PESTS AND DISEASES IN TOBACCO SEEDBEDS*

TOBACCO growers will shortly be commencing their preparations for the crop of the coming season, and in so doing they should bear in mind that many of their troubles originate in the seedbed. Without an adequate supply of strong, healthy seedlings, the grower cannot hope for success, and it will therefore pay him to give careful thought to the preparation of his seedbeds, and to take every possible precaution to safeguard them against the attack of pests and diseases. The following brief notes will help him to recognize the chief troubles which occur in the seedbed or are likely to originate there.

INSECT PESTS

Nematode.—The nematode or gall-worm causing root-knot is an internal root-parasite. The immature worm or larva is hair-like in appearance, measuring less than half a millimetre in length, and is able to live in the soil for months without taking any food. When susceptible plants are grown on infested soil, the young worm enters the root through the growing tip, and the whole life-cycle is completed within the tissues of the root. The full-grown female resembles a pearly-white rounded body, and is less than half the size of an ordinary pinhead.

Affected plants usually have a sickly yellowish appearance, and show a poor and stunted growth; when heavily infested the plants may die off. If the roots are examined, typical swellings or knots caused by the nematodes, will be found on them.

Light sandy soils are more favourable for the breeding of nematodes than are turf or heavy clay soils, although the latter may in due course become heavily infected. High temperatures favour the activity of the nematodes, and this is probably one of the reasons why they prefer the warm sandy soils. A certain degree of moisture is essential for the maintenance and breeding of the parasite, which cannot live in very dry soil. These facts should be borne in mind when selecting a site for seedbeds.

Over 400 wild and cultivated plants have already been listed as host plants of the nematode which attacks tobacco. This explains why virgin soil is sometimes found to be infested with it.

Springtail or Earthflea.—This is a wingless soft-bodied insect of a dark-blue colour. It is a moisture-loving insect, and can usually be found in large numbers in damp places; tobacco seedbeds which are kept very moist therefore afford ideal breeding places for it. When it becomes troublesome, the beds should be watered less frequently, and it would furthermore be advisable to remove the hessian covers, to get rid of any excess moisture. Tobacco extract may also be used as a contact spray to keep the insects in check.

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* By Dr. E. S. Moore, Plant Pathologist, and A. J. Smith, Entomologist, Division of Plant Industry, in *Farming in South Africa*, Vol. VIII, No. 89, August, 1933.

Stem-borer.—The adult moth, which is greyish-brown in colour and measures about half an inch across the extended wings, deposits her eggs singly on the tobacco seedlings. The egg takes about a week to hatch and the larva or worm usually bores into the leaf soon after hatching. It may continue to tunnel along the midrib into the stem, or it may vacate the first tunnel to make a fresh entrance, which is usually under the bud at the base of the petiole. The larva spends its whole life, lasting about four weeks, within the stem. When full grown it prepares an exit-hole for the moth to emerge and then pupates. The stem of an infested seedling usually shows a distinct swelling where the larva has fed; above the swelling the growth is stunted or else dies off completely. In older plants, new shoots or suckers may develop below the swelling. Infested seedlings are, however, useless, and should be destroyed.

Leaf-miner or Splitworm.—The moth resembles the stem-borer moth, and is closely allied to it. The worm in this case, however, does not usually bore into the stem, but mines inside the leaf, destroying the soft tissues in irregular patches and leaving only the upper and lower skins. When full-grown the worm may spin its cocoon either inside or outside the plant. Although serious damage may be done to the leaf, this pest does not usually cause such heavy losses as does the stem-borer. Apart from tobacco, it also attacks potatoes, gooseberries and thornapple or stinkblaar. The insect is a prolific breeder, and it is therefore advisable to destroy all host-plants near the beds.

Tobacco Slug.—The adult beetle measures about $\frac{1}{4}$ inch in length, and is black in colour with two pale-yellow longitudinal stripes running parallel down the back. The eggs are usually deposited on the lower side of the leaves, in clusters of ten to thirty. The incubation period of the egg is about 7 days. The larva or slug has a slug-like appearance and is greenish in colour and covered with slime. It feeds on the leaves for about 14 days, and then enters the soil to construct a whitish papery cocoon in which to pupate. The pupal period varies from about a fortnight to three weeks. Both the beetle and the slug feed on the leaves and can do enormous damage if not kept under control. Besides tobacco, it also attacks several species of gooseberries and thornapple or stinkblaar.

Whitefly.—This is a very small winged insect which is easily overlooked in the seedbeds. The body is covered with a whitish powder, giving it a marked whitish appearance. Both the immature and the full-grown stages of the insect feed on tobacco by sucking the juice out of the leaves; the damage due to actual feeding is, however, of minor importance. The insect is the carrier of the virus which causes crinkly dwarf or leaf curl in tobacco, and since this disease was responsible for heavy losses in certain tobacco-growing areas during the past season, growers will be well advised to prevent the breeding and spread of whitefly on the lines suggested elsewhere in this article. In addition, it may be advisable to include in the recommended Bordeaux-lead arsenate spray, a contact insecticide like tobacco extract for the control of the insect in the seedbeds.

DISEASES

Damping off is a common disease which, if neglected, may play havoc in the seedbed. It attacks plants from an early age, and is caused by various soil-dwelling fungi which rot the base of the stem, causing the

seedling to collapse and shrivel up. The threads of the fungus quickly spread to adjoining plants, so that within a few days a bare patch marks the progress of the disease. Damping off is encouraged by excessive organic manure in the top layers of the soil and it spreads with great rapidity in overcrowded beds and under conditions such as may be caused by bad drainage, prolonged wet weather or heavy irregular watering. It attacks other seedlings as well as tobacco, and since its spores survive for long periods in the soil and can be carried by the lightest breeze, the disease is not easily kept out of the seedbed. The grower can however, check it by (1) ensuring that cultural conditions are unfavourable for its development, (2) destroying it by dusting affected patches liberally with Bordeaux powder. If each disease-centre is thus treated at its *first* appearance, further spread can usually be checked; a few days' delay means that infection spreads through the whole bed, and treatment then becomes very difficult. In this country the damping of fungi are not known to attack plants after they have left the seedbed.

Black Root Rot is caused by a soil-dwelling fungus which attacks the roots, turning them black; in mild cases the root-tips are affected and break off when the plant is pulled up. A diseased seedling is not killed, but it makes slow growth owing to the damaged root-system. This retarding effect is particularly apparent when sterilized and unsterilized seedbeds are grown side by side in an area infected with root rot; the slow and stunted growth in the unsterilized beds is linked with blackening of the roots due to the root rot fungus.

It is essentially a cool weather disease, and this probably accounts for the fact that in South Africa it has been found only in seedbeds, that affected plants usually recover after transplanting, forming fresh healthy roots as the summer advances. In cooler climates it is a serious disease in the field as well as in the seedbed, but it is not anticipated that in this country it will ever cause trouble except in abnormally cold seasons. The slowing down of growths is, however, of sufficient consequence to justify the precaution of sterilizing the seedbed soil in infected areas.

Wildfire is only too well known to tobacco-growers throughout the Union. It attacks the leaves, forming yellowish-green spots and patches which turn dry and brown at the centre, in young seedlings the leaves may rot progressively from the tips downwards. The plants are severely checked, and may even be killed if the outbreak is severe. The name wildfire is justified by the amazing speed with which the disease can spread through the whole seedbed or field, or from one seedbed to those nearby, especially in wet and stormy weather.

It is caused by a minute bacterium which is highly infectious and which moreover possesses great powers of resistance to drying. Hence it is readily spread by wind-borne fragments of dry diseased leaf and by persons who have recently handled dry leaf-tobacco or diseased plants etc.

The danger of wildfire lies not only in the damage it does to the actual seedlings themselves, but even more in the risk of establishing the disease in the field by using infected transplants. It would certainly be preferable

to avoid using diseased beds at all for transplanting, but this is often impracticable, and moreover experience has shown that even a healthy seedbed gives no absolute guarantee of a disease-free crop in the field, although it certainly goes a long way towards ensuring it. This can well be understood when it is remembered how easily wildfire germs may be sheltered in the soil or carried by the wind.

Wildfire thrives best under damp conditions, although its results often become more apparent during hot days after a wet spell.

Mildew or White Rust is the powdery white covering which appears on tobacco leaves when the plants are damp and shaded. It is caused by a fungus which grows largely on the outer surface of the leaf and which can be checked by free ventilation and sunlight. Dusting with sulphur is an easy remedy that can be applied in the seedbed but would not, of course, be practicable with larger plants in the field.

Tobacco Wilt is a soil-borne disease caused by a fungus (*Fusarium*) which invades the water-channels in the roots and therefore causes the leaves to droop and wither up. Wilting often affects only one side of the plant and is accompanied by darkening of the wood from the roots upwards. The disease lives over in the soil from year to year, and infection may take place in the seedbed, although the symptoms do not usually appear until later.

Mosaic is the well-known yellow-green mottling and blotching which is especially obvious on young leaves and is almost universal on autumn suckers. Although midsummer infection does little damage, plants attacked by mosaic early in life make poor growth and develop extensive rusty marks over the middle leaves. The disease causes steady and appreciable loss, since it lowers not only the quantity but especially the quality of the crop.

It is caused by an infectious virus which although too small to be visible under even the most powerful microscope, can multiply inside the infected plant and penetrate into every part of it. The juice of a mosaic plant is full of virus and the smallest quantity of it, if rubbed into other plants, will produce symptoms in them 2-3 weeks later. The disease is therefore easily spread by handling, and the greatest damage appears in plants thus infected at transplanting, because a single mosaic seedling may infect dozens of healthy plants handled subsequently. An infected plant can in no way be cured, and in spite of years of investigation, no real control has been discovered. Much can be done, however, by removing and destroying individual mosaic seedlings in the beds; this should be done by a worker who is not at the time handling plants for any other purpose. Further, those working with beds should avoid handling dry or air-cured tobacco *in any form,* since mosaic infection remains active in dry leaf for a very long while and most tobacco plants are infected by the time they are harvested, even though they may not show it. It has been found elsewhere that a marked decrease in mosaic can be secured by restricting the use of tobacco amongst those working on the beds.

Crinkly Dwarf or Leaf Curl has only recently come into prominence, and although the symptoms do not usually appear in the seedbed, it is possible for the disease to originate there and to spread through the field later. Affected plants are more or less dwarfed, and their drooping leaves are deeply crinkled, whilst on the under-surface along the veins there appears thickenings which may grow out into green leafy frills. Like mosaic, this disease is caused by an invisible virus which, however, cannot be readily transmitted by handling; it is spread by the feeding of insects in much the same way as the malarial germ is spread by the feeding of certain mosquitoes. The insect-carrier concerned is whitefly, which takes shelter during the winter on stump-suckers in the lands. It can therefore be checked by thoroughly cleaning up all tobacco lands during the winter, to ensure that for several weeks at least there are no living tobacco plants available to shelter the insects.

Kromnek or *Kat River Wilt* is not a true wilt and has no connection with the *Fusarium* wilt described above. It is not known to occur outside the eastern Cape Province, where it causes heavy losses in both seedbed and field. It is characterized by severe stunting and by leaf-markings in various patterns, frequently of a ring-spot type or else following the veins. It is caused by an invisible virus which is spread by a tiny insect of the thrips group when it feeds upon tobacco leaves. *Kromneek* has recently been the subject of a special investigation, of which a report will appear in this journal at an early date.