for planting cotton.

7. Winter irrigation of plots in irrigated regions in order to produce a more rapid decay of residue with the resulting destruction of the inducer of gummosis.

8. Removal of diseased plants (with infested cotyledons) in "breaking through" cotton plantings.

9. Prompt removal of plants destroyed by gummosis beyond the boundaries of plots and their burial no less than 20 cm. deep.

10. Introduction of mineral nitrogen fertilizers which increase plant resistance to gummosis; additional feeding.

11. Introduction of grass field crop rotation and utilization of best predecessors; not to tolerate planting of cotton after cotton; non-observance of this rule severely increases infestation of cotton by the cotyledon form of gummosis.

12. Introduction of sanitary-hygienic measures at cotton refineries and warehouses.

VERTICILLIUM WILT (TRACHEOMICOSE) OF COTTON appears on adult plants, particularly on lower leaves, gradually spreading to upper. Along leaf borders and between veinlets appear light green, later yellowing, diffuse spots; the normal green color is preserved only in stripes along veinlets. The infested tissue gets brown, the leaves dry and fall off. Occasionally, a defoliated plant will produce new leaves. Towards the end of vegetation a severe form of disease is occasionally observed, which causes the plant to wilt within 2 to 3 days and to perish without any trace of leaf yellowing.

A characteristic trait of wilt is "browning" of the woody part of the stem, easily distinguished on the cut of the lower part of the stem. The start of the dise se usually coincides with the end of budding and early blooming period. Towards the end of vegetation, the disease strengthens, reaching its maximum development in September. It affects primarily American cotton.

The inducer of the disease, Verticillium dahliae Kleb. This parasite belongs to the imperfect fungi of the sub-group hyphomycetes. V. dahliae is a soil organism. The fungus penetrates into the plant through the roots and its mycelium develops in the vascular system of the plant. Sometimes small irregularly shaped micro-sclerotia form on the decayed parts of the plant (stem and leaves), as well as on the folds of the cotton balls. Conidial spore-bearing does not take place under natural conditions. In pure culture, however, (when the infested tissue is planted), the fungus quickly produces spores. They consist of branched conidiophores and small cylindrical uni-cellular colorless spores distributed singly on conidiophores.

V. dahliae is a non-specialized parasite which infests up to 135 species of various plants of some 38 genera. Among cultivated plants, this organism infests, aside from cotton, sunflower, potatoes and other crops, also many weeds. Among non-susceptible crops are cereals and alfalfa. Practically resistant are the Egyptian varieties of cotton, while the majority of American cotton varieties get severely infested.

Mycelium and micro-sclerotia are preserved directly in the soil and the residue of plants. The transmittance of infestation through seeds is possible, although it has no practical significance since the frequency of seed infestation amounts to ten thousand of one per cent.

The presence of injuries of the root system, particularly injuries caused by nematodes carry significance in plant infection. Temperature, moisture of the air and soil conditions affect disease. Increased moisture of the soil contributes to disease development. At a high temperature of soil and strong sunlight, diseases are more pronounced and the plant withers rapidly. As to types of soils, greater development of disease is observed on light, sandy and clayey soils.

The reaction of the parasite upon the plant is basically mechanical. By filling the vascular system, the mycelium of the fungus obstructs the proper water supply to individual parts of the plant, as a result of which the leaves wilt. Infection also causes the tissue to die under the reaction of toxic excretions of the fungus.

Cotton wilt is spread all over, in all cotton raising countries, particularly in Central Asia.

Wilt belongs to the most injurious diseases of cotton. By causing premature death and falling of leaves, the disease reflects upon the quantity and quality of yield.

METHODS OF CONTROL. Measures designed to reduce soil infection and replacement by resistant varieties are among the most effective. Among practical measures we list the following:

1. Grass field crop rotation of plantings with alfalfa, as a crop resistant to wilt. Planting of alfalfa is recommended before any other on severely infested plots.

2. Careful gathering of all residue from fields, particular attention to be given the extraction of roots. All residue should be immediately removed from plots.

3. Deep fall plowing.

4. Regular weed control not only on cotton plantings but on boundaries and roadsides, as well.

5. Introduction of adequate dosages of organic and mineral fertilizers which ensure normal plant development and increase resistance to wilt. Additional feeding of cotton throughout its development is most

important. The degree of infestation of cotton is reduced by the introduction of speedily acting fertilizers, such as ammonium sulfate.

6. Introduction of resistant varieties: S-450, S-460, 108F, and others, products of the All-Union Cotton Institute; Nos. 0.1363, 02129, 02006 and others were products of Azerbaidjan cotton Institute.

FUSARIUM WILT. Affects Egyptian cotton varieties. The disease is spread only in several regions of the USSR. It infects cotton at various stages of development and particularly early germination. Sprouts show traces of the disease on cotyledons and foliage in the form of yellow, later brown spots, distributed along veins. Because of the dying of veinlets, a characteristic net forms on the leaves. The foliage drops, the plants perish. This may occur equally during the plant's budding and blooming stages. If the infested plants continue to grow and last until the end of the vegetation period, they fail to bear fruit. Towards the end of the vegetation period the disease takes the form of typical wilt. The leaves lose "turgor", without changing color, the top of the plant droops and full destruction follows in 2 to 3 days. A typical characteristic of various forms of fusarium wilt is the darkening of pulp which spreads over the entire plant and which may be easily established on a cross-cut of the stem at different height.

The inducer of the disease is the fungus Fusarium vasinfectum v. egyptiacum Fahmy, belonging to hyphomycetes. This a strictly special parasite which infects only cotton. Its steady habitat is the soil. It penetrates plants through the roots and spreads through the vascular system of the entire plant, reaching even seeds. In addition to conidial spore-bearing, the parasite forms chlamydospores in which the fungus winters and survives the unfavorable conditions of moisture. Soil and seeds represent the foci of the disease. It may also spread through plant residue.

METHODS OF CONTROL.

1. Quarantine measures to prevent further spread of the disease into USSR. The import of seeds and raw cotton is therefore prohibited beyond the limits of infested areas. In view of the possibility of infecting the soil through the seed stock of root crops, strict quarantine measures are maintained with respect to this material.

2. It is essential to assign special equipment for the cultivation of plots infested by Fusarium or to provide for its careful cleansing and disinfection with formaline (1:20) before use on non-infested plots.

3. Raw cotton material from infested plots should be stored separately from healthy crops.

4. Seeds of infested cotton should not be used as seed stock but subjected to treatment.

5. Careful removal of all residue of cotton from infested plots; this may only be used for fuel.

6. Introduction of proper grass crop rotation; cotton plantings not to succeed cotton crops.

LEAF ROLL.

A virus disease characterized by deformed leaves. The borders of leaf lamina are rolled upwards and occasionally rolled into tube form. The infested leaves are much thicker, fragile, of specific shine.

Because of the shortening of internodes, the diseased plants are retarded in growth. Diseased plants are branched, the runners and leaves drooping. They frequently lodge. Fruit bearing, following early and severe infestation, is almost completely absent or the number of cotton balls greatly reduced. Diseased plants are usually found in fields in foci. The appearance of single infested plants points to late infestation.

The virus producing leaf roll is a special one and affects primarily Egyptian varieties. American varieties are seldom affected; symptoms of the disease either hardly show, do not show at all or are not typical. Other species of cultivated cotton, including "guza" (Asiatic cotton), are evidently resistant, according to observations.

The host of the virus is primarily the cotton aphid. Acacia and peach aphids may also act as hosts. The virus may winter in cotton seeds. However, aphids, the carriers of the virus, and those weeds on which aphids feed are of considerable significance in preserving the virus in the winter. Among perennial weeds [Malva] "prosvirnik" and [Barberaea Beck.] "surepka" represent threats in spreading virus disease.

Leaf roll belongs to injurious diseases of cotton since it reduces the number of cotton balls and deteriorates the quality of fiber. Quarantine object.

METHODS OF CONTROL.

1. Introduction into production of resistant cotton varieties: Nos. 4786-1, 2966-1, Az 29, Az 68, and others (Azerbaidjan conditions).

2. Quarantine measures which prohibit the importation of seeds from infested areas into non-infested; this applies to Egyptian cotton.

3. Regular control of aphids, virus hosts and chiefly cotton aphids. Control measures should apply not only to cotton plantings but also to surrounding plots where aphids may winter. Control should begin in early spring in wintering habitats.

4. Weed control, especially of Malvacae, where infection is preserved throughout the winter. This weed serves in addition as forage for aphids.

5. Early planting of cotton; avoidance of thin planting since viruses spread chiefly on thin plantings.

PESTS AND DISEASES OF FLAX (p. 358-369)

Among multi-poisonous insects, flax is primarily injured by the stem borer, [Phytometra gamma L.], the flax moth, [Chloridea dipsacea L.], the sugar beet webworm, [Loxostege sticticalis L.], and flax gnat. The most serious injury is caused among "special" pests by the "blue flax flea," [Aphthona euphorbiae Schrank]. Diseases affect flax throughout the vegetative period. Rust, fusarium wilt, polysporoses, anthracnose, and the flower parasite, "povilika" dodder [Cuscuta epilinum] represent the greatest threat.

FLAX PESTS

Blue flax FLEA (APHTHONA EUPHORBIAE SCHRANK) is a beetle of the Chrysomelidae order, of small size, jumping legs, black with blue or green shine; legs yellow, except for back "hips"; length 1.5 to 2 mm. ill. no. 100, p. 359.

The beetle is widely spread in flax areas and represents one of the most dangerous flax pests. It injures flax primarily in the southern flax growing regions (Northern Caucasus), less in the central belt (northern Ukraine, Voronezh, Kursk, Moscow, Smolensk, Gorki oblast(s); in the northern belt (Leningrad and Ivanovsk oblast(s)), it causes damage only in warm and dry years. Develops only one generation; adult beetles winter; they awaken in early spring and at first feed on different weeds. When flax germinates, the beetles attack this crop. Their number increases on flax within one month. This is connected with the appearance of beetles at a different time after wintering and the period necessary for their transfer to flax fields.

The beetles injure flax by producing sores on cotyledons and young leaflets which resemble small, round holes. In cases of severe infestation, not only individual leaves dry out, but the entire plant. Towards the end of spring the number of beetles is radically reduced and they gradually disappear. This may be explained by the withdrawal of the beetles into the soil for egg laying, after which they die. Eggs are laid either on roots or close to them. In 14 to 15 days, small, white, wormlike larvae appear; they eat small rootlets and the bark of the main root. The larvae stage lasts 25 to 30 days. Pupating also takes place in the soil, and in another two to three weeks, usually shortly before the harvesting of flax, new beetles appear from the pupae and immediately come to the surface. The young beetles feed on leaves and stems of flax. On the latter they scrape the epidermis and parenchyma, injuring the fibers in the meantime. After flax is harvested, the beetles remain in the soil or spread along ditches, shrubs, edges of forests, where they winter in the soil, under fallen leaves and weeds. The pest causes damage in hot, dry weather; in cold and rainy seasons, the danger is insignificant.

It represents a particular threat to young germinating flax in the spring. Damage to young shoots may injure or severely reduce yields or result in their complete loss. The injury caused by young beetles in July at harvesting time reflects upon the quality of the fiber. Because the fibers have been chewed, their length is reduced and the injured stems soak later unevenly in processing, which affects the durability of the fiber.

Larvae affect the development of plants by feeding on roots and delay growth, which shows particularly in dry weather. Larvae also injure the root system, contribute to the penetration of fungi parasites into the plant and the development of such diseases and fusarium and flax anthracnosis.

METHODS OF CONTROL.

1. PLANTING OF FLAX IN EARLY AND CLOSE PERIODS. When planted early, the beetles appear in masses on the fields at the time the plants have already gone through their most dangerous stage of development (cotyledon leaves and first pair of genuine leaves).

When planting is closely timed, the beetles distribute evenly throughout the flax plots; when plantings are timed far apart, they concentrate on plots of later periods and cause severe injuries.

2. The destruction of beetles by poisons of intestinal and contact action. Dusting with calcium arsenate (8 to 10 kg./h.) or sodium fluoride (10 to 12 kg./h.) or the dusts DDT and GKHTSG (12 to 15 kg./h.). Good results are also obtained from dusting with anabadust or nicodust (5 o/o).

3. Timely harvesting to reduce the period of stem injury by young beetles.

4. Disking or deep plowing of plots, immediately following flax harvests, in order to plow-in the remaining plants which may serve as forage for beetles before they enter their wintering stage.

DISEASES OF FLAX.

RUST OF FLAX. A widely spread disease; known also under the names of "prisukha" and "mukhosed."

Appears in the middle of the summer, at the time of flax bloom. Orange pustules, uredospores, form on stems, chiefly on thin branches, leaves and calyxes. These spores spread the disease throughout the vegetation period.

Shortly before harvesting black, protruding, shiny dots of round and elongated shape form on the stems. These formations represent the collection of winter spores of rust, telespores. They are uni-cellular, of brown color and united into a firm layer which settles under the epidermis.

The inducer of the disease, Melampsora lini Desm. is a one-host parasite, which spends all stages of development on flax. The aloidial spring stage appears in the form of yellow pustules at the bottom of cotyledons and leaves and is usually not noticeable. In the summer, both summer and winter stages develop. The parasite winters in the third (winter) stage on post-harvest residue. Thus only residue are foci of infection; the fungus penetrates seeds from remnants of injured stems and balls. However, the disease cannot be transmitted directly through seeds or soil; this distinguishes rust from other flax diseases.

The degree of infection caused by rust depends upon ecological conditions. Rust develops severely at a temperature of 16 to 22° and under precipitation, rains, dew, fog. Winds contribute to the rapid distribution of alcidiospores and uredospores. The spores are spread also by insects, fleas and thrips and other pests. Rust, by infesting the stem, causes substantial injury to the quality of the fiber.

Dark spots of rust that form on stems are not removed from the fiber during soaking, which is responsible for the name "prisukha." The strength of fiber and its length are affected. When severely infested, flax is reduced by 5 to 7 and even 11 grades. The degree of loss depends upon many factors. Different varieties of flax are affected in different manner. Along with severely infested varieties, there are resistant ones. The degree of flax infestation depends to a large extent upon different agro-technical factors, especially the periods of planting and harvesting. Early plantings suffer less from rust , since by the time telespores appear, crops have reached maturity. In late plantings rust infests plants long before maturity, and therefore causes much damage to plantings. Early harvesting also reduces losses from rust.

METHODS OF CONTROL.

1. Introduction of resistant varieties. Among rust-resistant varieties are Svetoch, Priadil'shchik, 128812, and others.

2. Careful cleansing of seeds, since rust may spread through vegetative residue (stems, calyx).

3. Early planting.

4. Early harvesting of flax (during early yellow stage) reduces losses from rust.

5. Introduction of grass field crop rotation which precludes the frequent return of flax to the same field.

6. Careful harvesting of flax and fall plowing with plow and fore-plow.

FUSARIUM OR FLAX WILT. A most dangerous disease. Plants are affected throughout vegetation. On germinating seedlings, fusarium appears in the form of decay of root collar. The plants get yellow and wither. The most characteristic traits of the disease are observed on young plants before blooming. Infested plants wilt. At first the top yellows and droops, then the plant gradually gets brown and dries out. Wilt usually spreads by foci, with the result that circular areas form on plantings consisting of wilted and browned plants. Fusarium is observed in the later stages of flax development, the period of last bloom and ball formation. Then the plants get yellow and brown, balls do not reach maturity, and even seeds get frequently affected. In cases of light infestation, plants develop more or less normally and reach maturity.

The inducer of the disease, [Fusarium lini Boll.], belongs to the group of imperfect fungi, the sub-group of hyphomycetes. This is a soil organism. Mycelium penetrates the roots first, next the vascular system of the stem, which interferes with the supply of water and nutritional substances. This accounts for the plants' yellowing and wilting. Sometimes a pink film, the spores of the fungus, appears on the root collar of infested plants, which consists of cohidia carriers and conidia. The latter are colorless, usually 4-cellular, of scythe shape. The parasite is preserved (in the form of spores and mycelium) in seeds, plant residue and soil. In the latter the fungus does not lose its viability for 5 to 6 years. The accumulation of the infectious origin of fusarium in the soil determines along with other unfavorable factors, the state of "flax sickness."

Infection is transmitted throughout vegetation chiefly through the soil, which accounts for the distribution of the disease by foci.

Infection is most severe in moist and warm weather (19 to 20°). At low temperature the development of fusarium is stopped and does not develop at temperatures lower than 13°. Early plantings are therefore lightly affected, while later plantings are severely injured, since they do not have an opportunity to accumulate strength before the appearance of the disease. Moist, acid soils equally contribute to the development of fusarium.

Fusarium of flax presents a threat to all regions where flax is cultivated. By injuring the plant at different stages of its development, it produces poor yields, reduces the harvest of seeds. This disease affects both the quantity and quality of fiber by reducing yield of long fiber and grades.

METHOD OF CONTROL.

1. Careful cleansing and sorting of seeds, at which time not only impurities but also sickly, undeveloped seeds, usually carrying infection, are removed.

2. Treating seeds with "protars" (PD) or NIUIF-2 dry method. The preparations are applied in the proportion of 1.5 kg. per 1 ton of seeds; treatment is applied 2 to 3 days before planting.

3. Grass field crop rotation during which flax is planted on land formerly occupied by perennial grasses.

4. Close and early periods of planting which result in a lower percentage of infection by fusarium, as compared to late periods.

5. Liming of acid soils. Lime is introduced after flax is harvested or at least 2 to 3 years before planting.

6. To prohibit the spreading of flax straw on fields under flax crop rotation and on virgin soils intended for flax during the succeeding 2 to 3 years.

7. No cultivation in the proximity of livestock farms, barnyards and manure storage areas to prevent the spread of infection to fields by manure. In this connection, it is also recommended to feed flax residue to livestock and chicken poultry only in boiled form. Other residue of the first flax crop should be burned.

8. Production and introduction of resistant varieties. This measure is perspective. The varieties I-5 and I-7, produced by the Flax Institute, and the variety A-2176, of Smolensk Station selection, are distinguished by resistance to rust and fusarium.

BROWNING OR FRAGILITY OF STEMS. is observed on flax at different stages of growth. The disease appears in the form of brown spots on cotyledons and root collar. Browning during severe infection of early crops results in complete decay. The disease is particularly typical on stems, the brown spots gradually flowing together. The stems become fragile, especially in their lower parts. Brown spots appear also on balls and lead to premature drying; infection next spreads to seeds. The disease reaches its strongest development on mature plants from bloom to maturity.

The inducer of the disease, [Polyspora lini Peth et Laff.], belongs to the group of imperfect fungi, the sub-group of (Melanconiaceae) Spores are jellied, colorless pustules consisting of conidia and uni-cellular conidia, oval in shape. The infection is transmitted by seeds, residue and soil. Preserved in the soil for several years, the parasite depresses development of flax and is one of the causes of "flax sickness."

During vegetation the infection is spread by aerial currents, soil, rain drops and insects.

The disease prevails in Vologda, Arkhangelsk, Molotov, Pskov, Smolensk oblast(s) and Belo SSR (White Russia).

Browning of stem is among the dangerous diseases of flax; it causes loss of yields, lodging of plants, reduces the yield of seeds and particularly affects the quality of fiber. The latter becomes fragile and takes on a brown coloring. The pulp of the stem cannot be removed from the fiber even by soaking. The grade of fiber is frequently reduced 5 to 7 degrees.

METHODS OF CONTROL. For control, measures designed to improve seeds and soil, are foremost; among them the following measures are recommended:

1. Disinfection of seeds with "protars" (PD) or NIUIF-2.

2. Grass field crop rotation, under which flax is returned to the same plot no earlier than every 5 to 6 years.

3. Prohibition to spread flax on fields under crop rotation and particularly on predecessors, in order to prevent further infection of the soil by flax straw.

4. Fall plowing which destroys "podsed" (lower layer of plants on meadows), infected plants and their residue.

Control of weeds of flax, since the possibility of their infection is not precluded and may be transmitted to flax.

5. Introduction of resistant varieties. Different varieties and strains of flax possess different degrees of susceptibility to this disease. This suggests the possibility of producing resistant varieties.

ANTHRACNOSE OF FLAX. Various parts of the plant are affected by this disease throughout the vegetation period. The disease is of greatest danger at the germination stage. The first indication of the disease appears on the cotyledons in the form of small brown spots. On the hypo-cotyl spots form and later cracks and decays. Browning occasionally spreads to the roots. Such injury reflects upon the general condition of the plant: it yellows, often wilts and perishes. During mass infection the entire field acquires a yellow coloring which is responsible for the name "yellowing of sprouts."

The disease later appears on leaves in brown spots. The injured tissue gets brown and dries out, especially on margins and tips of leaves. Stems of adult plants are also covered with brown spots and cracks. Characteristic of the disease is the marbling of stems which have the appearance of minute brown spottiness. Occasionally stems are completely brown. Spots are, however, not deep and thus do not affect the quality of the fiber.

Finally, the disease may appear on balls in brown spots, not clearly defined. When balls are infected early, the mycelium of the fungus penetrates into seeds, infecting primarily their epidermis. Diseased seeds are usually sickly, of dull color, thus distinguished from healthy seeds. Germination is low in infected seeds. The harm caused by anthracnosis hence causes loss of sprouts, reduction in yield of seeds and impairs the quality of the latter.

The inducer of the disease, (Colletotrichum lini Boll.), is a fungus of the imperfect fungi of the Melanconiales order. Spores of the parasite appear on infected parts in the shape of orange pustules. The spores are colorless, uni-cellular, elongated or cylindrical. Infection is transmitted by seeds, residue of plants, and soil. The parasite remains viable in the soil for several years and may also be one of the causes of "flax sickness." During vegetation the disease spreads rapidly with the aid of spores which are easily transported by wind, rain and insects, such as, for instance, the "flax beetle" [Aphthona euphorbiae Schrank.]. Moist and warm weather favor the development of anthracnosis, and so do light acid soils and late plantings.

Anthracnosis is spread in all flax growing regions.

METHODS OF CONTROL. As seen from the above description, the inducer of the disease is related to Fusarium lini biologically and ecologically and control is therefore similar to that of fusarium. The principal measures are cleansing, sorting and mordant treatment of seeds; grass field crop rotation, and good cultivation of the soil.

"POVILIKA", DODDER, [CUSCUTA EPILINUM] is a climbing plant of thin stem, without roots or foliage. By winding its stem around flax plants, it feeds upon it as upon a plant host. When strongly developed, it winds itself around many plants; one clump may generally injure 15 to 20 plants. The latter become depressed; yield of fiber and seeds is reduced.

In the middle of the summer small flowers form on stems of Cuscuta epilinum, gathering into heads; seeds are very small; the plant produces 3000 seeds. The seedling, when coming in contact with the green plant host winds itself around it and acts as a parasite.

During vegetation the parasitic plant spreads by "pieces of stem" which, when they come in contact with a plant, are capable to grow and form suckers. Two species of Cuscuta epilinum act as parasites on flax: [Cuscuta epilinum Weihe] (flax) and [C. epithymum Murr.] (clover).

FLAX "POVILIKA" DODDER, [CUSCUTA EPILINUM WEIHE] affects particularly flax, less frequently its weeds; the seeds of this species are single or, in contrast with other species, double, grown together. The parasite is spread by seed stock. Seeds do not remain in the soil long and develop in large masses in the succeeding year. Very low soil temperature and deep penetration hinder their growth.

CLOVER "POVILIKA" DODDER, [C. EPITHYMUM MURR.] injures in addition to clover and flax, "Timofeevka" [Phleum L.] and even grain cereals; its seeds remain in the soil for many years. (p. 338).

METHOD OF CONTROL.

1. Careful cleansing of seeds with "trieur" (grain cleaner). Seed stock should not contain any seeds of this parasitic plant. Following the sorting of infested seeds, residue may be fed in boiled form to livestock; unused residue is buried no less than 1 mm. deep or burned.

2. Pre-harvesting survey of seed plantings to eliminate non-infested plots. Plantings infested by the parasite during the summer are not used for seed.

3. Disinfection by boiling of bags and packing material used for infested seeds, since the seeds of the parasitic plant because of their

rough surface are retained in the bags and thus spread infection.

4. Quarantine measures to protect uninfested regions and plots from C. epilinum.

5. Grass field crop rotation. Use of clover, infected by C. epilinum in the preceding year, is permitted only with the approval of the Quarantine Inspection Service.

6. Destruction of foci of C. epilinum, including a strip one meter wide of non-infected flax area around the focus. Infested flax is burned with weeds; soil is dug up.

7. Careful harvesting of flax. Harvesting and processing of flax from areas severely infested by C. epilinum should be separate. Deep fall plowing with plow and fore-plow of all plots planted with flax.

PESTS AND FLOWERING PLANT PARASITES OF HEMP (p. 369-371)

Hemp is injured chiefly by sugar beet webworms, stem borers, crickets [Gryllotalpa vulgaris L.]. Among special pests (infesting only hemp) the crop is infested by the hop flea beetle [Psylliodes attenuata Koch.], which frequently causes considerable damage to hemp. [Orobanche ramosa] uses hemp as its host.

PESTS OF HEMP

HOP FLEA BEETLE [Psylliodes attenuata Koch.] represents one of the most serious pests of hemp. Small beetle of the order of (Chrysomelidae); has jumping legs; dark green; only ends of upper wings, feelers, and legs are rust-yellow; length 1.8 to 2.6 mm.

Found in hemp growing regions, but particular damage is caused in Kuibishev and Gorki oblasts, Bashkir ASSR, Northern Caucasus, and northern Ukraine.

Develops one generation; the beetles winter; they awaken in early spring and at first feed on nettle, hops and residue of hemp. When young hemp sprouts appear, the beetles transfer there and feed first on cotyledons, then genuine leaves, eating regular circles of them. In the beginning of the summer, the beetles disappear in the soil and lay their eggs near rootlets of plants. One female may lay as many as 300 eggs. The larvae feed on roots of hemp, chiefly small rootlets. Pupating takes place in the soil; new beetles appear in late July, early August and feed on hemp plants, settling on upper parts, leaves and seeds of "milky ripeness." The damage caused by the pests may be considerable. After harvesting, the beetles continue to feed on hemp stubble and remaining residue. They winter on hemp fields, in the upper layers of the soil, remainders of plants and if machine-harvested, in the stubble.

When hemp is severely infested in the spring, yield is reduced and its quality impaired. Large damage is usually observed in years of dry and warm springs.

Plants that were severely infested in the spring have shorter stems (25 o/o), and seed output is reduced 40 o/o and over. Injuries caused in the fall may equally cause considerable damage.

MEASURES OF CONTROL.

1. Destruction of residue and nettle on which beetles feed in the early spring.

2. Planting of hemp in close periods.

3. Destruction of beetles by dusting with calcium arsenate (8 to 10 kg/h), sodium fluoride (10 to 12 kg/h), dusts DDT and GKHTSG (15 to 20 kg/h).

Good results are also obtained from dusting with anabadust and nikodust. Control should begin before the beetle transfers to hemp crops, while pest is still feeding on nettle.

4. Gathering and destruction of residue following harvesting, disking, and fall plowing.

FLOWERING PLANT PARASITES (p. 371-372)

Branched (Orobanche ramosa L.). This parasite develops on roots, causing the formation of characteristic swellings with numerous long runners. A branched stem, 25 cm. high, grows out of the swellings. One plant of Orobanche has up to 20 fruit-bearing branches. The fruit is a ball containing very small seeds, the total number of which amounts to 150 thousand per plant. The seeds of Orobanche remain in the soil for many years.

By depriving the plant of nutritional elements and water, Orobanche causes severe depression of the plant and leads to loss in yields. It infests in addition to hemp, also tobacco and sometimes legumes.

Develops in southern and south-western regions and Povolzhie (Volga)

METHODS OF CONTROLS.

1. Grass field crop rotation, with the exclusion of hemp and other susceptible crops for several years. Potatoes, sugar beet, not infested by branched Orobanche, may be included in crop rotation;

2. Fall plowing;

3. Weeding and destruction of Orobanche before seeding;

4. Introduction of Orobanche-resistant varieties and forms, specifically Italian hemp. Hybrids of Italian and central Russian hemp are considered resistant.

5. To prohibit the carrying of seeds from infested regions into non-infested.

PESTS AND DISEASES OF RUBBER BEARING PLANTS. (p. 372-378)

Because of the exceptional importance and economic significance of rubber, this crop is given much attention. Areas devoted to plantings are extended each year and their yields increase. Resistant yields of rubber bearing plants may, however, be obtained by applying advanced agricultural techniques, including pest and disease control. Rubber bearing plants are injured by multi-poisonous and special pests.

Among multi-poisonous pests are wireworms and pseudo-wireworms, cockchafers, cutworm moths injuring roots, grey weevils [Tanymecus palliatus F.]; "medliak peschiany," [Opatrum sabulosum L.]; sugar beet webworms (Loxostege sticticalis L.], which eat the above-ground parts of plants.

Among special pests are [Olibrus bicolor F.]; the (cabbage) weevil curculio; [Ceutorrhynchus punctiger Gyll.]; and [Ensina sonchi L.], and aphids.

Among diseases prevailing on rubber bearing plants are rust, mildew and root decay.

PESTS OF RUBBER BEARING PLANTS

"ODUVANCHIKOVY SEMIATOCHETS" (Olibrus bicolor F.) is a small beetle of the order Phalacridae; bulging body, black; on upper wings in the back a red spot on each; length 2.2 to 3.2 mm. Distributed in European USSR and Central Asia.

The beetles winter in the soil. In early spring they come out of their wintering abodes and settle on wild growing dandelions. When kok-saghyz begins to bloom, they transfer to it, settling primarily on second year plantings. The eggs are laid in buds; development of eggs takes several days. Larvae feed on achenes; they suck their content and at the time of the ripening of achenes and opening of inflorescence, one part of the larvae has already completed their development and passed onto the upper layer of the soil for pupating down to a depth of 5 cm. If by that time the larvae did not complete their development, they transfer to the unopened inflorescence and continue to feed there. One inflorescence usually holds two larvae; the pests cause noticeable harm, destroying 30 o/o of seeds of inflorescence.

When harvesting is early, many larvae are carried away with yields, and in drying places where seeds are cleansed, many abandon the inflorescence and disappear into the soil, thereby creating new foci.

METHODS OF CONTROL:

1. Destruction of wild dandelions close to fields of kok-saghyz.

2. Shaking off beetles from blooming kok-saghyz into vessels smeared with sticky liquid. The beetles may also be gathered with the seed gathering machine of Filipov make; gathered beetles are burned.

3. Immediate gathering and destruction of residue where seeds were cleaned; deep plowing of plots where temporary seed receiving, drying and cleaning stations were established.

4. Laying out of new fields as far as possible from the old.

"ODUVANCHIKOVY SKRYTNOKHOBOTNIK" (Ceutorrhynchus punctiger Gyll.), belong to the order of weevils. This small, black beetle is covered with brown scales and a light spot; length 2 mm. Distribution European USSR.

The beetles winter; they awaken in the spring when wild growing dandelions bloom and settle on them; transfer to kok-saghyz, primarily to fields of second and third generations. The females lay eggs in the buds and flowering heads. Larvae consume the ovaries of flowers and then achenes. Larvae feed for two weeks and then disappear into the soil down to a depth of 5 cm. to pupate. Duration of the pupating stage is one month; the beetles winter in the soil.

Another species is found in Central Asia, C. ostator Forst.

METHODS OF CONTROL are the same as in the case of [Olibrus bicolor F.]; except that beetles are not gathered.

"OSOTNAIA PESTROKRYLKA" (Ensina sonchi L.) belongs to the order of Trypetidae. A fly of transparent wings; the front border of each has a brown eye, occasionally 1 to 3 brown spots; length 3 mm.; larvae is legless, has no clearly visible head; length 6 mm.

Injures kok saghyz, tau saghyz, krym saghyz; particularly injurious to annual kok saghyz. Develops on weeds, especially dandelions, [Sonchus] and [Heriacium]. Flies appear in the spring and feed on nectar of blooming Compositae. Eggs are laid between leaflets and into the flowers of rubber bearing plants. Larvae feed on achenes; the latter become soft under larvae excretions and create conditions conducive to fungi diseases. Larvae pupate within the inflorescence. The pest may develop several generations; in steppe regions it produces four generations.

METHODS OF CONTROL. Destruction of weeds of Compositae around plantations of rubber bearing plants.

APHIDS. The dandelion aphid, (Macrosiphum taraxaci Kalt.) and green root aphid (Xerophilaphis scorzonerae Mordv.) transfer onto kok saghyz from wild growing Compositae. The former aphid sucks the juice of leaves. The green root aphid settles near the root collar and on roots and sucks their juice. Their sugary excrements attract black ants, which gnaw holes in the roots and thereby cause additional damage.

METHODS OF CONTROL.

1. Destruction of wild growing dandelions.

2. Spraying with anabazin-sulfate (0.1 o/o) with soap (0.4 o/o) to destroy the dandelion aphid.

3. Treatment with paris green of black ants living in the soil. This preparation is introduced by teaspoon into the opening apertures of burrows leading to the ant hills. (Ill. 106, p. 375, Pests of seeds of kok saghyz).

In order to prevent injury to rubber bearing plants by the larvae of click beetles [Agriotes obscureus L.] ("shchelkuny"); "chernotelki," [Pedinus femoralis L.] and weevils, plantings should be on plots of low infestation.

By taking soil tests the degree of infestation of plots is established. Planting is permissible on plots infested no higher than by one larvae of weevil, 5 to 6 wireworms, 7 to 8 pseudo wireworms, in the proportion to 1 m^2 of area.

DISEASES OF RUBBER BEARING PLANTS

RUST OF RUBBER BEARING PLANTS. The disease injures leaves, causing the formation of small yellowish or orange spots with pustules, the spores of fungi. The coloring of pustules varies from yellow to dark brown, depending upon the stage of the parasite. On rubber bearing plants several species of rusts are found, of which the most widely spread is Puccinia taraxaci and P. variabilis.

Puccinia taraxaci Plowr. injures kok saghyz. Rust appears in early spring on two-year old plants. Orange pustules appear first on the foliage, which is the aecidial stage. In the summer uredospores develop, appearing as brown powder-like pustules. They are freely distributed by wind and cause mass infestation of plants. In the fall, telespores, pustules of a much darker color appear on foliage; this parasite winters primarily on foliage at the telespore stage, which develops only after wintering. Rust of kok saghyz may winter in the uredospore stage.

P. variabilis Grev., a one-host parasite, develops on krym saghyz. The aecidial spore bearing takes place on the lower side of leaves in the form of yellow pustules. Uredospores and telespores appear also on the lower sides of leaves. They are small, powderlike, round or elongated pustules, dispersed, occasionally flowing together. Uredospores are brown, telespores dark brown.

Rust of tau saghyz is caused by the one-host parasite Puccinia scorzonerae Jacky. Alcidia appear first as yellow pustules, followed by brown and dark brown pustules of uredospores and telespores.

Leaves of rubber bearing plants dry out prematurely when infested by rust.

Infection of rust (of different species) remains during the winter on plant residue and winter plantings.

METHODS OF CONTROL.

1. Destruction or ensilage of residue after the cutting of roots during harvesting and burning of wastes following seed cleaning.

2. Careful weeding, especially of dandelions from which rust may be transferred to kok saghyz and krym saghyz plantings.

3. Spraying (2 to 3 times) of plantings with 0.75 o/o solution of Bordeaux mixture or lime sulfur decoction, of a concentration 1:50, or 1 o/o solution of sulfur paste. On first year plants measures are applied when there are leaves on a plant.

MILDEW OF RUBBER BEARING PLANTS. Kok saghyz and krym saghyz are infested by Sphaerotheca fuliginea f. taraxaci; on tau saghyz Leveillula taurica f. tau saghyzi develops. Mildew appears on the foliage in the form of white film. There are the mycelium and conidial spores. The ascigerous stage develops toward the end of vegetation and appears in the form of dark points. The parasites winter in the latter stage on residue of leaves. Severely infested plants terminate their vegetation prematurely.

METHODS OF CONTROL.

1. Ensilage or destruction of residue of plants.

2. Dusting of plantings with sulfur or spraying with lime sulfur decoction, of a concentration 1:50 or with 1 o/o solution of sulfur paste.

ROOT DECAY OF RUBBER BEARING PLANTS.

The disease consists in the decay of the root system.

The causes of decay are manifold. The disruption of the entire covering of root tissues is of primary significance. When there is abundant moisture of the soil, especially preceded by a dry period, the growth of inner and external tissues is irregular. As a result, external old, less elastic tissues are torn. Parasitic micro-organisms/into splits penetrate penetrate, causing decay. Part of the root tissue is injured by nematodes. The degree decay development is determined by the depth of wounds and the time of their appearance. Injury is light when wounds are fresh and not deep. Many soil micro-organisms participate in the formation of root decay. The most widely spread are white, grey and red decay.

WHITE DECAY is caused by the cup fungus Sclerotinia Libertiana Fuck. On injured roots the epidermis remains untouched, but the internal parenchyma tissue decays completely. The milky tubes containing rubber are not destroyed and resemble threads which pull in breaking. Numerous large, black sclerotia are observed in the injured tissue. All plants of which the root system is infected wilt. The mycelium of the parasite penetrates into the roots through cracks, occasionally through side rootlets. Infection remains in the soil.

GRAY DECAY is caused by the fungus Botrytis cinerea Pers. Roots decay; above-ground parts of injured plants wilt. The fungus develops in the conidial and sclerodial stages. Infection remains in the soil. White and gray decay may affect roots during winter storage.

RED DECAY is caused by the soil fungus Thizoctonia violacea Tul. Injured roots are covered with a matted (felt) film of violet color; roots decay. This disease is primarily observed on tau saghyz in the fall.

All species of decay of roots develop on heavy moist soils.

METHODS OF CONTROL.

1. Fall plowing and good pre-planting cultivation of the soil.

2. Hill method of planting, as proposed by T. D. Lysenko. This method ensures favorable development of roots and thus increases resistance of roots to decay.

3. Proper care of plantings, specifically deep cultivation between rows, which contributes to aeration of the soil and thus improves conditions for root development.

4. Removal of infested plants.

PESTS AND DISEASES OF SUNFLOWER CROPS (p. 378-384)

Sunflower plants are injured by locusts, grasshoppers, sugar beet webworms, chewing moths, wireworms, "chernotelki," [Pedinus femoralis L.]; "seryi sveklovichny dolgonosik," [Tanymecus palliatus F.] among multi-poisonous insects. Among special pests, the sunflower moth is particularly widespread.

Sunflowers are injured by disease at any stage, but particularly when mature. The greatest threat represents sclerotinia, rust and broom rape [Orobanche ramosa].

PESTS OF SUNFLOWER PLANTS

SUNFLOWER MOTH (Homoeosoma nebulellum Hb.). Belongs to the order of Pyralidae. The front wings of the butterfly (moth) are long, gray, with black dots in the center; back wings are wider, light , with dark veinlets; spread of wings 20 to 27 mm. Caterpillar is gray, has three lengthy stripes on the back; head light brown; length 15 to 16 mm.

The sunflower moth has a wide distribution and represented a serious threat to sunflowers before the introduction of moth-resistant varieties of this crop.

Caterpillars of the last stage winter in the upper layer of the soil. During the sunflower's blooming period, the moths begin to fly. They lay their eggs, one at a time, chiefly on anthers of the sunflowers and wild plants of Compositae.

Caterpillars of the first two stages feed on pollen, petals and other parts of sunflowers, without touching their achenes; beginning with the third stage, they continue to feed on the same flowering parts but gnaw achenes and eat their kernels completely or in part. Caterpillars can also feed on leaves of epidermis and tissue of heads.

Having completed their feeding, caterpillars descend to the ground along a web and in the upper layer of the soil braid cocoons, where they winter. One part of the caterpillars pupates the same year, and in this case, butterflies make their appearance and produce a second generation, which also develops in part.

METHODS OF CONTROL.

The introduction into practice of moth-resistant, so-called "panzer" varieties of sunflowers, which are hardly injured by the moths. Inside the capsule of achenes of those varieties there is a special black layer consisting primarily of carbon. The formation of this layer begins on the third day after blooming and is completed in 8 days, i. e., at the time caterpillars of the third stage gnaw into achenes.

The panzer layer is firm and caterpillars are not able to gnaw through it. Although the sunflower moth lays her eggs on the flowering heads of panzer varieties, as it does on the other, caterpillars are unable to cause damage to achenes and feed on leaves of cover and tissue, The injury caused to these parts of the head do not reflect, however, upon the yield of achenes.

The introduction into practice of panzer varieties of sunflowers has solved the problem of controlling the sunflower moth, which until then had caused untold damage to the crop, compelling some regions to even abstain from cultivating it.

DISEASES OF SUNFLOWERS

SCLEROTINIA OR WHITE DECAY.

The disease develops on sunflowers throughout the entire vegetative period, appearing in various forms. The first symptoms of the disease are observed on young plants of 5 to 6 leaves. The base of the stem is covered with white cotton-like film which represents mycelium. This matty mycelium may also be observed on roots and even on soil. The injured tissue of roots and stems softens and gets brown. The plant wilts and dries. Occasionally, an injured plant will break in its lower part. This form of disease is called root decay. It may appear on adult plants.

The second type of injury is stem decay; this is characterized by injury to the central part of the stem. The injured tissue gets brown; concentric zones appear frequently. Mycelium develops primarily within stems and not on their surface. Stems soften in places of injury and break off. Inside the stems, less frequently on the outside, sclerotia form in large quantities, giving the appearance of fairly large black nodules.

During the ripening of the sunflower heads, decay is observed. This decay begins at the rear end of the head. The tissue of the head gets brown and soft; decay spreads to the upper part. The entire head is finally covered with a white cotton-like mycelium. Numerous Sclerotia form in the pulp of the head, in between the achenes, sometimes inside them. They frequently develop between achenes and in flowing together form a typical net. The head is destroyed and falls apart, the achenes drop. In place of the head remains a bundle of individual vessels protruding in thick cords. Head decay is the most widespread and dangerous form of this disease.

The inducer of the disease is the cup fungus Sclerotinia Libertiana Fuck. This parasite has two stages, sclerotial and cup. Sclerotia which form in injured tissue winter in the soil or in plant residue. In the spring they grow into saucer-like or stem glass-like fruit bodies ("apotetsia") on legs. In these containers numerous cups ("sumki") spores are held. The spores are uni-cellular and colorless. Spores grow into mycelium and infest the plant. Since infection occurs chiefly through the soil, there is usually foci distribution of the disease.

Infestation is also spread by air, pieces of mycelium or spores from cups. Infested seeds, when penetrating the soil, also serve as sources of infection. Sclerotinia infests many technical and almost all leguminous crops, in addition to sunflowers, i. e., carrots, cabbage, etc.

Development of the disease is possible under increased moisture of the soil and air. It is particularly severe on acid heavy soils.

Sclerotinia on sunflowers is widely spread and causes much damage to this crop. White decay reduces the yield and quality of seeds radically, contaminates the fields by wastes (in cases of head decay). In the heads of infested plants the number of spoiled seeds (empty, sickly, infested) is 3.5 to 8 times larger than in heads of healthy plants.

METHODS OF CONTROL.

Control of sclerotinia is of purely prophylactic nature. Measures are:

1. Grass field crop rotation, in such rotation that sunflowers are preceded by non-affected crops (cereals, forage legumes, etc.). Sunflower crops are returned before 6 to 8 years.

2. Careful harvesting of all residue; stems are used for fuel, decayed stems are burned. Fall plowing.

3. Cleaning and sorting of seeds; in this manner sclerotia and diseased seeds are segregated, since they are lighther.

4. Early planting and early maturing of sunflowers (in dry, hot weather) reduces the threat of sclerotinia.

RUST, injures leaves, more seldom leaflets of flower heads. Brown pustules form on injured tissue. Leaves dry prematurely, which leads to reduction in yield. The inducer of the disease, rust fungi Puccinia helianthi Schw. One-host parasite, of which all stages develop on sunflowers. Spermogonia and aecidia appear on seedlings of sunflower crops. Yellow pustules form on cotyledons. Urespores appear as brown, large pustules and develop on leaves of mature plants, chiefly on the underside. Telespores are dark borwn or black pustules distributed frequently along veins of leaves. Telespores winter on residue of plants. In the following spring they grow into a basidial stage.

Basidiospores infest seedlings of sunflowers. In the summer stage (uredospores) there is mass spread of rust. Telespores appear toward the vegetative end of sunflowers. Widely spread, especially in southern regions.

METHODS OF CONTROL.

1. Careful cleaning of fields from post-harvest residue, since parasites winter in it.

2. Fall plowing.

3. Careful cleaning of seed stock from residue of foliage which may spread rust.

OROBANCHE Develops on roots of different plants. Has fleshy stem upon which are distributed primary leaves in the form of scales; roots are lacking. The stem has stalk-like inflorescence. The fruit is a ball filled with a large quantity of small seeds.

The unbranched Orobanche cumana is parasitic primarily on sunflowers. Two biological races of this species are known, A and B, distinguished according to their relationship to varieties of sunflowers. Among race A there are a great many perfectly resistant varieties. Races A and B differ in their geographical distribution. Race B, or Don race, is found chiefly in southern and south-eastern regions. Race A, Saratov race, is spread in the northern regions of the zone of oil-bearing sunflowers. Morphologically, the two races are not distinguishable.

The development of Orobanche takes place at a relatively high temperature. Germination of seeds is possible at soil acidity no higher than pH 6.5. Root excretions of the plant-host increase the growth of Orobanche seeds. The grown seed produces a seedling which nourishes on the roots of the plant-host. In places where it penetrates into the root tissue, a nodule forms, from which later develops the flower.

Orobanche spreads through seeds, which once they enter the soil may remain there for as long as 10 to 13 years.

Orobanche represents a serious threat to sunflower crops. When Orobanche flowers are numerous on one plant (50 or more), the plants perish from exhaustion and lack of water. When the number is smaller, the sunflower survives, but the quantity of seeds is low. Thus the yield of seeds is reduced almost four times when there are 18 flowers on one plant.

In addition to sunflowers, the non-branched Orobanche infests many cultivated plants, tobacco, tomatoes, "perilla," etc., as well as weeds, [Artemisia], [Xanthium L.], etc.

METHODS OF CONTROL.

1. Introduction of resistant varieties. Among varieties resistant to both races are: Zhdanovskie 6432, 8281, VNIIMK 1813, Fuksinka 62, etc. The varieties Kruglik A-41 and Saratovskii 169 are resistant only to Orobanche A but are severely affected by race B.

In regionalizing varieties, it is necessary to consider the regions of distribution of the respective races.

2. Grass field crop rotation; sunflower crops should not be returned to the former plot before 5 to 6 years. Non-affected crops enter into crop rotation, i. e., cereals, legumes, grasses, sugar beet, cotton, topinambur, soya, etc. This measure contributes to the elimination of foci of Orobanche and reduces the stores of its seeds in the field.

3. Destruction of Orobanche in the field prior to planting; destruction of weeds, particularly Artemisia, Xanthium L., as plants infested by Orobanche.

4. Deep fall plowing with plow and fore-plow, during which time the seeds of Orobanche penetrate from the upper layer deeper (20-22 cm.), which considerably reduces the degree of their germination.

5. "Provocationary" plantings. This special measure consists in the following. Sunflowers are first planted on silos on plots infested by Orobanche. The majority of seeds of the latter develops from the first planting of silos sunflower. Plantings of oil sunflowers, [Helianthus L.], grown after harvesting of the silos kind will be healthy and not infested by Orobanche.

A new method was developed by the Institute of Oil Crops for this purpose: A pulverized ("razmel'chennoi") mass of young plants is introduced into the soil one month before planting, which accelerates germination of Orobanche seeds. Seedlings of Orobanche perish in the absence of the plant-host.

PESTS AND DISEASES OF TOBACCO (384-391)

Among the multi-poisonous insects which injure tobacco plants are grasshoppers, crickets, wireworms, darkling beetles, cutworm and other chewing moths, ballworms, stem borers, and beet webworms. The specific tobacco pests are tobacco thrips and tobacco or peach aphids.

Tobacco and makhorka are affected by bacterial, virus and fungi diseases, in addition to various species of broomrape. Particularly, large losses are incurred from diseases affecting seed stock, i. e., black leg and black root rot, as well as from Bacterium tabacum ("riabukha") and virus diseases, which severely affect adult plants.

PESTS OF TOBACCO PLANTS

TOBACCO THRIPS (Thrips tabact Lindemann) are the principal pests of tobacco crops. A small insect of light yellow coloring; length 0.8 to 0.9 mm.; it is distinguished by its multi-poisonous effect. May, in addition to tobacco, feed on cucumbers, onions, potatoes, tomatoes, soya, cotton. Distributed in the Ukraine, Kursk, Voronezh and Crimea oblast(s), in the Caucasus and in Central Asia. The adult insects winter in dried grass, various vegetative residue and even in upper layers of the soil.

In early spring they feed at first upon weeds, laying eggs in their leaves. As soon as tobacco seedlings are planted, thrips begin to feed on the juice of their leaves and lay their eggs in them. The female usually lays one very small egg in the upper young part of the leaf. Throughout its life cycle (20 to 25 days), it may lay some 100 eggs. Larvae appear on the 3-5 day. These too suck the juice of the foliage; adult insects appear in 15 days, and the duration of the entire cycle of development lasts approximately 40 days. In the Crimea it produces from 6 to 7 generations.

Following harvesting, thrips remain on left-over stems of tobacco and weeds, and shortly before cold sets in they enter their wintering stage.

Rust brown spots appear as a result of the injuries they cause. The leaves roll and dry out. Loss of yield and deterioration of quality of the harvest follow. Injured tobacco crumbles, loses its taste, strength and aroma. Tobacco thrips propagate in masses in dry and hot years with moderate precipitation; during rainy years thrips propagate slowly since the rain washes them off the plants. Tobacco thrips are the

the transmitters of Bacterium tabacum.

METHODS OF CONTROL.

1. Destruction of weeds on plantings and surrounding territory.

2. Distribution of tobacco apart from plantings of vegetable crops (tomatoes, potatoes, cucumbers, melons, etc.)

3. Timely picking of leaves which have reached the stage of technical ripeness.

4. Gathering of stems and other residue following harvesting.

5. Crop rotation. Fall plowing.

6. Destruction of thrips by spraying the tobacco plants (no less than 3 times), with anabasine-sulphate (0.6 o/o) and soap (0.6 o/o) at the rate of 1000 to 2000 liter per hectare. Both upper and lower sides of leaves should be sprayed.

TOBACCO OR PEACH APHID. (Myzodes persicae Sulz.)

Winters in the egg stage on the skin of peach or apricot and develops in the spring on the foliage of these plants.

The females fly over to tobacco and other agricultural crops and produce many generations of aphids, propagating parthenogenetically. In the fall the females return to the trees and produce larvae, which develop into sexual females and males. Fertilized females lay wintering eggs.

During years of mass propagation, tobacco thrips cover tobacco foliage in thick, dense colonies. Leaves get deformed as a result of the sucking and dry out. Loss in yield and deterioration of quality follow.

Spraying with anabasine-sulphate or nicotine-sulphate (0.3 o/o) with soap (0.3 o/o) is applied.

DISEASES OF TOBACCO

DISEASES OF SEEDLINGS. Mass destruction is caused by black leg and black root rot.

BLACK LEG. Root collar is injured; tissue darkens; plants are retarded in their growth, and in cases of severe infection wilt or rot.

The disease is spread by foci.

The inducers of black leg are semi-parasitic fungi which belong to the genera Pythium and Rhizoctonia. Pythium de Baryanum Hesse is a fungus of the phycomycetes class and has a thin one-cellular mycelium. Propagates and spreads through zoospores, winters in the stage of oospores. Rhizoctonia sp. possesses only vegetative organs, mycelium and sclerotia. The mycelium of this parasite is darkly colored, thick, may be preserved for a long time. Sclerotia also winter. Both organisms are not specialized and affect many crops, including tobacco and tomatoes.

BLACK ROOT ROT, in contrast to black, infects the root system. Roots become black and die, which may lead to the destruction of the plant, which stops its growth; the foliage gradually gets yellow; occasionally, new roots form around the root "collar", which may restore the viability of the plant.

The inducer of black root rot, Thielaviopsis basicola Ferr., is an imperfect fungus of the order hyphomycetes. Its mycelium develops in the soil from where it penetrates into the plant. Sporebearing of this parasite is of two types. Some spores are large, dark, forming at the ends of hyphae similarly to chlamydospores. Others, the genuine conidia, are smaller than are chlamydospores and colorless.

The parasite winters in the soil and in the residue of plants, preserved as mycelium or chlamydospores. Th. basicola is a non-specialized parasite which infects a large quantity of plants of over 20 families.

Black leg and black root rot develop at a high degree of moisture of the soil. Inadequate ventilation and dense planting also contribute to mass infection of plants. In warm nurseries (hothouses), black leg is primarily observed on tobacco plants, while in open, cold or partly heated frames and nurseries, black root usually develops.

METHODS OF CONTROL.

Non-infested soil in nurseries is of major significance for the control of both diseases, since they spread exclusively through the soil. The following measures are used to provide for healthy soil.

1. Substitution of soil in infested nurseries with fresh, non-infested soil or soil disinfected thermically or chemically. Thermic disinfestation of the soil is achieved by heating at 100^{o} for 30 to 45 minutes.

As seen from the studies of the All-Union Institute of Tobacco and Makhorka (VITIM) in the southern regions, solar energy may be used to render the soil harmless. In nurseries, under frames, the temperature of the soil during the summer rises to 60^{o} and above. At such temperature, one day suffices to sterilize the soil down to a depth of 10 cm. At a temperature of 50 to 55^{o}, nurseries are heated for three days.

Chloropicrin is recommended as a chemical disinfestant of soil; it is used in the proportion of 0.3 l. to 1 m^3 of soil or 60 g. to 1 m^2.

The soil is treated in the fall at a fairly warm temperature in specially dug holes; moisture of the soil is brought to 60 o/o of saturation. Soil moistened with chloropicrin is covered. The disinfestation of wooden parts of frames and nurseries is done by formalin in the proportion of 1:100.

2. Proper agricultural technique in nurseries: moderate irrigation of seed stock, good ventilation, additional feeding of plants with a fertilizing mixture, ammonium sulfate, super phosphate and potassium sulfate.

BACTERIUM TABACUM ("riabukha"). Affects seed stock and adult plants. The disease is first observed on cotyledons in the form of dark, green spots and rotting tissue. Adult plants are infested during the period of development. Characteristic, round spots appear on the foliage, which are at first of chlorinated yellow-green coloring; soon, the tissue dies in the center of the spot and changes into a dark spot. The disease progresses and the spots in spreading reach 2 cm. in diameter. Infested tissue dries and gets grey brown. The nature of spots may, however, change, depending upon the species and varieties of tobacco and degree of air moisture. They are sometimes concentric with clearly defined yellow-green aureole. Such spots are observed on wide-leafed cigar tobacco. On makhorka spots are necrotic, without the aureole.
In cases of severe infestation, spots fuse, taking in the entire surface of the leaf on occasions. On petioles and balls the disease appears in the form of brown spots.

The inducer of the disease, Bacterium tabacum Wolf et Fost. is a specialized species of bacteria. This disease affects only species of the genus Nicotianum, including tobacco and makhorka. B. tabacum is spread chiefly by seed stock which gets mechanically infested by infected residue. Bacteria may penetrate into the soil with the residue from infested plants, but there they are rapidly destroyed because of the harmful activity of other more viable species of bacteria. In the fields bacteria are dispersed by insects, in rain drops and by wind. They penetrate into the plant through apertures, hydathodes and wounds. The disease is at its severest during precipitation, especially when rainy weather alternates with sunny days and is accompanied by winds.

Bacterium tabacum is spread all over, particularly in the south.

METHODS OF CONTROL.

1. Treatment of seeds by chemical or thermic methods. During chemical disinfestation silver nitrate in a proportion of 1:1000 is applied. Seeds are kept in the preparation for 15 minutes and then rinsed in water. Formalin in the proportion of 1:50 is also used. According to data of VITIM, thermic disinfestation may be applied against bacterial and some virus diseases. Seeds are dried prior to disinfection (their moisture should not exceed 6 o/o), then dried at a gradually increased temperature to 85-90^{o} and at this temperature kept for one hour. Disinfestation of nursery equipment is performed by steam for 45 minutes.

2. Proper agricultural technique; early sowing and planting; The Institute of Tobacco and Makhorka proposed winter sowing in nurseries;

regulated irrigation in nurseries; cleaning of infested seedlings; elimination of infested stock.

3. Prophylactic spraying of seed stock with 0.5 o/o Bordeaux mixture at intervals of 7 days between sprayings.

4. Fall plowing.

5. Grass crop rotation. Leguminous-cereal mixtures are recommended as predecessor crops for makhorka and tobacco, since they improve the soil.

MOSAIC OF TOBACCO. Among virus diseases of tobacco, the common mosaic is the most widely spread disease. It affects the plants throughout the vegetation period. The first symptom of the disease is in the lightening of veins on young leaves. These acquire subsequently a typical mosaic coloring. The parenchyma tissue along the veins gets dark green, is frequently wrinkled, while parts of tissue between the veins remain pale green. Occasionally deforming of the tips of leaves is observed, the lamina of which is narrowed or its end extended into a sharp point. On fully developed leaves, especially old ones, mosaic spots are replaced by necrotic, brown, later white spots of different shape and size.

Symptoms of mosaic may be observed on flower petals.

The virus causing mosaic infects many plants of the Solanaceae and Compositae families., etc., but does not infect cucumbers.

During the vegetation period, the virus is primarily spread through some special agricultural means; i. e., breaking of leaves, pruning, etc. The virus of mosaic is very sturdy (persistent) and may remain in dry residue for many years, even in fermented and processed leaves. Dry residue, tobacco products and dust may therefore serve as sources of infection.

Mosaic affects yield and quality of raw tobacco. Dried mosaic foliage breaks easily and is difficult to process. Such leaves contain a smaller amount of nicotine and carbon.

METHODS OF CONTROL.

1. Measures in nurseries: a) disinfestation of the substrata by steam at 100° for 30 minutes; treatment of all equipment and frames with a solution of formalin (1:25), where they are kept (covered) for 72 hours; b) grass crop rotation; predecessor crops should not be Solanaceae, Compositae and other susceptible crops; c) removal and destruction of infested seed stock prior to planting.

2. Prophylactic measures in the field: a) removal of mosaic plants before each cultivating, prior to the first breaking of leaves; b) prohibition of tobacco smoking on tobacco plantations; c) use of selective method in pruning and breaking of leaves when plants are infested on a large scale.

RING SPOT AND BACTERIUM MACULICOLA DEL.

Both diseases of virus origin appear on leaves. Ring spot is characterized by the presence of locked and interrupted rings of white color. This is particularly the case on old leaves.

Bacterium maculicola or smallpox, appears in the shape of numerous small white and light brown spots. During the vegetation period, these diseases are spread by insects (tobacco thrips, aphids). Viruses winter in seeds and rapidly perish in dry residue.

METHODS OF CONTROL.

1. Thermic (dry) disinfestation of seeds by heating at a temperature of 85 to 90° for one hour.

2. Control of insects, especially thrips and aphids.

3. Use of seeds from healthy plants.

PESTS AND DISEASES OF POTATOES (p. 394-410, in part)

[Introduction (p. 391-392) and Pests of Potatoes (p. 392-394) not translated.]

DISEASES OF POTATOES (p. 394-410)

PHYTOPHTHORA.

The disease affects all above-ground parts of the plant and its tubers. It appears in the second half of summer, usually after the potatoes have bloomed. The first symptoms are observed on the lower leaves in the form of brown dispersed spots. A delicate white film bordering the infested tissue appears on the inner side of the leaves at high moisture. This film represents the conidiophores of the parasite. (Ill. 111, phytophthora of potatoes, p. 395).

The inducer of the disease, Phytophthora infestans D. B., belongs to the peronosporalles. In spreading, conidia cause mass infection of the plants. The injured leaves and stems rot, blacken, and the plant dies prematurely. Rain carries conidia into the soil through infesting the tubers. In fields it is the upper part of the tuber which is chiefly infected, when directed upwards. But the majority of tubers are infected during harvesting of potato crops because of the immediate contact with the infested foliage. The infection penetrates the tubers usually through the lenticels. The disease appears on the tubers in the form of brown, slightly indented, hard spots. Discoloration of the tissue starts on the outer layers of the tuber and gradually extends to the inner layers in the form of strands.

Tubers infected by phytophthora have poor keeping quality. In storage, a secondary so-called dry rot or fusarium, develops on such tubers. Phytophthora is therefore difficult to recognize on tubers during the second half of winter storing, since it is masked (camouflaged) by dry rot.

The disease is transmitted chiefly through seed stock in which mycelium is preserved. The parasite is capable of wintering in tubers and foliage that remain in the soil. In the spring when the diseased tubers begin to grow in the soil, mycelium penetrates the sprout. Infected sprouts get severely depressed and perish at high moisture of the soil. Their surface is covered with a conidial film. The first stage of infection, i. e., infection of the foliage of diseased tubers, is primarily caused by conidia formed on infected sprouts. In this respect tubers with hardly noticeable traits of infection represent considerable danger. These tubers have a normal growth but after 45 to 60 days following planting, the sprout becomes diseased and the infection spreads from then on. Residue of infested foliage equally contributes to the re-establishment of the disease.

Secondary infection, i. e., the infection of above-ground and underground parts of leaves, takes place with the aid of conidia which had formed on above-ground parts (leaves and stems).

The development and spread of phytophthora depend upon meteorological factors; an essential requirement is moisture of the air no lower than 70 o/o. High temperature (18 to 20°) also contributes to the development of the disease. The duration of the incubation period is determined by the temperature of the air. It has been established that at a low temperature (below 10°) or high temperature (30° and above) conidial spore bearing does not take place and the further development of the disease is thus curtailed. This uniformity in the development of phytophthora is used as a basis of prognoses or forecasts for the appearance of the disease. It has been established that phytophthora requires the following joint conditions during one of the 15 days preceding the disease: 1. median night temperature no less than 10°; 2. dew no less than 4 hours in succession; 3. high cloudiness on the following day; 4. precipitation, though not extensive. The presence of the above conditions points, however, only to the possibility of an outburst of the disease. It has been established that the duration of the incubation period and the date of the outbreak of the disease depend upon variations in temperature in the period following the "critical" day (day of joint conditions). To determine the duration of the incubation period, a special chart, nomogram, has been developed. (Ill. 112).

The calculation of the duration of the incubation period, according to the nomogram, is done in the following manner. Over a period of three days (minimum incubation period for phytophthora), following the "critical" day, observations are conducted of the temperature; minimal, median and maximal temperatures are recorded and the average temperature for the three days computed separately. For instance, a median 24 hour temperature of 17.3, a minimal of 11.3 and a maximal of 23.3° were established for the period between August 12 and 14. These three points are looked for on the nomogram. Then the nomogram is covered with a celluloid or glass plate having two perpendicular lines. This plate is turned and moved in such manner that the horizontal line crosses the minimal and maximal temperatures on the given points, i. e. 11.3 and 23.3, while the upper end of the vertical line corresponds to the (given) points of the median temperature, i. e. 17.3. In such case the lower end of the vertical line will point to the length of the incubation period and register it in days (on the lower horizontal line of the nomogram).

By using the latter, it is possible to establish periods for applying chemicals to control phytophthora.

Phytophthora is widely spread but particularly pronounced in regions where air moisture is high.

On the basis of multi-annual data gathered by the Record Service with regard to phytophthora the entire territory of the USSR can be divided into four zones.

1. Zone of total absence of phytophthora, to which belong the central asiatic republics.

2. Zone of light development of phytophthora, southern and south-eastern parts of the USSR.

3. Zone of periodically severe development of phytophthora, eastern and central regions of European USSR.

4. Zone of perennially severe infestation of phytophthora, oblasts of the non-Black Earth zone and BSSR (White Russia).

Phytophthora causes lossés in potato crops, the result of losses in yields from the premature dying of the foliage, inferior keeping quality of the tubers, their decay and reduced growth of tubers.

Phytophthora affects tomatoes in addition to potatoes. Species of wild South-American potatoes, Solanum demissum, S. antipoviczii, etc. are resistant to this disease. The above species served as the initial material for producing phytophthora-resistant varieties.

Soviet scientists were first in world practice to produce phytophthora-resistant potato varieties by crossing cultivated potato varieties (Solanum tuberosum) with the wild species S. demissum, (by following the Michurin method). Hybrids (from triple crossings) exhibited the most valuable characteristics; phytophthora and frost resistance and high contents of starch.

Selection is continued with these hybrids. At present many phytophthora-resistant varieties possessing economically valuable characteristics have been produced.

METHODS OF CONTROL.

1. Production and introduction of resistant varieties, among which the best, in economically valuable characteristics, are the following: Kameraz hybrids (medium-late); medium-early variety Moskvich (seedling 18883). Many hybrid varieties are undergoing industrial tests. Among the relatively resistant varieties are Lorkh, Woltman, Jubel.

2. Selection of healthy seed stock to prevent the transmittance of the disease through tubers.

3. Vernalization of tubers. This method provides earlier and better yields. Tubers, infected by phytophthora, decay during vernalization and can be easily discarded.

4. Fall plowing.

5. Spraying and dusting of potatoes during the vegetative period as a precautionary measure. Among fungicides, one per cent Bordeaux mixture and AB preparation are applied (12 to 15 kg/h). Chemical means are used as soon as phytophthora makes its appearance or at the end of the incubation period calculated on the nomogram. Treatment is repeated in 8 to 10 days.

6. Removal of foliage 3 to 5 days before harvesting. This measure is used in cases of severe potato infection.

7. Harvesting in dry weather, potatoes dried in the sun for four hours. Prior to storing, potatoes are dried again, sorted, and all infected and injured tubers are removed, if necessary.

8. Fall sorting of potatoes from infested plots, 3 to 4 weeks after harvesting. At that time tubers carry pronounced phytophthora symptoms.

9. Maintainance of proper conditions in storing potatoes. Warehouses must be disinfected 25 to 30 days before potatoes are stored. Temperature in storage quarters must be 1 to 3°, moisture 80 to 85 o/o.

[Pages 400-410 on potato diseases omitted]

PESTS AND DISEASES OF SUGAR BEETS (p. 410-429)

Among the multi-poisonous pests of the sugar beet are the sugar beet webworm, the cutworm moth, the gamma moth, and wireworms.

The specific pest of this crop is the common [Bothynoderus punctiventris germ], ("sveklovichny dolgonosik"), beet fleas [Chaetocnema breviuscula Fald.]; [Poecylosoytus cognatus Fieb.), "sveklovichny klop"; and sugar beet nematodes, [Heterodera schachtii Schmidt.] "sveklovichnaia nematoda."

Among the most harmful and widespread diseases of the crop are "kornéed," leaf spot, or [Cercospora beticola], and "kagatnaia gnil'."

PESTS OF SUGAR BEETS

Common sugar beet "dolgonosik," [Bothynoderus punctiventris Germ.]. A black beetle covered with grey scalse; length 12 to 15 mm.

Larvae white, legless, bent, brown head; length of adult larvae to 30 mm.

This pest injures sugar beet crops in regions where they were formerly grown in European USSR. Has annual cycle of development. Adult beetles winter in the soil at a depth of 12 to 32 cm. In the spring when the soil is heated to 10 to 12°, they appear on the surface. In the principal sugar beet growing regions, beetles make their appearance usually in April and last to the middle of May. The lengthy process is due to the gradual heating of the soil surfaces. Upon appearing on the surface the beetles feed at first upon wild growing plants of the goose-foot family (Chenopodiaceae). When sugar beet crops begin to germinate, they transfer onto them. The pre-flight period (walking stage) lasts 1.5 to 5.5 weeks, depending upon weather conditions. The flight of beetles takes place at a temperature of no less than 20°.

Beetles feed on the shoots of sugar beets, eating the lamina and petioles. Because of their voraciousness they destroy a considerable part of young plants. They present the greatest danger at the stage prior to the appearance of secondary leaves.

Eggs are laid in the upper layer of the soil, next to the roots of sugar beets, into depressions made by the trunk (proboscis) of the female.

One egg is laid in every depression. The female lays altogether 100 to 120 eggs in two and more months, daily 1 to 2 eggs. The egg develops in about 10 days. The development of the larvae stage lasts 45 to 90 days. Larvae feed on roots of sugar beets.

When roots are severely injured, the plants perish; when partly devoured, the yield is reduced and so is the sugar content. Root injury is particularly severe in dry weather. The presence of 2 to 3 larvae of medium and adult age delays the development of plants considerably; 6 larvae reduce the yield of roots 3 to 4 times, while in dry weather the same amount of larvae reduces the yield 7 times. In the event of the plant's destruction, larvae may transfer to neighboring plants.

Larvae of adult age arrange "cradles" in the soil, where they pupate upon completing their development. Beetles appearing on the 15th to 16th day remain in the soil for the winter. Larvae of medium and adult age develop in the fall even at 6^{o}, while pupae require 3 to 6^{o}, but in view of the lengthy spring appearance of beetles and egg-laying, not all larvae and pupae manage to develop into adult beetles by the beginning of the first frost.

Beetles winter alone. Larvae and pupae die from fungi diseases, known as muscardine. The winter supply of beetles remains primarily on sugar beet fields, but may also dwell upon other field crops under rotation. The pest lays eggs on all fields contaminated by wild growing plants of the Chenopodiaceae family; they also have a prolonged diapause (2 to 3 years), which in some years affects 30 o/o of all beetles. Dormant beetles remain in "cradles," where pupating took place; good and careful cultivation of the soil reduces the number of dormant beetles radically.

Variations in quantities of pests depend primarily upon the number of wintering beetles, since pupae and larvae perish from muscardine. The warmer and drier the weather, the larger the number of larvae and pupae which change into adult beetles. In cold and moist years development is delayed. In years preceding mass propagation, the death rate does not exceed 70 to 80 o/o, while under unfavorable conditions, 90 to 95 o/o of the remaining generation is destroyed.

In composing the prognosis, it is necessary to dig the soil in wintering abodes in the late fall in order to establish the different stages of the pest's development and the number of beetles per plot unit.

METHOD OF CONTROL. To protect sugar beets from this pest, agro-technical and destructive measures must be applied.

Among the latter are gathering and destruction of beetles in ditches with subsequent compulsory chemical treatment and biological control with the use of chickens. Preliminary destruction of beetles in ditches is necessary to reduce their quantities. Agro-technical methods which accelerate germination contribute to the stability of plants against injury.

1. In order not to permit the spread of pests from their wintering abodes, the ditch system is used. All old plots contaminated by the pest should be dug in early spring around their borders to a depth of 35 cm. and a width of 27 cm. at top and 37 cm. at the bottom; wells should have a depth of 25 to 35 cm. at every 8 m. distance.

In addition to these trap ditches, small ditches are dug in the center of plots at depths of 7 to 9 cm. and widths of 6 to 7 cm.; wells of 35 cm. in depth at every 4 m. These ditches are laid in one or two directions, perpendicularly to each other.

Beetles which fall into wells should be frequently removed and destroyed. Polychlorides are used in wells to poison the pests.

In order to interfere with the penetration of pests upon plantations, the latter should be dug around their borders at the time of planting. In cases of mass appearances of pests wintering on old fields (1 beetle per 1 m^2), additional small ditches are dug two or three days following planting.

2. Along with catching pests in ditches, hand picking of beetles is practiced during daily observation trips until such time that they no longer fall into ditches or are found on plantings.

3. Destruction of beetles by intestinal poisons. Barium chloride (1 o/o) is used for this purpose, sodium fluoride (0.8 o/o) or sodium fluorite (1 o/o); 110 g. of molasses are added to each pail of the mixture for better adherence. Molasses should not be added to sodium fluoride because this reduces its action. In the past years aviation spraying with concentrated barium chloride has been widely applied in the proportion of 60 l/h of the mixture or sodium fluoride (7 o/o) in the same proportion.

One may also use Paris green (0.35 o/o) with a double quantity of lime. This preparation is less effective for controlling [Bothynoderus punctiventris Germ.] than the preparations phthora and barium chloride.

Chemical control should be begun as early as possible. As soon as rows of sugar beet shoots are distinguishable, spraying of plots closest to the old sugar beet field, extending over a width of 30 m., should be undertaken every three days. With the appearance of beetles, the entire plot is sprayed at intervals of 5 days. In sections of mass infestation, spraying is done throughout the entire month. Among new poisons the dust GKHTSG is successfully applied.

4. Destruction of beetles on old fields and sugar beet plantations with the aid of chickens. Lots which are treated chemically should not be exposed to chickens.

5. Cultivating between rows in May and June, while eggs are laid in the soil.

6. On plots infested by the larvae of the pest, additional feeding is provided to accelerate plant growth and thus reduce the damage caused by injuries.

7. Application of agricultural methods (good pre-sowing cultivation of soil, planting of seeds of normal germination, careful cultivation between rows, etc.), which ensure early, sturdy and close plant growth. It was established that in cases of irregular appearance of germinating shoots, beetles manage to cause considerable injuries even when present in small quantities.

[TANYMECUS PALLIATUS FABR.] ("Sery sveklovichny dolgonosik"). Distributed widely; injurious to sugar beets in particular regions of Eastern USSR, Voronezh oblast and Altai territory. In addition to sugar beets, it damages sunflowers, safflower, gambo hemp ("kenaf"), coriander, poppies, leguminous, etc.

The beetle is grey, twice as small as the common "dolgonosik," but just as injurious since it feeds on the shoots of young beets.

It lays its eggs in the soil; fertility of the female produces 300 eggs; larvae feed on roots of various weeds; they interrupt their development in the fall; winter and pupate in July of the following year; beetles appear in August but remain in the soil during the winter and appear on the surface only in the spring. The cycle of development is bi-annual; injurious at adult stage.

METHODS OF CONTROL.

Measures are practically the same as those applied against the common "sveklovichny dolgonosik." Green poisoned attractants are also used against this pest, prepared from fresh leaves of thistle, goosefoot, and other weeds, moistened in a 1.5 o/o solution of sodium fluoride. Attractants are laid in heaps at 2000 g. each in checkerboard every 6 to 8 m. in places where beetles accumulate most. Good results are obtained from green attractants dusted with GKHTSG (12 o/o) [CHAETOCNEMA BREVINSCULA FALD.] ("sveklovichnye bloshki").

Sugar beets are injured by two species of these pests, [Chaetocnema concinna Marsh.] (buckwheat) and the southern sugar beet beetle [Chaetocnema breviuscula Fald.]. These are small beetles of black color of green or red-bronze shine, of a length of 1.5 to 2.3 mm. The two species differ in the details of their external structure.

The buckwheat beetle injures sugar beets, buckwheat, rhubarb and garden sorrel. Spread in southern regions of European USSR, the Caucasus and Siberia.

The southern beetle [Chaetocnema breviuscula Fald.] damages sugar beets and is widespread in the Northern Caucasus, the south-eastern regions of USSR and Altai krai.

There is much similarity in the development of these beetles. Adult pests winter and in the spring damage shoots of sugar beets, eating sores into the leaves. When infestation is severe, the young plants die. The southern beetle occasionally consumes the top bud, causing the plant to perish.

By the end of spring, the beetles disappear, dying in the natural course of events, following their egg-laying (in the soil near the plants). The larvae of the buckwheat beetle feed on roots of buckwheat plants, while those of the southern beetle eat roots of sugar beets; they pupate in the soil and new beetles make their appearance in July and August. They feed at that time on plants, though the damage they cause is not particularly noticeable. Appearing in masses in the spring, they may cause a great deal of injury and damage the sugar beet crop.

METHODS OF CONTROL.

1. Agricultural methods ensuring the rapid growth of plants in the spring.

2. Dusting of plantings of sugar beets with sodium fluoride and calcium arsenate (8 kg/h), as well as with the dust GKHTSG (20 kg/h).

[POECILOSCYTUS COGNATUS FIEB.] ("sveklovichny klop") One of the most injurious pests of sugar beets in the Eastern steppe regions of the Ukraine, Voronezh oblast, Krasnodar krai, Central Asia, Western Siberia. Great damage is particularly caused in the Altai krai.

The adult pest [Hemiptera] is small, of variegated coloring. Length 3 to 5 mm. Larvae is green with red eyes; length 3.3 mm.; egg of oval shape, slightly bent, at first light yellow, then orange yellow; length 0.95 mm.

The pest is multi-poisonous. In addition to sugar beets, it injured flax, hemp, sunflowers, mustard, soya, alfalfa, veitch, peas, lentils. It develops two generations; the eggs winter in alfalfa and other wild grown plants; in the spring larvae appear, developing within a month on perennial leguminous grasses and weeds. At the end of May the adult pest flies over to sugar beet fields and feeds there, sucking the juices of leaves. They are of special danger to young plants which become colorless, blacken and dry out. On more advanced plants only the injured foliage dies.

Females begin to lay eggs one week after reaching maturity, placing them in veins and petioles of leaves; several eggs are laid close to each other in the form of a chain or small group.

Larvae appear on the 5th to 15th day. They suck the more tender central leaves, causing them to dry out and stopping their growth; runners are equally damaged; adult pests of the second generation appear by the end of July. By that time sugar beets harden and become unfit for consumption, while the pests fly over to alfalfa fields and other weeds to lay their winter eggs.

As a result of leaf injuries, the weight of sugar beet roots is reduced and so is the sugar content. Yield of seeds is diminished, seeds getting smaller, are sickly and of low germination.

METHODS OF CONTROL.

1. Destruction of pests by chemical methods. Dusting with DDT, GKHTSG, nicodust (4 o/o) and anabadust (5 o/o). Spraying with anabasine or nicotine sulfate with soap. Liquid solutions of 0. 75 o/o of anabasine sulfate or 0. 5 o/o nicotine sulfate with an admixture of 2 o/o of soap

are used against adult pests, in the proportion of 650-700 l/h. Against larvae, the solution of 0.12 o/o of anabasine or 0.1 o/o nicotine sulfate with 0.4 o/o of soap, in same proportion.

2. Planting of sugar beets at earliest possible periods and the application of the entire complex of agricultural methods to ensure rapid growth of plants.

3. Systematic control of weeds. In areas surrounding plantings, careful extermination of wild grown vegetation is recommended. In the Altai krai residue is burned in the fall or early spring at a radius of no less than 3 km. from the field.

4. Close cutting of alfalfa in the fall, to prevent eggs from wintering in the field.

5. During spring harrowing of perennial grasses, injured plants should be gathered and burned.

6. Picking of pests with nets.

[HETERODERA SCHACHTII SCHMIDT] ("sveklovichnaia"). belongs to round worms; in adult stage reaches 1.5 mm. Lives in the soil and injures the root system of sugar beets, causing particular harm in old sugar beet fields.

The wormlike larvae move in the soil and knock against the roots of beets, digging into them. Feeding is done at the expense of the parenchyma of bark. Larvae thicken and take on a "bottle" shape. In succeeding development part of the larvae are transformed into mobile wormlike males, the other into immobile females with blown-up bodies which cling to the roots. The females are at first under the skin of roots which gradually swells; when the skin bursts, they come out and appear in the form of white grains. At this time fertilization of the females takes place. Fertility of females amounts to 250 to 300 eggs, which are laid in the soil. Under unfavorable conditions the outer cover of the female gets brown, dies and forms a so-called cyst, within which eggs may be preserved for as long as 6 years. Larvae appear from the cyst not at once but in parts over a period of years, 50 to 60 per year. Their exit from the cyst is aided by root hairs of plants. In certain sugar beet growing regions of the Ukraine, there may be 4 to 5 generations of nematodes.

They most frequently are found on low and moist plots. As a parasite of the sugar beet, the nematode may develop on different plants of the Chenopodiaceae family, Compositae and saltwort ("solianka"). Leaves of plants injured by the nematode fade and dry. In severe cases of infestation plants perish.

Injured rootlets of sugar beets die as a result of sucking, and in their place are formed new rootlets in the shape of warts. Much nutritional element is spent on the formation of new rootlets, as a result of which they develop weakly and their sugar content is reduced. Roots injured by nematodes are unable to stand prolonged storage.

Nematodes are spread by water, wind, agricultural implements, seeds, whenever harvesting is done carelessly and the latter are soiled by infested soil or plant residue.

METHODS OF CONTROL. Agricultural methods are used primarily at present in the control of nematodes.

1. Introduction of crops into crop rotation not susceptible to injury and at the same time reacting negatively to nematodes. To these

crops belong wheat, barley, corn, clover, flax, veitch, chickory, sweet clover. On these cultivated plants the nematode does not feed, but the "discharge" of their roots stimulates the exit of larvae from cysts which perish not finding any forage.

In cases of severe infestation of plots by nematodes, sugar beet plantings should not be returned upon the old field any earlier than after 7 to 8 years.

2. Careful destruction of weeds of the Chenopodiaceae family, Compositae and saltwart, which contribute to the development and propagation of sugar beet nematodes.

3. Introduction of fertilizers (nitrogen, phosphorus, potassium) which do not affect nematodes directly but in contributing to the development of sugar beets reduce their damage.

4. Deep plowing under non-susceptible crops. This measure is based on the better aeration of the soil, which contributes to the mass exit of larvae (from cysts) which get onto plants that cannot feed them.

5. Disinfestation of residue of sugar beets at industrial plants from possible cysts of nematodes. Lime is used for the purpose in the proportion of 1 to 6 of residue. Mixed residue is kept for three years in compost piles. Nematodes perish because of alkaline environment during this time.

6. Gassing of the soil with chlorolpicrin (400 to 800 l/h) destroys sugar beet nematodes. This rethod has up to now not received sufficient recognition and use.

7. Control of seed stock to prevent bringing in of nematodes into new regions, particularly from old sugar beet fields.

DISEASES OF SUGAR BEETS

ROOT-EATER OF SUGAR BEETS.

Seedling gets brown and so does the root collar of young shoots. Usually primary bark of the shoot is affected. Side roots do not develop in injured plants, while germination is delayed. In cases of severe infestation, when it penetrates into the central vascular bundle, the upper part of the plant wilts, dries out and rots. Infestation by "korneed" is limited in time; it occurs only in the stage of germination before the primary skin of the root is shed, i. e. prior to the appearance of the third and fourth pairs of genuine leaves.

The principal reason for the disease is found in unfavorable soil and meteorological conditions, the negative action of which upon the plant is expressed in the retardation of growth and the delay of the critical period most suitable for infestation by micro-organisms.

These conditions are created in heavy, non-structural, moist soils. Because of the lack of aeration and increased acidity characteristic of heavy soils, physiological processes are disturbed in the plant and it becomes depressed. In this condition a plant is easily susceptible to infestation by various semi-parasitic micro-organisms.

Among the most active organisms causing "korneed" are [Pithium de Baryanum Hesse] and [Aphanomyces cochlioides Drechs.], which are capable of infesting plants of normal development. [Pythium de Baryanum] belongs to peronospore fungi.

Parthenogenic propagation is through zoosporangia, more seldom conidia. The parasite winters in the soil in the stage of oospores. The subsoil part of the plant is primarily affected.

[Aphanomyces cochlioides] belongs to phycomycetes; it has cylindrical zoospores and ball-like oospores. This is a soil parasite. It infests young shoots and plants having even 3 to 4 pairs of leaves. The stem in the root collar is affected, occasionally even petioles and cotyledons.

Plants of weak development may become infested by [Phoma betae Frank] and other semi-parasitic fungi. Ph. betae belongs to inferior fungi. Its fruit bodies contain small uni-cellular spores. The parasite is preserved on post-harvested residue and in seeds.

Heavy precipitation contributes to the development of "korneed" during the period of germination of sugar beets. The condition of germination and degree of infestation by the disease depend also upon the quality of seeds. Seeds of low germination and little energy in growth produce irregular, weakly developing shoots. They rapidly succumb to infestation by "korneed."

The influence of the disease upon plants is determined by the time and degree of their infestation. Early infestation of seedlings is frequently accompanied by their destruction and thus leads to thinning of plantings. Even in cases when a diseased plant continues to develop, the disease has its effect upon the yield. Those plants are delayed in growth, have reduced sugar content, are occasionally deformed.

General losses caused by this disease are frequently considerable.

METHODS OF CONTROL. The control of this disease should be primarily directed towards creating better conditions for the development of plants. Of exceptional significance in control are agricultural measures.

1. Grass crop rotation, during which sugar beets follow winter or summer cereal crops. Such crop rotation established favorable conditions

for the development of sugar beets and thus increases their resistance to the disease.

2. Fall plowing and spring cultivation prior to sowing.

3. Introduction of fertilizers increases the development of plants and their resistance. Among fertilizers, potassium phosphates are specially recommended. On heavy soils, manure and lime are introduced in the fall to improve the physical composition of the soil.

4. Sowing with healthy, full-weight seeds. Moistening of seeds and vernalization are recommended since they reduce the critical period of infestation. As shown by the academician Iakushkin, vernalization of seeds of sugar beets increases the percentage of "tsvetukha" only in the northern regions of sugar beet growing.

5. Pre-sowing treatment of seeds with NIUIF-2 in the proportion of 0.5 kg. per one centner of seeds.

6. Early cultivation which aids germination; keeping the soil friable.

7. Additional feeding in the early stage and through the vegetative period.

8. Drainage of wet soils, adjoining ground waters.

[CERCOSPORA BETICOLA] (or spottiness of leaves of sugar beets).

Belongs to the number of widely distributed and harmful diseases of sugar beets.

Appears in the form of spotted leaves, more seldom petioles and stems.

Numerous small, round spots appear on the leaf lamina. They are brown at first, later grey with sharply red-brown border. The size and character of spots may vary. Thus on old leaves they are larger of vaguely outlined wide, light, brown border. In the fall spots are very small. On petioles and stems spots are elongated. In cases of severe infestation, when 30 to 40 o/o of the leaf surface is covered with spots, the leaf dies.

But even a partial necrosis of the tissue reduces assimilation. [Cercospora beticola] develops primarily in the second half of the summer, reaching its maximum in August. The disease is caused by the fungus [Cercospora beticola Sacc.] of the hyphomycetes group. Conidial sporebearing of the parasite appears in the form of a grey film in spots, on the lower side of leaves. They consist of bundles of unbranched, slightly bent, light brown conidia bearers with conidia. The conidia are colorless, elongated with several perpendicular partitions. The fungus, by producing abundant sporebearing on leaves, causes mass infestation of plants through conidia. The latter retain their viability only for 1 to 4 months. The wintering stage of the parasite consists in sclerotial accumulations of mycelium which form on infested residue. Infested leaves that winter on the surface of the soil aid the return of the disease in the following year. The fungus perishes rapidly when the injured foliage is subjected to decomposition.

Infestation of plants and degree of development of cercospora depend upon the moisture and temperature of the air. Germination of spores takes place at moisture of 90 o/o and over. High moisture contributes to plant infestation. The most favorable temperature for infestation is 15 to 20^{o}, the minimal 5^{o}. The duration of the incubation period is also determined by temperature conditions and thus also the beginning of secondary infestation. The shortest incubation period (7 days) may take place at an average daily temperature of 20°, the minimal at no less than 10° and maximal no higher than 25°. At a reduction of median temperature and at sharp variations between minimal and maximal temperatures the incubation period is increased.

Table 10

DEPENDENCE OF INCUBATION PERIOD OF CERCOSPORA UPON VARIATION IN DAILY TEMPERATURE

Temperature of the air			Duration of incubation period in days.
Median	Maximum	Minimum	
20°	no higher than 25°	no lower than 10°	7
20	25-30	same	9
19-22	30-35	"	10-11
23-26	above 35	"	12-15
16	not above 30	ab. 10	13-14
16	same	10-5	to 20
13-16	"	below 5	20-30 and over

The incubation period is increased when nitrogen is lacking in the soil and because of the infestation of young leaves. Cercospora is spread in sugar beet regions and causes particularly heavy damage in Krasnodar and Primor'e krai(s), where conditions of increased moisture and optimal temperature contribute to the rapid course of the disease and mass infestation of plants.

The injuriousness of the disease is caused by the disruption of the process of assimilation in infested leaves which leads to the reduction in sugar content in the roots. In addition, untimely dying of diseased leaves leads to the accelerated growth formation of new leaves which absorb the supply (stores) of sugar in roots.

METHODS OF CONTROL. Control is conducted by chemical and agro-technical measures, the principal role of which is to destroy the foci of infection and preserve the plantings of sugar beets during the period of vegetation. The following measures are recommended:

1. Dusting or spraying of plantings with copper preparations. The most effective preparation is 1 o/o Bordeaux mixture. High efficacy is obtained from the copper-lime powder, consisting of one part of copper sulfate and 4 parts of lime-"pushonka."

The first chemical treatment is performed at the first symptoms of disease on leaves, which usually coincides with the period of closing of rows of sugar beets.

Periods of successive treatments are determined by air temperature. Sample periods are: every 10 to 12 days after the preceding spraying, if normal summer temperature prevails; every 15 days if maximal temperature reaches 35^{o} or minimal 8^{o}; every 20 days if minimal temperature is lower than 5^{o}.

Chemical measures are conducted usually following precipitation (rains, fogs, dew); primarily on those plots where the danger of infection and development of disease is greatedt, i. e. close to old fields near reservoirs or valleys.

In hot, dry weather chemical treatment is not required since the disease does not develop under those conditions.

2. Harvesting and ensilage of foliage. Destruction of unsuitable reside.

3. Fall plowing.

4. Additional feeding with organic and mineral fertilizers.

"KAGATNAIA GNIL'" of SUGAR BEET. (Sclerotinia...)

Prolonged storing of sugar beets is of particular significance in the sugar industry. The introduction of rational methods of storing sugar beets offers the opportunity to increase the productive period of sugar plants.

Large losses are observed during winter storing of beets, connected on one hand with the natural loss of various elements (water, sugar, etc.); on the other, determined by the activity of various micro-organisms. In the roots of stored sugar beets accumulation of sugar is stopped and subsequently, in connection with intensified breathing and other physiological processes, reduction in sugar content follows. The water regime of roots is also disrupted; there is no supply of water coming from outside, while evaporation is intensified. These processes all reduce turgor of cells and thus the resistance of roots to micro-organisms. Wounds are particularly contributing to the penetration of the latter, and are caused usually by cutting roots and leaves. As a result of injury by various micro-organisms, fungi and bacteria, complex rot results, the so-called "kagatnaia gnil'". The process of the rotting of roots begins in the fall under the influence of fungi.

The most active inducers of rot are [Botrytis cinerea] [Phoma betae], various species of Fusarium, mukorovye fungi, etc. The greater part of the above species is carried into warehouses with residue of foliage and soil, but some species, i. e. Phoma betae, penetrate into roots during the vegetative period and continue to develop in storage. The development of bacteria is observed primarily in the spring, when roots are weakened by the preceding processes (loss of turgor, infestation by fungi).

Increased moisture and temperature contribute to the development of this disease. The activity of fungi organisms is increased by increased acidity of the environment; bacteria demand alkaline surroundings.

METHODS OF CONTROL. Study of the physiological processes in stored sugar beets permitted the proper approach for controlling the crop in storage. The measures aim at preserving sugar beets from infestation and creating conditions unfavorable for the development of micro-organisms. The following measures are being used:

1. Timely harvesting of sugar beets, depending upon the degree of their maturity, ripeness and conditions of harvesting.

2. Storing of sugar beets should follow their digging as closely as possible, since a considerable interim between the operations leads to wilting of roots.

3. Proper cutting of foliage in digging. It has been established that in cutting roots at an angle, they are preserved better than if cut flat, because in the former case the more resistant part of the root is preserved. Better keeping quality is observed when the central bud alone is cut (according to the Iarmoshchenko method).

4. Careful elimination of injured beets and of those where the roots are hollowed. Nor should frozen sugar beets be ever stored.

5. The periods of storing sugar beets (prolonged and short storing) should be established depending upon the quality of the crop. During storage a phytopathological analysis of roots should be made to judge their condition. A chart should be kept of this data for further guidance (information) on the treatment of beets.

6. Proper conditions of storing: optimal temperature in storing in the winter at about 0°; in the fall and spring at 3 to 4°. Regulating of temperature by ventilating pipes and channels.

7. Disinfection of roots before placing them in storage. The best disinfectant is slaked lime and defecation slime. The latter represents residue from the sugar industry containing up to 60 o/o of lime, primarily carbonic acids. The application of these compounds is based on their alkaline content which delay the development of inducers of "kagat" rot, fungi. In addition, these compounds interfere with the germination of root crops, prevent them from wilting and increase the sugar content in processing.

Lime is applied in the form of lime "milk." The latter is recommended whenever sugar beets are harvested at high temperatures and also when wilted beets are used. Spraying with lime liquid is done in "kagats." Dusting of roots with lime powder or defecation slime when placing root crops in "kagats." The expenditure of lime is 0.4 to 0.5 o/o in dusting and 0.2 to 0.25 o/o in spraying, depending upon the weight of the crop. Defecation slime is applied only after airing, since in a fresh state it contains a large quantity of bacteria. The amount used is 0.4 o/o, depending upon the weight of beets.

The above disinfectants should under no circumstances be used in treating frozen beets. The dead tissues of such root crop are quickly infected by bacteria, the development of which is hastened by the application of alkaline compounds, such as lime and defecation slime.

End of Chapter

TJH: 31 July 1951

Chapter Thirteen

ORGANIZATION OF PEST AND DISEASE CONTROL OF AGRICULTURAL PLANTS (p. 623-637)

Pest and disease control of agricultural plants is exercised under a plan in the USSR and is compulsory for all collective, state and other farms.

To correlate planning, the administration of general supervision for the organization of control set up a Department of Pest Control at the Ministry of Agriculture of the USSR; at republic, krai and oblast agricultural administrations, special departments and groups devoted to pest control were organized, and at regional agricultural branches and individual MTS, the services of agronomists, specialists in plant protection, were made available for direct supervision of work in this field at collective farms.

To aid the respective sections on pest control in their planning and to provide effective guidance in plant protection, a special Signalization Service was established to offer prognoses on the appearance of pests and diseases. This service is located at observation points. Every republic, krai and oblast of the Union maintains several observation points which are in close contact with collective farms and where entomologists and phytopathologists are at work.

The task of observation points is to provide estimates on infested areas, to sound signals on the appearance of pests and diseases, announce dates for their control, conduct surveys and estimates on the efficacy of applied measures and compile prognoses concerning the potential appearance of pests and diseases based on regular observations.

Observation points depend in their work upon information obtained from correspondents among collective farmers. The latter, guided by special instructions of the Government, inform observation points of the appearance on their farms of pests and diseases of agricultural plants.

Information collected by observation points and collective farmer-correspondents is processed at oblast agricultural departments, of both republic and Union Ministries of Agriculture. The data is used for planning and guiding pest and disease control.

A Plant Quarantine Service is organized within the Ministry of Agriculture of the USSR, to which inspectors are assigned at all republic, oblast and regional centers, as well as at USSR boundaries, for the administration of quarantine measures. The Ministry of Agriculture of the USSR organized special expeditions destined to destroy mass pests, such as locusts and ground squirrels on territories outside of collective farms.

The civilian aviation fleet participates in large measure in practical control; it maintains special squadrons of airplanes for pest and disease control of agricultural plants. The airplanes are used in controlling locusts in their foci, as well as against pests and diseases on collective and state fields, orchards and vineyards.

Plant protection in the Soviet Union has a scientific foundation. The All-Union Institute of Plant Protection was organized for this purpose within the network of VASKHNIL and operates with stations of its own. In addition, sections on plant protection at special agricultural institutes and their respective zonal stations are engaged in studying pest and disease control of agricultural plants.

Specialists in plant protection are trained at the Institute of Applied Zoology and Phytopathology at faculties in plant protection at agricultural institutes and departments in plant protection of agricultural technical schools. Mass personnel on plant protection receive their training at corresponding regional and oblast courses.

Plant protection is organized in a manner to meet widely and effectively the demands of socialist agricultural production and to aid collective farms in controlling pests and diseases of agricultural plants.

Collective farms engage in plant protection at their own expense and provide their own labor supervised by the regional sections of agriculture and MTS.

Every household is required to compile a working plan for pest and disease control and put it into practice. Special farm workers are selected who were trained at courses conducted during the winter for this purpose. These workers are authorized to organize pest control and supervise all practical measures undertaken at collective farms, as well as to carry the responsibility for the storing and expenditure of poisons.

The duties of collective farmer-organizers of pest control are : to survey their fields with respect to infestation by pests and diseases; familiarize collective farm brigades and units with the technique of control to be applied on plots assigned to them; to maintain records of the efficacy of practical measures; submit summaries concerning pest and disease control, and records on the expenditure of poisons to MTS and regional sections of agriculture.

A collective farm plan on pest and disease control is necessary to foresee the volume of work, the quantity of chemicals and apparatus (equipment), labor strength (in working days), hauling strength (in horse-days) and required equipment for conducting the work, and to determine the dates for introducing control.

Special surveys of pests and diseases of agricultural crops are made to determine the volume of the work. These surveys which concern the contamination of the territory by pests are usually conducted in the fall when injurious insects are dormant. The quantities of wintering masses of insects are established directly in their wintering places (hide-outs) which may be soil, plants or parts thereof and post-harvesting residues.

The following methods are used to record the majority of pests wintering in the soil. The plot under survey is laid out in checkerboard, $0.25\ m^2$ (50 x 50 cm.), squares at even distances from each other; these are dug to a depth of 20-30 cm. and the insects counted in each square. On sugar beet farms it is customary to divide plots of 10 hectares into 8 lots; plots of 11 hectares into 12 lots; plots of 51-100 hectares into 16 lots, and plots exceeding 100 hectares are assigned four additional lots for every 50 hectares above 100 hectares.

The degree of pest population per plot is expressed in averages arrived at from one m^2. Thus, if in 8 tests were found a total of 30 wireworms, the index for the plot contaminated by this pest will be 15 wireworms per one m^2.

Locusts are recorded differently and their number determined according to hills(?) "kubyshki", in the places they are found. In the summer the flight of locusts is watched to establish places where eggs are laid. In the fall soil tests are taken from the designated lots of 0.25 m^2, 5 cm. deep, every 50 to 100 steps, by passing the plot in two perpendicular directions. A boundary of foci is considered the place on which tests did not show hills. Degree of contamination is determined by the average number of hills per 1 m^2.

It is possible to judge pest population in the soil indirectly by the degree of contamination of individual plants, such as in plantings infested by caterpillars of the cutworm moth, [Agrotis segetum Schiff], wireworms, etc. In that case 8 lots at 0.25 m^2 each are selected in an area planted with cereals, all distributed in checkerboard. In surveying plants within the limits of each lot, the degree of infestation is established by a three-grade scale. Grade I indicates losses of 25 o/o; grade II, losses from 25 to 50 o/o; grade III, those exceeding 50 o/o. On plowed or leguminous crops, 200 plants are examined for this purpose; plants are examined on ten squares in checkerboard; at 20 plants on each: Grade I, indicates losses of 10 o/o; grade II losses of 10 to 20 o/o; grade III above 20 o/o. The average index of injury is established from the average grades obtained from all surveyed plants.

The percentage of populated plants is established when insects winter. Thus, in examining winter crops on every surveyed plot, 200 plants are taken for tests in checkerboard at 20 plants each. In the event that insects are hidden inside the plants, the latter are opened. This procedure is used when winter crops are infested by the Swedish fly, [Chlorops pumilionis Bjerk], etc.

When pests winter on post-harvest residue, the latter is equally examined. Thus stores of the cabbage aphid, [Brevicaryne brassicae L.], are determined by examining cabbage cores on which females lay their eggs in the fall. For this purpose 20 to 40 cabbage cores, distributed in checkerboard at equal distance, are taken, the percentage of populated cores determined by examination, the number of eggs counted, and the average population of eggs on each core thus established.

Whenever it is not possible to determine the quantities of pests in their wintering abodes, the number of insects should be recorded before they enter the winter stage. Thus the cabbage worms, [Pieris brassicae L.] winter in their pupae stage on trees, in barns, under window cornices, and it is therefore difficult to estimate their number. The quantities of these pests should therefore be recorded before caterpillars change into pupae. Fifty to 100 plants are examined on every lot under survey for this purpose. On crops with a dense grass stand, such as flax, insects are counted not on individual plants but on lots of 0.25 m^2; there are 4-8 of these recorded lots on a plot under survey. If counting of pests presents difficulty, because of their small size (aphids, red spider), the quantity of pests is estimated according to degree of population or degree of injuriousness caused to plants; the population or injury caused to every plant is expressed tentatively. Thus, in recording cabbage aphids, the following scale has been accepted: I for single specimens found on a plant; II for colonies of aphids on individual leaves of a plant; III for colonies of aphids found on the majority of leaves of a plant.

In recording wintering pests, the stage of development of insects should be taken into consideration, the age of the larvae, the infestation of insects by parasites and diseases, etc. Thus the cutworm moth winters only in its mature caterpillar stage, while caterpillars of young and medium ages die out. The destruction of insects caused by parasites and different diseases can be very large. To establish the condition of insects that winter, checks are made in the spring when the destruction of insects from various causes (diseases, parasites, unfavorable conditions in wintering) can be established. Spring checking is done by the same method, but on a smaller number of plots.

Recording of mice-like rodents is done at their habitats. Plots and the number of burrows are segregated for this purpose. A plot under examination should be no smaller than 0.5 o/o of the surveyed area. Thus if a field of 100 h. is examined, the size of the recorded plot should be no less than 0.5 hectares. The latter represents a narrow strip which diagonally crosses the entire plot under survey from corner to corner. One worker pulls the "ogranichitel'" (2-meter), used to measure land plots, the other in back of him counts the number of inhabited and uninhabited burrows within the limits of the two meter strip. Prior to the survey all burrows are covered up. In recording, dug-up burrows are counted as inhabited, covered ones as uninhabited. The index for plot infestation is determined by the number of inhabited and uninhabited burrows in relation to one hectare.

In surveying ground squirrels, a plot of 0.5 hectares is taken for every 100 h. and the number of burrows counted; or after passing 1000 m., the number of burrows is counted on a strip 5 m wide, at 2.5 m in every direction. In this case the under area immediate surveyed will also equal 0.5 hectares. The number of inhabited burrows is established by covering all burrows.

Surveying of fields with respect to infestation by disease is primarily made during the vegetative period. In order to establish the spread of the disease, samples of plants are taken from which the percentage of infestation is determined. The samples are distributed diagonally. The number of samples and plants in the sample differs depending upon the disease. Thus in recording smut of cereals ,100 samples, at ten to fifteen plants each, are taken for every test. The number of infested stalks are counted. In establishing the percentage of infestation the number of infested plants is divided into the general number of surveyed plants and multiplied by 100. For instance, if all plants in 100 samples amounted to 1500, and 8 were infested, the percentage of infection would be $\frac{8 \times 100}{1500}$ or 0.53.

In diseases distributed in foci, such as dodder [Cuscuta europea] and flax wilt [Fusarium lini], the foci of diseased plants are counted. The size of foci is established according to Table 11.

Table 11

Width in paces	Area in Sq. Meters	Width in paces	Area in Sq. Meters
1	0,2	6	6,7
2	0,75	7	9,7
3	1,7	8	12,0
4	3,0	9	16,2
5	4,7	10	28,7

In estimating the entire infested plot, areas of all foci are totalled.

Degree of plant infestation is established by various methods depending upon the nature of the disease. In some instances the number of infested organs is counted, such as stalks with sclerotia of ergot, stems of potatoes infested by black leg, etc. In other diseases the degree of infection is established by special scales.

In estimating the degree of rust infection the following scale is applied:

1. Light infection; foliage or stems covered with single pustules.
2. Medium infection, pustules of rust form small groups;
3. Severe infection, surface of leaf or stem densely covered with rust pustules.

To provide a more precise definition of the degree of infestation by rust, the VIZR scale is used.

The estimate of degree of spotting in foliage is made according to the following scale: Light, one quarter of all leaves infested; medium, one quarter to one half of foliage infested; severe, infestation exceeds one half. The estimate of contaminated plantings is made during the period of maximum appearance of the disease. Thus diseases of cereal crops are estimated in periods of milk stage; diseases of flax in early yellow stages, etc. Diseases which are not noticeable or cannot be observed above ground, such as club root of cabbage, various species of potato scab, etc., are estimated after harvesting by examining the diseased organs.

In order to establish the distribution of pests and diseases in a territory and to identify their principal foci, surveys are conducted on all plots of a farm. Having identified the species of pests and diseases upon examining the winter residues and data on their infection of agricultural crops during the period of vegetation, the farms propose concrete control measures concerning pests and diseases in conformance with the decrees of MTS and agricultural organizations. All chemical, agro-technical and mechanical measures should be applied at definite periods and should, if possible, be applied.

The schedule listed below, composed for pest and disease control of cabbage plants, will serve as an example, as applicable to collective farms in the Leningrad oblast.

PERIOD OF SPRING PLANTING.

1. Mordant treatment of cabbage seeds by chemical or thermic methods (bacterium and fungi diseases).
2. Replacement of soil in greenhouses (club root of cabbage, black leg and other diseases).
3. Liming of soil in greenhouses in the proportion of 1.5 - 2 kg per frame for 10-15 days prior to sowing, as well as on plots above ground intended for cabbage, in the proportion of 5 - 10 tons per hectare, depending upon the acidity of the soil (to control club root of cabbage).
4. Rejection of cabbage seedlings infected by club root.
5. Prophylactic dusting of cabbage seedlings with the preparation DDT in greenhouses immediately prior to their planting in open ground.

PERIOD OF CARE OF CROP.

6. Early periods of planting (cabbage fly /Hylemyia brassicae Bouche/ and club root of cabbage, bacterium, etc.)
7. Timely hoeing and hilling (cabbage fly, club root of cabbage).
8. Dusting of cabbage with the preparation GXTSG or strewing it under the plant during early egg laying of the cabbage fly (against cabbage fly and cruciferous moths, cabbage moth, etc.)

9. Crushing of eggs and young caterpillars of the cabbage worm [*Pieris brassicae* L.], and [*Barathra brassicae* L.] during the "binding" cabbage heads.

10. Autumn plowing (pests and diseases preserved in the soil or above it.)

Agro-technical measures (periods of sowing, cultivation of the soil, etc.) are of significance in protecting harvests from pests and diseases and should be included in farm plans.

The required quantity of control methods, material, equipment, labor and freight strength is determined by the composition of species of pests and diseases, the size of infested areas, quantities of sowing stock, cubage of storehouses, methods of control, periods of cultivation, the general organization of the work. In determining quantities of poisons, it is necessary to consider the methods for applying the specific preparation, it's concentration and dosage, the size of infested plots and the stages in plant development. Let us illustrate by an example of spraying and dusting with calcium arsenate of orchards of different ages. In spraying gnawing insects this preparation is used in a concentration of 0.3 per cent, of which in a ten-year old orchard 100 liters are expended, and in a 25-year old orchard, 600 liters per hectare. It follows that in the first orchard 900 grams are required per hectare; in the second, 1.800 grams. In dusting a ten-year old orchard, ten kg per hectare are necessary; in a 25-year old archard, 45 kg per hectare. This indicates that dusting takes a much larger amount of arsenate calcium, which should be considered in computing quantities.

The necessary amount of equipment for chemical control depends upon the latter's strength and the time of it's use.

To determine the required number of apparatus, the size of the plot under treatment is divided in hectares, by computing the output of apparatus and the number of days during which the control is applied. Thus to spray an orchard of 60 hectares for 5 days with the sprayer OBP, (to cover 2 hectares) 6 pieces of apparatus are needed.

Labor for servicing control varies depending upon the methods used. Mechanical measures produce the largest output; chemical methods are chiefly mechanized and applied with a relatively limited labor force. To service apparatus different quantities in labor personnel are required, depending upon their construction. Knapsack apparatus can be serviced by one laborer, and another special worker assigned to prepare the mixture for ten pieces of apparatus.

The motor-driven sprayer "Pioneer" requires the help of 6 laborers. Two horses are needed to move the equipment. To service the mordant-treating machine PSP-05 two laborers are needed; for the machine AB-2, of a productivity four times as large, 4 laborers. The greater the output of a machine, the smaller is generally the number of laborers.

Pest control requires other means; necessary chemicals, repair of equipment, and implements such as pails, barrels, etc.

Collective farm brigades must be organized at the beginning of the vegetative period for regular observation of pests and their development and better eventual control.

In order to ensure the completion of measures within definite periods and produce high quality work, the placement of control apparatus and the distribution of labor must be properly organized. Workers from the brigade are selected for the purpose to service the equipment, prepare components and transport water and material.

The organization of crews for the following treatment may be cited as an example. It is recommended to create detachments of 12 laborers to deal with knapsack sprayers for ten apparatus under field conditions, 10 laborers per apparatus, one laborer for preparing compounds, another to transport water. In spraying with horse-driven apparatus OK-5.0, the crew is assigned three apparatus and 8 laborers. For treating ground squirrels with mordants (chlor picrin), crews of 35 laborers are used; 20 men for applying, treatment, 10 for digging, 4 for the preparation of chemicals, one for driving.

In locust control with poisonous attractants, crews of 26 laborers are used, 20 to distribute the chemicals, four to prepare them, one driver to transport water. The above plan is tentative and requires specification, depending upon particular conditions. In organizing a crew the different types of tasks should correlate, supplement each other and the entire performance proceed without interruption.

Periods in providing control are of decisive significance. When delayed or extended they are a considerable part and occasionally the entire harvest ~~are~~ may be lost.

Pest control is applied in periods which ensure the timely liquidation of pests. Thus the destruction of the asiatic locust in low lands should take place immediately following the appearance of larvae and end in the pre-last larvae stage in order that locusts be destroyed not only before they reach the wing stage but to aid the control survey and destruction of the remainder of "kuligi"--. Periods for conducting control surveys of pests in dormant stages depend upon the duration of the latter. Thus the elimination of winter pests of the pierid butterfly and brown-tail moth may be done in early fall until spring. This measure is usually timed to the snow season, however, when all nests are easily gathered from the snow. For controlling fungi diseases the time for conducting control surveys is equally decisive. Spraying and dusting with fungicides are primarily intended to prevent the development of disease. Poison should be administered to plants prior to spore development. Once the latter develop and mycelium penetrates into the plant tissue, all measures become futile.

Periods for applying several mordants are determined by their action upon seed germination. The preparation AB can be used 6 months before planting, in treating grain the preparation PD no earlier than one month before treatment. In order to control measures in time, it is necessary to know the period of appearance of pests and diseases. This depends upon meteorological factors. It was established that the apple weevil, /Anthonomus pomorum L./ awakens at a temperature of the air of 6° and the cabbage butterfly flies out when the soil is warmed to $8-9^{\circ}$.

Conditions connected with pest appearance and beginning of harmful activity are still unestablished and inadequate with respect to many pests. This suggests the advisability of keeping calenders from year to year on pests and diseases, mark the time of their appearance, the distribution of the stages of their development, the periods of their injurious activities. Although appearance and development of pests may vary depending upon weather conditions, a calendar permits nevertheless to establish tentative dates for the future.

In order to correlate pest appearances and their injurious activities with factors of the surrounding environment, the various phases of development of agricultural plants shoudd be noted in calendars. Germination, swelling, opening of buds, beginning and end of bloom, etc., all development should be listed, as should temperature and other factors. Many control measures correspond to definite phases. Thus the first spraying with intestinal poisons to control the codling moth /Carpocapsa pomonella L./ is done when petals drop (80 per cent); spraying with contact poisons of the larvae of suckers /Psyllidae/, when the buds begin to unfold, etc. Notes on calendars should be kept for future guidance in organizing practical measures.

Observation on the need of appearance and development of pests and diseases permits the signalling for control. This should generally begin when pests first make their appearance. In some cases, when this is difficult to establish by direct observation, various other supplementary methods are used. Thus to establish periods for spraying the codling moth in it's second and third generations, several hundred caterpillars of the last generation of this pest must be gathered, placed into jars covered with gauze, kept in shady places in the orchard, and watched for the flight of butterflies. To control the codling moth two sprayings are required; the first spraying when butterflies begin to fly and the second when 40 per cent of the butterflies are winged. To establish periods for chemical control against caterpillars of the grape berry moth, /Polychrosis viteana (Clem.)/ special traps are put up in vineyards, i.e. wide iron vessels filled with "bekmes" solution. When the butterflies accumulate in traps, spraying is undertaken every 18 days on pests of the first generation, and every 10 to 14 days on the second and third generations, i.e. before the birth of young caterpillars that may have remained unnoticed because of their small size. (p.545). The degree of danger from the cutworm moth, /Agrotis segetum Schiff./ is estimated by the number of butterflies which get into basins filled with syrup (molasses) distributed in the fields.

In many cases dissection of insects is necessary to establish how egg formation proceeds and to estimate when egg laying will begin. This is done with regard to butterflies of beet webworms, [Loxostege sticticalis] the cutworm moth, stem borers [Phytometra gamma L.] etc.

Records of the efficacy of pest control of agricultural plants are kept to evaluate the results of the application of control methods, as well as of the quality of the work. Efficacy of control is determined by the reduced number of injurious insects and the increase and improvement of the quality of the yield on treated plots.

By counting the number of pests before and after treatment it is possible to establish this from the reduction in their number. If, for instance, prior to control 500 living insects were found on 100 plants and later only 50, the number of destroyed insects is 450, or 90 per cent.

Estimates of quantities of insects are made on plots of 0.25 to 0.5 hectares, typical of infestation, segregated from the total treated territory; on these plots insects are counted on individual plants (25 to 100 plants) or on test plots (4-8 plots, 50 x 50 cm each), or yet on specially distributed attractants (4-8 hills) distributed in checkerboard. Post-treated estimates of insects are usually made 3 to 5 days following treatment.

Simultaneously with estimates on quantities of insects the injuriousness of agricultural plants is determined, i.e. number of injured plants and degree of injury. The pre-treated record of injured plants offers the opportunity to judge timeliness of control. When the latter is delayed plants are usually already injured and if infestation is high, the yield will not prove adequate even if control is introduced at this stage. Post-treated estimates of the injuriousness of plants is essential to determine whether injury to pests has been stopped. In determining injuriousness, 50 to 100 plants are examined and the degree of their injury established by the 4-grade scale 0 indicating absence of injury; I,- light injury, foliage eaten 25 per cent; II,- medium injury, foliage eaten 25 - 50 per cent; III,- severe injury, foliage destroyed in excess of 50 per cent. No record of injury of foliage by aphids is kept since data concerning their population is sufficient to estimate the injury caused to plants.

By comparing harvests from treated plots with those where no treatment was applied, an index of efficacy with regard to yields is obtained.

Measures for controlling smut of cereals are considered good when no injured plants are found in plantings.

The collective farm-instructor on pest and disease control should maintain close contact with specialists on plant protection and other agronomic personnel and secure necessary instructions from them.

End of article.

A.M.F.
August 13, 1951.

Bo[illegible]

Osnovy zashchity s.-kh. rastenii ot vreditelei i boleznei [Principles of the protection of plants from pests and diseases]. Moskva, 1936, 423 B635
2 v.

[illegible] Plant Protection

Translated in part from the Russian by R. G. Dembo

181

v.1,
Table of Contents (p. 765-[773])

Boldyrev, V. F.
Osnovy zashchity...

Boldyrev, V. F.
Osnovy zashchity...

11 July 1951

Chumakov, ...
Posoboie po bor'be s vrediteliami i bolezniami sel'skokhoziaistvennykh kul'tur [A guide to the control of pests and diseases of agricultural plants]. Ed. 5. Moskva, 1945, 464.4C72

Translated in part from the Russian by R. G. Dembo

Chapter XIV. Organization of Work in Controlling Agricultural Pests and Diseases in the Collective Farm. (P. 463-469.

In order to execute the control of agricultural pests and diseases, an elementary knowledge of the biology of pests and diseases, the measures in registering their quantity and the methods of controlling them, as well as the application of poisons and simple equipment, is essential.

182

All this indicates the necessity of providing a thorough preparation of instructors (one or two, depending on the size of the collective farm) for the organization of protection of farm crops against pests and diseases.

The collective farm instructor carries the responsibility for correct storage, registration and expenditure of poisons and materials and also for efficient equipment and inventory. The instructor registers the crops infested by agricultural pests and diseases and the work in pest control. The instructor presents a report, signed by the chairman of the collective farm and by the bookkeeper,(through the Village Soviet) to the raion department every ten days, and, if necessary, also to the Machine and Tractor Station, concerning the progress of controlling pests and diseases according to form Nr. 19 of collective farm accounts (see appendix 1).

The collective farm instructor presents a monthly report to the raion agricultural department and the Machine Tractor Station, concerning the chemicals in controlling pests and diseases on the form Nr. 20 of collective farm accounts (see appendix 2).

The direct control of agricultural pests and diseases is carried out by brigades and sections which fulfill this work according to the suggestion and supervision of the farm instructor as to the fields assigned to the brigade or to the section.

Thus, the control of agricultural pests and diseases is carried out by men power and means of the collective farm itself.

General supervision and technical guidance in this work is carried out by the agronomist-entomologist or technician-entomologist of the machine tractor station or of the raion agricultural department.

The agronomist-entomologist or the technician-entomologist assists the instructor in drawing a plan of measures in controlling pests and diseases, in suggesting which poisons are most beneficial, in indicating the most appropriate control measures according to the conditions of the given farm.

The basis for planning the work in controlling agricultural pests and diseases is the data of the degree of the infestation on the given field caused by pests and diseases. For this purpose, it is imperative to inspect carefully, at a certain time, the location and the amount of the available pests and diseases, the size of the infested field in the given year, and to accumulate complete information concerning the size of the field infested by any of the pests and diseases during the preceding years. All this will help in determining the amount of ~~poisons-and-machines~~ future work, prepare the work beforehand, and to bring the necessary amount of poisons and machines for the given fields and to carry out the work indicated in the plan.

Shortcomings in the planning of work in controlling pests and diseases, as a rule, cause superfluous expenditure for either wider preparation than is really necessary or for emergency measures in case of a sudden appearance of pests and diseases on a larger field than was expected. At the same time, even emergency measures are often unable to prevent considerable losses of crops from pests and diseases. Therefore, the inspection of the accumulation of pests is the principal measure for a successful co-trol of pests and diseases.

First of all are inspected gophers, field mice, locust, grasshoppers, unhardy locust, meadow moth [Loxostege sticticalis], winter owlet [Agrotis segetum], pests of sugar beets, flax, cotton, and among the diseases, smut, gangrenous ergotism and rust of crops, cotton hommoz, diseases of flax and sugar beets.

All the inspections are carried out according to instructions sent out to all collective farms by the People's Commissariat of Agriculture of USSR through the agricultural departments.

The inspection of gophers has to be carried out in the entire field where the gophers are spread. The inspection consists in appointing fields infested by the gophers; before the gophers hibernate, the control registration of their nidi upon the inspected fields are carried out.

As the result of that inspection, the general field inhabited by gophers, the average amount of holes per hectare and how many of them are occupied by gophers are determined.

The inspection of field mice is carried out in spring (March-April) and during the second half of the summer (July-August) by means of counting the holes upon testing fields, taken separately on virgin soil, beds, sowing fiels, etc. The inspection determines also the field inhabited by mice and the average density of holes for one hectare, including the occupied ones.

Locust, grasshopper, unhardy locust are inspected several times. The first inspection is carried out at the end of summer during ovipository, in order to determine in advance the fields occupied by mature locust, and the places where holothurians are placed. Such inspection assists in determining the amount of locust. At the end of ovipositing, in the fall, inspection of the holothurians is done. On fields, where the holothurians were placed, samples are taken which help in fixing the average density of infestation, namely, the storage of locust for next year.

To determine the wintering supply of caterpillars and to compose an operating plan of work for next year based on the obtained data, the inspection of the meadow moth is carried out on the sowing field and on untilled soil: 1) during the development of caterpillars of the last generation, when the occupied fields and the density of infestation are counted; 2) after the caterpillars of the last generation enter the soil for hibernation.

The winter owlet is inspected on fields and on winter crops by the electing method. In the first place, for 5-10 days before the sowing the contaminated paras are inspected for the density of infestation by caterpillars.

In the second half of September, or beginning of October when the caterpillars hide in the soil, a second inspection is carried out which determines the density of infostation by caterpillars which remain for the winter.

The inspection of sugar beets pests (winter owlet, weevil, etc.) is carried out between the first of September and first of October, and aims to disclose the supply of wintering pests. The inspection is carried out by means of soil digging in various places.

Inspection of cereals infested by smut is carried out starting milk stage to wax stage, but not later than five days before the beginning of harvest. The aim is to put into practice the control by poisoning the same year, and also to determine the degree of infestation by smut for the planning of measures in controlling smut the following year.

The crops upon which the inspection is made are not inspected as to smut and to gangrenous ergotism since during inspection the infestation of crops is counted according to species.

Inspection is the most important work in preparing the control of pests and diseases.

Based on the material under inspection and on the factual infestation of fields in previous years, the collective farm instructor proceeds to formulate a plan of measures in controlling pests and diseases for the following year.

In the working plan are reflected all the productive indexes: the amount and the method of work, the necessary amount of poisons, the demand for man and tractive power, demand for equipment, inventory and financial means, the time of work and the amount of labor days.

A sample form of the labor plan is given below in appendix 3, 4 and 6.

According to the plan, all the preparatory and eradicating measures for controlling agricultural pests and diseases are carried out.

The formulated working plan has to be discussed at a farm council.

Further, the instructor has the following responsibilities: to register the demands for pest control (time of sowing, crop rotation, tillage and sowing care, etc.); to prepare early the poisons, attractants, inventory and vessels, to acquire and prepare the equipment and the traps, to plan "voloki" and other mechanical control measures; to plan the personnel of labor groups and squads among the regular field brigade and to fix them to a definite field. The instructor has the responsibility to fix the salaries of the personnel according to working days and to present them to the farm administration for confirmation at the general meetings of the farmers.

The farmer instructor must also:

a) carry out the control of correct storage of seeds and other seed supplies, and, in case of necessity, to carry out its disinfestation;

b) to carry out the registration of the effectiveness of measures in controlling agricultural pests and diseases and to organize an early and correct control ensuring the full destruction of pests;

c) to register the damage caused by pests and diseases and the crops destroyed by them.

In order to fulfill the entire work bestowed upon him, the instructor must prepare a working schedule for each month, and, still better, for each ten days.

An example of the working schedule of the collective farm instructor is given below, in appendix 7.

Based on the schedule and on the working plan, the brigadier of the field or other brigade should place correctly all the workers in the entire brigade, taking into consideration the amount of work, the time for its execution and the norms of its procedure.

Before the work starts, the brigadier composes a plan assignment for each day, indicating who is supposed to carry out the definite assignment, the norm of the assignment, etc. The brigadier should register the exact number of labor days and the results of accomplished tasks. An example for the arrangement of the work in a brigade under the chemical control of pests is indicated in appendix 5.

At the determination of work, the brigadier should return all the remaining poisons and equipment to the farm instructor of controlling agricultural pests and diseases, whereby the equipment and supplementary inventory should be cleaned from remaining poisons and washed out.

Every farm should possess a special storage room with a safe lock for the poisons and equipment. The farm instructor registers the expenditure of poisons by each brigade or division; in all cases of extra expenditure over the fixed norm, the instructor clears up the reasons for the extra expenditure and informs the farm management about it; if necessary, he writes a report about the matter.

The control of agricultural pests and diseases occupies an important and sometimes even a decisive place in the system of measures for obtaining high crops. Nevertheless, the effectiveness of the struggle and the ensurance of a full protection of crops against pests and diseases depends first of all upon its timely and appropriate execution.

It is possible to organize and to carry out the control only under the condition that the pest has been discovered at the very beginning of its appearance, and not when it was transferred from weeds and waste to the crops. Therefore, besides the indicated inspections carried out yearly according to a specific plan, at a specific time, the timely operating warning of the appearance of pests and diseases and supervision of their further development are most important. It is especially important when the pests and diseases appear in threatening quantities.

In order to accelarate the organization and the execution of control of pests and diseases and to protect the crops against damage, the instructor must:

1) inform the farm, the machine and tractor station, and the raion department of the threatening danger from pests;

2) to take in advance , with the assistance of the farm administration, all the necessary measures against the possible damage caused by pests.

The operating warning and inspection are carried out not only by the farm instructor of pest control, but by the brigadier of the field and other brigades and divisions, and by the farmers. All these persons should inform the farm instructor immediately (the same day) concerning the results of their discoveries and present to him the samples of the collected pests and damages of agricultural plants.

The operating warning and observations should be carried out early in spring and during the entire season of the development of pests and diseases.

The instructor should give a considerable amount of attention to the youth: communist union of youth, pioneers, school children. They are able to do an important share in protecting crops against pests and diseases.

It is necessary to create at the farm laboratory a room for plant protection, in which the principal pests and diseases (collections, herbaria) their development, sample of the damages, data of the losses, etc.

should be given. In that room should be available a library concerning control of pests and diseases, posters, diapositives, etc.

Among the experienced farmers, it is necessary to organize a group of activities which would undertake the solution of important problems, originating in the practice of plant protection against pests and diseases.

Among many questions, the following deserve the greatest attention:

1. The appearance of agricultural pests and diseases on the farm fields and the observation of their spreading.

2. Registration of crop losses caused by pests and diseases.

3. Registration of the effectiveness of the work in controlling pests and diseases.

4. The improvement of applied measures in controlling pests and diseases.

5. Carrying out experiments which indicate the significance of the agrotechnical methods in controlling pests and diseases, for instance, shallow plowing of stubble field, autumn plowing, early sowing of spring crops, vernalization, etc.

Concerning these or other problems of crop protection against pests and diseases, the farm instructor should be of assistance to the farm laboratory in working together with the agronomist, the specialist or technician in controlling agricultural pests and diseases, the machine tractor station, raion agricultural department, and also with experimental stations so that they could provide constant assistance and consultation.

End of Article

29 Jun 50

Supplement 1.

Collective farm..............
Village Soviet...............
Raion.....................

Collective farm report, form No. 19 based upon the decisions of the economic Council of the Soviet of People's Commissars of USSR, No. 598, from April 25, 1940 has been confirmed by CUNKHU State Plan of USSR No. 328 from May 14, 1940.

Is presented through the village council into raion agricultural organization and collective farms which serve the Machine Tractor Stations, also Machine Tractor Stations on 1st, 11th, 21st of each month from the moment of appearance of pests after the first of November.

REPORT ON CONTROLLING AGRICULTURAL PESTS AND DISEASES

For-------Date ------------Month----------Year.

Has the Collective Farm Machine Tractor Station been served? (Yes, Not - underline)

Name of Pests and Diseases	Infested: The amount of Hectars, Centners, Square meters, pieces	Out of these: Destroyed	Out of these: Damaged	Worked on: Hectars, Square m. cubic m Pieces, Centners	Worked on: inc. the Chem. Method

The date of sending the Report ____________

The chairman of the collective farm Bookkeeper

Supplement 2

Collective farm

Collective farm report, Form No. 20. Based upon the decision of the Economies Council of the Soviet People's Commissars of USSR No. 598 of April 23, 1940.

Is sent through the Village Council into Raion Agricultural Organization, and by the collective farms which serve the Machine Tractor Station the first of each month from the moment of the appearance of pests after November 1.

REPORT ON THE AMOUNT OF POISON CHEMICALS FOR CONTROLLING AGRICULTURAL PESTS AND DISEASES.

For the First of --------------month 194--.

The name of poison chemicals	There were poison chemicals in collective farm at the beginning of the reported month	Acquired during the reported month	Spent during the reported month	Left at the end of the reported month

The date of sending report-------------

The chairman of the collective farm Bookkeeper.

Supplement 3.

Report of usage, insurance and import of chemicals and equipment for the control of agricultural pests and diseases.

For 194-- year at the collective farm ------------------
name of farm.

raion------------------------
(in kg and in pieces)

Name of the chemicals and of equipment	The amount required according to plan	Left from previous years	Necessary according to import quarters	The means necessary to buy poisons and equipment (rubles)

Distribution of labor and tractive power, and also equipment and inventory according to the months of the year.

Name	January	February	March	April	May	June	July	August	September	October	November	December
1. Sprayers												
a) "Avtomaks"												
b) "Tramass"												
c) "Pomona"												
d) "Zara"												
2. Dusters												
a) by men												
b) by horses												
3. Other machines												
a)												
b)												
c)												
4. Inventory												
a)												
b)												
c)												
d)												
5. Man power (in labor days)												
6. Tractive power (in horse days)												
7. Distribution of the amount of labor days according to months.												

SAMPLE ARRANGEMENT OF WORK IN A BRIGADE (DETACHMENT, TEAM) DURING THE CHEMICAL CONTROL OF AGRICULTURAL PESTS AND DISEASES.

Name of the measures, poisons, and equipment	The amount of equipment in a brigade, (detachment, team)	The number of workers in the brigade (detachment, team)	Workers according to their qualifications.																	
			Poison workers, sowers	Officials in charge of purchasing of attractants	Drivers for poison, material	Diggers	Drivers of equipment	Those who prepare solutions	Loading workers of poisons, solutions.	Drivers of wa[illegible]	Those who spray or dust	Those who turn equipments for poisoning	Workers for seeds bringing in and out	Workers who pour seeds into sacks and in machines	Workers in regulating pouring poisons and grains	Motorists, pumpers for "Pomona"	Diggers	Those who work with hose	The amount of equipment in the brigade (detachment, team)	The numbers of workers in a brigade (detachment, team)	And so forth...
I. Control of agricultural pests and diseases																					
1. Controlling gophers a) chlorpicrin (method of spreading, pneumatic sanding, dosing).	-	30	16	4	2	8	-	-	-		[illegible]	-	-	-	-	-	-	-	-	-	
b) cyanide, sulphuric slag.	-	21	20	-	1	-	-	-	-		[illegible]	-	-	-	-	-	-	-	-	-	
2. Controlling locust a) poisoned attractants	-	24	20	3	1	-	-	-	-		2	-	-	-	-	-	-	-	-	-	
b) Spraying, horse "Zara"	3	8	-	-	-	-	3	1	2		1	10	-	-	-	-	-	-	-	-	
c) Spraying pump "Automax"	10	11	-	-	[illegible]	-	-	1	-		[illegible]	-	-	-	-	-	-	-	-	-	
3. Controlling winter owlet Agrotis segetum a) Poisoned attractants	-	24	20	3	1	-		-	-												
b) Dusting, horse "Zara"	3	8	-	-	-						2	2	-	-	-	-	-	-	-	-	
c) Dusting, knapsack "Tip-top" RV-1	10	11	-	-	1	-		-	-		-	-	10	-	-	-	-	-	-	-	
d) Dusting, horses	3	7	-	-	2	-	3	-	2		2	-	-	-	-	-	-	-	-	-	
4. Controlling mice-like rodents by poisoned attractants	-	24	2	3	1	-	-	-	-			-	-	-	-	-	-	-	-	-	
5. Poisoning of seed grains																					
A. Dry poisoning a) apparatus "Ideal"	5	10	-	-	-	-	-	-	-			-	-	5	5	-	-	-	-	-	
b) apparatus "Harvest"	5	15	-	-	-	-	-	-	-			-	-	5	10	-	-	-	-	-	
c) apparatus Popova P-2	1	10	-	-	-	-	-	-	-			-	-	-	4	4	1	1	-	-	
d) apparatus Borhardt AB-2	1	6	-	-	-	-	-	-	-			-	-	-	2	2	[illegible]	1	-	-	
B. half dry poisoning a) sprayer "Avtomaks"	5	15	-	-	-	-	-	-	-			-	5	-	-	-	-	-	10	[illegible]	
b) machine Borhardt AB-2	1	7	-	-	-	-	-	-	-			-	-	-	2	-	4	1	3		

II. Controlling pests and diseases of technical plants.

Controlling the meadow moth and the owlet-gamma

a) spraying, horse "Zara"

b) spraying, pump "Automaks"

c) dusting, pump "Tip-top"
RV-1

Controlling the web mite of cotton Tetranychus urticae

a) dusting, by horses

b) dusting, pump "Tip-top" and others

Controlling karadrina and cotton owlet

a) spraying, horse "Zara"

b) spraying, "Automaks" and others

c) dusting, by horses

d) dusting, "Tip-top" and others

e) by poisoned attractants

4. Controlling the beet weevil

a) spraying, horses "Zara"

b) spraying, pump "Automaks" and others

III. Controlling pests and diseases of orchards and vineyards.

a) spraying, "Pioneer"

b) spraying, "Pomona"

c) spraying, pump "Automaks" and others

d) dusting, pump "Tip-top", RV-1

IV. Controlling pests and diseases of vegetables.

a) spraying, "Pioneer"

b) spraying, horse "Zara"

c) spraying, pump "Automaks" and others

d) dusting, horses

e) dusting, pump "Tip-top" and others

V. Controlling pests of grains during storage

A. Gas disinfestation

a) of rooms

b) of grains in granaries by embankment

c) grains under tarpaulin

B. Wet disinfestation

a) sprayer "Pomona"

b) pump "Automaks".

Supplement 6

Labor outline in controlling agricultural pests for the year 194---

Collective farm----raion---------oblast'(krai)
name

No.	The name of the plant and the measures applied against separate pests and diseases according to measures (spraying, dusting, and others)	Measure Unit	Amount of Work	Which Chemical has been used	The norm of expenditure of chemicals for one unit of work (kg)	Required Chemicals	The period of work from..........date ....month to..........date ....month	days	Required man power (man days)	Required tracting power (in horse days)	Required inventory and equipment		The sum of labor days
											Name	Amount	

 n

Posobie po bor'be s vrediteliami i
bolezniami sel'skokhoziaistvennykh kyl'tur
[A guide to the control of pests and
diseases of agricultural plants]. Ed. 5
Moskva, 1945. 464.4 C72

Translated in part from the
Russian by R. G. Dembo

183

A Sample Schedule for the Work of the Collective Farm
Instructor in Controlling Agricultural Pests and Diseases (for Central Asia)(p. 480 - 487

Months of Year	Name of Measures
January	1. Prophylactic measures in orchards (cuttingout dry and diseased branches, clearing the bark
	2. Collecting the winter nidi of hawthorn
	3. Covering the places of ovipository of the gypsy moth [Porthetria dispar L] with heavy mineral oil
	4. Winter watering of orchards, vineyards and cotton fields
	5. Spraying orchards with mineral oil emulsion in controlling scale
	6. Control of storehouse pests
	7. Poisoning of seed grain, grain and oil plants
	8. Remodeling the equipment and the inventory
	9. Preparation of poison and materials
	10. Control of the harmful eurygaster in the winter nidi
	11. Control of "epiliakhna" in winter nidi
	12. Applying adhesive rings against bruce span worm [Operrophtera brumata]
	13. Preparation course for farm instructors in controlling pests
February	1. Prophylactic measures in orchards (cutting out and removal of dry and diseased branches, clearing the bark)
	2. Collecting the winter nidi of hawthorn
	3. Covering the places of ovipository of the gypsy moth with heavy mineral oil

Months of Year	Name of Measures
February (Con't)	4. Winter watering of orchards and vineyards
	5. Spraying orchards by mineral oil emulsion in controlling scale
	6. Covering the barks of orchard plants by calcareous lime
	7. Remodeling adhesive rings applied against bruce span worm and the destruction of moth and eggs under the rings
	8. Spraying orchards with 6-8 per cent lime milk against spottiness
	9. Controlling "epiliakhna" in its winter nidi
	10. Poisoning seed grain by dry mordants
	11. Control of storehouse pests
	12. Eradicating eurygaster in winter nidi in valleys
	13. The end of remodeling equipment and the inventory
	14. Preparation of horse manure in controlling locust
	15. Preparatory course of collective farm instructors for pest control
	16. Checking on the farm's provision of poisons and the acquisition of the missing amount
	17. Prophylactic clearing of mulberry (spraying ISO)
	18. Inspection of the wintering supply of orchard pests
	19. Mechanical control of gophers and of mice like rodents
	20. Composing the monthly report concerning the poison movement and tho ten day report concerning pest control cours

Months of Year	Name of Measures
March	1. Spraying orchards by mineral oil emulsion in controlling scale
	2. Spraying with 1.5 per cent lime milk in controlling spottiness when the buds become pink
	3. Poisoning the seeds of grain and oil plants
	4. Inspection of premises for infestation by field rodents and controlling them
	5. Checking the wintering nidi of eurygaster and supplementary clearing of infested fields
	6. Inspection of crops for infestation by winter owlet [Agrotis segetum] and controlling it.
	7. Carrying out prophylactic measures in orchards (cutting and removing dry branches and the clearing of bark)
	8. Covering trunks and heavy branches of fruit trees with calcareous lime
	9. Checking and remodeling adhesive rings in controlling bruce span worm, the eradication of moth and eggs under the rings
	10. Spring inspection of orchards for infestation by pests and diseases
	11. Coating the eggs of gypsy moth
	12. Shaking of fruit trees in controlling weevil
	13. Prophylactic clearing of mulberry (spraying ISO)
	14. Controlling storehouse pests
	15. Inspection of premises for infestation by field rodents and carrying out measures in controlling them
	16. Inspection of alfalfa for infestation by phytonomus and carrying out measures in controlling beetles (from the moment when the alfalfa starts to grow)

Month of Year	Name of Measures
March (Cont'd)	17. Inspection of crops and wild vegetation as to infestation by eurygaster and leaf beetle [Lema melanopus] and the organization of their control
	18. Burning reed and other weed in controlling "epiliakhna"
	19. Poisoning of cotton seeds
	20. Burning and eradication of weeds in the vicinity of cotton field in controlling pests
	21. Storing horse manure and other material (lime, ashes) in controlling locust
	22. Composing a monthly report concerning the course of poisons and a ten day report concerning pest control
April	1. Checking and remodeling adhesive rings in controlling the bruce span worm
	2. Poisoning seeds of cotton and of cereals
	3. Inspection of forage and seed alfalfa for infestation by larvae of phytonomus and their control
	4. Controlling storehouse pests
	5. Coating the eggs of the gypsy moth by heavy mineral oil
	6. Clearing weeds from "shaly"
	7. Coating the bark and the branch foundations by orchard plaster
	8. Spraying vines by 0.5 per cent ISO until they swell
	9. Application of chemical and mechanical control measures against cotton pests on weed
	10. Inspection of locust during first stage and controlling them
	11. Inspection of premises for infestation by field rodents and controlling them
	12. Inspection of crops of cereals and of the adjoining virgin soil for infestation by eurygaster and leaf beetle [Lema melanopsus] and their control

Month of Year	Name of Measures
April(Cont'd)	13. Inspection of crops for infestation by winter owlet and controlling it
	14. Spraying apricot orchards with lime milk in controlling spottiness
	15. Shaking [Curculiodae] [Noctuidae][Geometridae] upon the panel from dry apricots
	16. Spraying the apricot tree against sucking pests
	17. Registration of trees infested by mulberry "piadenitsa" and covering them with lime
	18. Spraying seed species against rodents and sucking pests
	19. Control of Curculiodae on dry apricots
	20. Inspection of cotton sprouting for infestation by pests and diseases
	21. Protection of garden melon plants against pests
	22. Application of control measures against hommoze and root rot on cotton sprouts
	23. Destruction of dodder in the alfalfa and flax fields
	24. Controlling caterpillars of gypsy moth
	25. Composing a monthly report concerning the course of poisons and of pest control
May	1. Registration of trees infested by "piadenitsa" on dry apricots and moraceae and covering the trees with lime
	2. Inspection of cotton crops during sprouting for infestation by pests and diseases
	3. Shaking the moraceae Curculiodae upon the panel
	4. Controlling the storehouse pests
	5. Loosening and watering orchards infested by "piadenitsa" of dry apricots

Month of Year	Name of Measures
May (Cont'd	6. Eradication of dodder on the crops of alfalfa and of flax
	7. Application of measures against aphids and web mites upon the cotton crops
	8. Inspection of premises in the vicinity of cotton crops for infestation by corn ear worm [Chloridea obsoleta] and its control on tomatoes and weeds.
	9. Control of web mite [Tetranychus urticae Koch]
	10. Inspection of alfalfa for infestation by pests and diseases during blossoming and controlling them
	11. Inspection of locust during growth and controlling them
	12. Destruction of field beetles (gophers, mice, samd worm)
	13. Controlling eurygaster on crops and weeds
	14. Inspection of oil plants during mass sprouting for infestation by pests and diseases
	15. Inspection of wheat for infestation by smut
	16. Protection of garden melon plants against pests (rodents and sucking)
	17. Spraying orchards against pests and diseases
	18. Controlling caterpillars of gypsy moth
	19. Placing catching rings against codling moth [Laspeyresia pomonella]; spraying seed plants with intestine poison and stone fruit with pyrethrum
	20. Digging the soil and taking out cocoons of apricot "Piadenitsa" [Geometridae]
	21. Eradication of pests and diseases of vine
	22. Collection of fallen fruit damaged by apricot (Curcuiiodae]
	23. The final work on crops and weeds infested by eurygaster
	24. Composing a monthly report on the course of poisons and of pest control

Month of Year	Name of Measures
June	1. Control of alfalfa pests
	2. Eradication of pests and diseases of vine
	3. Inspection of tomatoes for the infestation by bacterial canker
	4. Application of measures in protecting cotton crops against pests (corn ear worm, aphids, web mite)
	5. Controlling pests on weeds
	6. Application of measures in controlling locust
	7. Inspection of locust during ovipositing
	8. Inspection of grain and oil plants for infestation by pests and diseases
	9. Protection of garden melon plants against pests
	10. Spraying seed plants against rodents and sucking pests
	11. Spraying stone fruit against sucking pests
	12. Collection of fallen fruit damaged by Curculiodae and by codling moth and utilizing it in production
	13. Inspection and remodeling attracting rings
	14. Digging the circles around trunks in order to destroy cocoons of mulberry and apricot Geometridae
	15. Coating the trunks and the bases of branches by garden plaster
	16. Collection of fallen fruit damaged by apricot Bibionidae
	17. Inspection of cotton plants for infestation by pests and diseases during mass blossoming
	18. Application of the mechanical method in controlling eurygaste on crops
	19. A monthly report concerning the course of poisons and of pest control

Month of Year	Names of Measures
July	1. Spraying seed plants in controlling rodents and suckling pests
	2. Spraying the vineyard with lime brimstone compound in controlling diseases
	3. Controlling the alfalfa pests
	4. Application of measures in controlling crops against cotton pests (corn earworm, mite, aphids)
	5. Controlling weed pests
	6. Controlling moth of gnawing owlet (placing syrup containers for catching)
	7. Inspection of locust during ovipositing (grasshopper, "konofima")
	8. Controlling garden melon pests
	9. Digging circles around trunks at the depth of 25 cm and taking out cocoons of mulberry and apricot Geometridae
	10. Collection of fallen fruit infested by codling moth, apricot Curculiodae, chalcid wasp
	11. Watering gardens in controlling apricot Curculiodae
	12. Controlling macrosporiose on cotton
	13. Inspection of catching rings and destruction of codling moth
	14. The import of poisons for poisoning seed grain for the fall sowing
	15. Inspection of tomatoes for the infestation by the bacterial canker
	16. Fixing the wintering location of eurygasters
	17. Control of pests and diseases of sugar beets
	18. Monthly report concerning the course of poisons and of pest control

Month of Year	Names of Measures
August	1. Controlling alfalfa pest
	2. Controlling the cotton pest (aphids of fall generation, web mite [Tetranychus urticae K.], corn earworm
	3. Controlling macrosporose on cotton
	4. Controlling sugar beet pest
	5. Controlling cercosporose and mildew on sugar beets
	6. Poisoning seed grain for winter sowing with dry mordants
	7. Controlling pests of melon fields
	8. Inspection of catching rings and destroying codling moths under them
	9. Inspection of cotton fields for infestation by pests and diseases furing the opening of the bolls
	10. Controlling the gypsy moth (coating the places of the ovipository by black mineral oil, petrolium, kerosene)
	11. Inspection of locust in jugs
	12. Inspection of rice crops for infestation by pests and diseases
	13. Inspection of premises for infestation of rodents and their control
	14. Inspection of wintering nidi of eurygasters and its control
	15. Controlling pests in storehouses and granaries.
	16. Loosening the soil in controlling apricot curculiodae and spraying the gardens against sucking pests
	17. Composing a report about the course of poisons and of pest control

Month of Year	Names of Measures
September	1. Controlling mildew and cercosporose upon sugar beets
	2. Inspection of cotton plants for infestation by wilt and virus
	3. Controlling melon field pests
	4. Controlling aphids of fall generation on cotton plants
	5. Controlling corn ear worm on cotton and garden plants: tomatoes, corn
	6. Inspection of alfalfa for the infestation by pests and diseases before the last sowing and carrying out control measures
	7. Inspection of pedaliaceae for infestation by gum flow and other diseases
	8. Poisoning seed grain for fall sowing
	9. Inspection of locust in jugs
	10. Inspection of eurygaster in winter nidi and carrying out control measures (burning and other methods)
	11. Inspection of premises for infestation by field rodents and their control
	12. Inspection of premises for infestation by winter owlet and controlling it, and also controlling grain ground beetle [Carabidae]
	13. Inspection of the winter supply of sugar beet pests
	14. Inspection of winter supply of orchard pests
	15. Inspection of catching rings in controlling the codling moth
	16. A monthly report about the course of poisons and of pest control

Month of Year	Names of Measures
October	1. Taking the catching rings off the trees and disinfecting them in boiling water
	2. Poisoning seed grain
	3. Inspection of winter nidi of eurygaster and carrying out its control
	4. Controlling storehouse pests
	5. Inspection of locust in jugs
	6. Eradication of mice-like rodents
	7. Controlling cabbage and melon aphids, corn earworm on tomatoes
	8. Coating the ovipositories of gypsy moth
	9. Inspection of orchards and vineyards for winter pest supply.
	10. Inspection of winter supply of soil pests
	11. Spraying vine with 5 per cent ISO
	12. Removing dead bark, cutting out dry places, diseased branches and burning them; making root attractant from leaves
	13. Registration and remodeling equipment
	14. Monthly report about the course of poisons and pest control
	15. Composing the plan of work in controlling agricultural pests and diseases for the following year and presenting to the raion agricultural department requests for poison and equipment

Month of Year	Names of Measures
November	1. Controlling mice-like rodents
	2. Prophylactic measures for controlling cotton pest and diseases (harvest of Asiatic cotton, fall ploughing)
	3. Poisoning of seed grain for winter sowing
	4. Controlling storehouse pests
	5. Disclosing the winter nidi of eurygaster and its control
	6. Inspection of winter nidi of "epiliakhny" and its control
	7. Removal of dead bark, cutting out dry parts, diseased branches and burning them in orchards
	8. Fall shaking of weevil off fruit trees
	9. Collecting winter nidi of pierid butterfly
	10. Gathering and burning fallen leaves and traps made of leaves
	~~11. Coating the eggs of the gypsy moth by black mineral oil~~
	11. Fall coating of barks with lime milk
	12. Coating the eggs of the gypsy moth with black mineral oil
	13. Inspection of winter supply of pests in orchards
	14. Spraying 5 per cent ISO in controlling apple and "chekhlik" month
	15. Spraying orchards with mineral oil emulsions in controlling scale
	16. Remodeling equipment and inventory
	17. Courses for preparing collective farm instructors in controlling pests
	18. Report on the course of pest control

Month of Year	Names of Measures
December	1. Preparation of farm instructor in controlling agricultural pests and diseases
	2. Prophylactic measures in controlling cotton pests (harvest of Asiatic cotton, winter ploughing
	3. Poisoning of seed grain
	4. Control of storehouse pests
	5. Prophylactic measures in orchards (cutting out dry parts, diseased branches
	6. Collecting the winter nidi of pierid butterfly
	7. Cleaning tree trunks for placing adhesive rings
	8. Winter watering orchards and vineyards
	9. Spraying 5 per cent ISO in controlling apple and "Chekhlik" moth
	10. Coating eggs of the gypsy moth with black mineral oil
	11. Inspection of winter supply of pests in orchards
	12. Controlling "epiliakhna" in winter nidi
	13. Winter spraying of orchards with mineral oil emulsions
	14. Controlling eurygaster in winter nidi
	15. Registration of poison and material and their acquisition
	16. Remodeling the equipment and inventory

<u>Footnote</u>. This schedule is only a sample. The collective farm instructor composes his own schedule in regard to the peculiarities of his farm, based on this pattern, after having consulted the entomologist of the raion agricultural department or the machine tractor station.

End of Schedule

2 July 1951

Sbornik instruktsii po karantinnym obsledovaniam sel'skokhoziaistvennykh i lesnykh kul'tur (Instructions for quarantine inspectors of agricultural plants and forest trees). Moskva, 1935. 104 p., 464.47 Ef6

Translated in part from the Russian by R. G. Dembo

Instructions For Field quarantine Inspectors of Selector Stations of Cotton.*
(p. 46-52)

I. The Entomological Part

The pink boll worm Platyedra gossypiella Saund (does not exist in USSR), parasitic worm Earias insulana B etc.

The experiment of field inspection of cotton against quarantine pests, under the conditions of Middle Asia for 1933-35, indicates that the field method in relation to the disclosing some quarantine pests is a method of little effect and does not produce good results. This conclusion has been convincingly confirmed by a few data of American practice - in particular, in regard to the pink worm. Therefore, we should consider the field method of inspection only as a secondary one. The basic methods of inspecting quarantine pests, and particularly the pink worm, should be - the analysis of gin waste with the assistance of worm catchers and with the analysis of cotton seeds.

When cotton has been damaged by the pink worm, the field inspection should be divided into two parts:

1) A triple collection of the worm's fruit-bearing organs which are suspicious as to availability of the pink worm.

2) A double collection of the fallen fruit.

184

* The instruction is printed as an example - the inspection of cotton in various parts of USSR is based on this instruction considering the local conditions.

II. Preparatory Work

When the supervisor is in charge of the task's data, namely, the investigating field and the percentage of inspection, he proceeds with the preparatory work which consists in becoming familiar with the sowing, with the division of the field into zones convenient for inspection, the organization of inspecting brigades, with the preparation of blanks, labels, etc.

The division of the field into separate zones is carried out in such a manner that the zones, according to their size, would not surpass the daily norm of inspection. For 25 percent of inspection for the collection of the fruit-bearing organs will be approximately 0.06 hectars which in production consists of 340 bushes. Each of these zones may consist of a series of smaller elementary zones of various contours.

The organization of the brigades is specified, mainly, by the amount of work, the time of its execution and to some degree by the availability of means and personnel. In connection with the indicated factors, the inspectional brigade could be organized with 4 to 13 persons including the supervisor and research workers whose number presents 25 percent of the brigade's body.

For the direction of the inspectors the sowing rows are used; with a "dzhoiachnyi" - the "dzhoiach" beds.

For the gathering of fallen fruit the field is divided in the following manner:

After having measured the area of the main field, the inspector divides it according to the ches method, for instance, from fields of a square meter for hecter, divides into 50 and taking the quotient for the area of the squaro. Then he divides into squares of the given area, and places landmarks which remain during the inspection. Before the second inspection (2 and 3) the landmarks are placed in a different manner, in points equal in all squares.

III. Collection of the Fruit-bearing Organs from Bushes Infested and Suspicious

The first collection of suspicious and infested fruit bearers is carried out immediately after the first harvest.

The damaged and the suspicious flowers and buds, the unopened and slightly opened bolls, are collected.

The percentage of inspection is determined in regard to the inspected field, availability of means, actual task and the time for its execution. Under the conditions of Uzbekistan SSR, when a zone of tens of hectars has been inspected, the inspection of 25 percent of the field was applied. In such a case every fourth bush of the row was inspected. The collected material is placed into a compact cloth tare whereby each separate field should have a separate tare.

When acquiring the collection, the inspector should write all the data legible with a chemical pencil on a label (form No. 1) prepared beforehand.

1. The date of collection.
2. The name of the number of the field and its size.
3. The cotton species.
4. The family name of the inspector.

The filled out label is placed in the bag along with the collected material and the bag is thoroughly tied in order to avoid losses.

The registration of daily work of each brigade during the collection of the fruit-bearing organs is made on a special blank (form No. 2), where the following has to be indicated:

1. the date of collection.
2. the inspected field.
3. the cotton species.
4. the field of each inspected sort.
5. the number of inspectors.
6. the amount of samples.
7. the name of the supervisor.

The daily norm of productivity of one inspector when 25 percent of inspection for the collection of the fruit-bearing organs is 0,06 hectar. The cost of one hectar of inspection is 100 rubles. On this field are inspected 340 cotton bushes, and infested and suspicious fruit-bearing bolls, buds, and flowers are gathered.

Note: In all cases the cost of the work is counted only according to the earnings of the inspecting personnel.

IV. Collection of Fallen Fruit

The inspection consists of a triple collection of infested and suspicious fruit bearers in fallen fruit:

1.- after the first collection of harvest of raw material
2.- after the second collection of harvest of raw material
3.- after the last harvest of raw material

The collection of the fallen fruit is done in a chess order with the estimation of 25 square-meters experiment from each hectar. The material gathered from each separate field: the fallen bolls, buds, flowers, seeds, and leaves, are marked down on the label No. 1, placed into a tare and tied down carefully.

The second gathering of the fallen fruit is carried out under the first inspection. If the first inspection has been carried out upon the white squares, the second should be done on the black squares.

The third inspection is carried out according to diagonals between the first and the second inspection (see scheme).

The work done during the day is fixed by the supervisor on a blank No. 2.

The norm of working out an inspection during a 10 hour working day, is 31 tests or 500 fruit-bearing organs, upon an area of 0.9 hectars.

Cost per 1 hectar is 6 rubles and 70 kopeik.

V. The Laboratory Analysis

The material gathered by the field inspection is sent to the laboratory for analysis.

In order to avoid a large gathering of material in the field, the supervisor should send it to the laboratory twice a day and watch that the material gathered during the day should be sent the same day.

The analysis in the laboratory is done separately on each field. When the tare has been emptied there should be a thorough inspection within and without it.

The entire material collected from the bushes and from the ground-bolls, buds, flowers, seeds, and leaves - is thoroughly inspected by the laboratory worker, first on the surface for signs of damage, then they are opened and the interior parts are analyzed; folds, lobules, seeds etc. as to the availability of damages, diseases and other deformed signs.

The raw material taken out from the cells is inspected, the presence of double and triple seeds is marked down; each normal seed is cut and is inspected for the presence of pests and damage.

The entire suspicious material is packed into small packages and is labeled on the form 3:

1) The name of the number of the field.

2) The dates of the inspection.

3) The cotton species and its area.

4) The dates of laboratory analysis.

5) The number of inspected fruit-bearing organs: bolls, buds, flowers, etc.

6) The family name of the laboratory worker.

If during the analysis a suspicious material, in quarantine sense, is discovered, it is sent into the Quarantine Laboratory for identification.

The analysed material is placed into a new tare and then gined (Dzhiniruetsia). Then the gin waste undergoes a manual and machine analysis.

The entomological material discovered during the analysis is preserved either in alcohol of 70°, after the material has been washed by boiling water, or by 2 percent formalin solution.

The registration of the daily work during the laboratory analysis is marked down on corresponding blanks (form No. 4):

1. dates of the laboratory analysis.

2. cotton species.

3. the field for each analysed species

4. the number of laboratory workers

5. the number of analyzed samples

6. their bolls, buds, flowers

7. the family name of the supervisor

The norm of the productivity of one laboratory worker during a ten hour labor day is 1.550 organs which means 0.04 hectars of cotton sowing.

VI. Signs for Fruit-bearing Organs of Infestation*

The young caterpillars penetrate into buds, gnawing through the undeveloped flower. The infested flowers don't open normally and remind a rose. The top of the petals are tied to the caterpillars by silk thread. Such a picture could be observed in Upland and on species with short fibers; upon Egyptian cotton or long fibered species the opening of the infested buds occurs normally. The caterpillars of the pink worm damage the bolls in all stages of their growth, starting with the time when the bolls are of the size of a pea, until the time when they open, the caterpillar enters the boll at any place and its behavior vary. Without gnawing the boll sides, the caterpillar penetrates into the tissue, immediately under its interior. This mine is quite characteristic for the pink worm and after having discovered it, we may be sure that the boll is infested. The mine disappears during the further growth of the boll and is unnoticed in the open boll. When the caterpillar gnaws through the side of the boll and enters the fiber, feeding on the same, then a slightly colored growing is formed, and some times there is left an abnormal coloration. The caterpillar is able to feed itself on immature fiber and seeds by running between them slightly colored passages. The seeds are often attacked at the wide end, near the exterior surface of the boll and are able to be

*Arranged according to data of foreign literature.

eaten entirely or partly. Often the caterpillar gnaws a passage through the partition into the next part. Such hole is gnawed evenly, round and oval and is a good indication that the pink worm was present in the boll. When the worm attacks young bolls which did not reach the half of their growth, then they become brown and usually fall from the plants, and their contents transforms into a mass of rotten waste. The presence of caterpillars causes the abnormal growth of the bolls or their deformation. On the inner side of the wall greenish white and brown swellings are formed. The seeds grow and form very little fibers. The extremely deformed bolls contain very little fibers which is also of inferior quality.

VII. The Summary of the Work

The data of the laboratory analysis are presented twice a month – on the 10th and 25th – to the Principal Quarantine Inspector according to the form No. 5:

1. The name of the selecting station.
2. The area of the inspected sowings:
   a) at the beginning of work
   b) for the report period
3. The field of inspected sowing.
4. Data for the beginning and end of sample gathering during the report period.
5. The amount of the samples.
6. The size of the samples in weight.
7. The amount of bolls, buds, flowers – of everything.
8. Dates of the start and the end of the analysis during the reported period.

9. How many bolls, buds, flowers and everything has been analyzed.

10. How many seeds (tripled, double and ordinary) have been disclosed, cut and analyzed.

11. How many were found:

    a) damaged bolls, buds, flowers

    b) caterpillars of the pink worm: alive, dead

    c) cocoons of pink worm: alive, dead

    d) other insects: mature, cocoons caterpillars

12. The family name of the supervisor.

VIII. The Analysis of the Soil

The inspection consists in the analysis of soil for the disclosing of the pests for quarantine.

When soil tests are done, the inspected field is divided into squares, each at the size of 100 square meters (10 x 10) and in the center of such a square of one square meter the soil is inspected in the depth of 15 cm. The soil is carefully kneaded by fingers and is sifted through a sieve with openings of 2 mm. The entomological material left in the sieve is taken out, is superficially evaluated immediately, is packed into small packages, and is labeled according to the form No. 1, with the indication of the number of the analyzed soil samples and is sent to the laboratory.

The registration of the brigadier's work is done on the form No. 2. The daily form of the productitivity of one inspection according to the indicated degree of inspection (1 percent) is 3 samples, namely, 0.03 hectars, in the volume it will mean 0.45 cubic meters of the inspected soil mass.

Composed by the Specialist
of Quarantine Laboratory

July 11, 1951. A. A. Khoprianinov

Leningrad. Institut prikladnoi zoologii i fitopatologii. Izvestiia vysshikh kursov prikladnoi zoologii i fitopatologii. (News of higher educational institutions of applied zoology and phytopathology.) 12, 337 p. 1941. 423.92 L544

Transl. 185: Plant Protection

Translated in part from the Russian by R. G. Dembo

For the doctor of Agricultural Sciences,
Prof. Nikolai Nikolaievich Bogdanov-Kat'kov
to his twenty-five years of scientific activity
(1913-1938)

Table of Contents (p. 5)

185

11 July 1951