Bunchy-top or Root-rot Disease of Manilla Hemp.

THE following extract on the Bunchy-Top or Root-Rot Disease of Manilla Hemp is taken from the article on "Abaca (Manilla Hemp) Heart-Rot and Bunchy-Top Diseases and their Control" by N. G Teadoro, Phytopathologist, and F. B. Serrano, Assistant Phytopathologist, Plant Pests Control Division of the Philippine Department of Agriculture, in the *Philippine Agricultural Review*, Vol. XIX., No. 3 :—

Symptoms:—Externally the disease is characterized by the general stunting of the leaves and stem. The leaves of the diseased plants are short, narrow, slender, stiff, brittle, and the blades gradually discolour from the rim inward, and sooner or later dry up and turn back. In advanced cases, stunting of the leaves is so marked that the youngest will be found almost bladeless and very short. The pseudo stem does not develop its normal size, although it is perfectly healthy inside.

All plants showing these symptoms when dug up will be found with their roots decayed or partly decaying and oftentimes with galls. In old cases the rhizome when cut open will show reddish-brown discolouration originating from the decaying roots.

Infected plants never recover and once a member of a stool is attacked the entire stool perishes, usually before it is half-grown or shortly afterwards, so that it is only a question of time until infested plantations are completely devasted.

Cause: Life history and dissemination.—The disease is believed to be caused, in part at least, by a microscopic organism called a nematode.

The life cycle of the nematode, from egg to egg, may be complete in from four to five weeks, and its female may lay as many as 500 or more eggs. The larval stage is that in which entry into the host takes place. When invaded by larvae (the worms) the roots become enlarged, distorted, or deformed, which stunts the plant. On account of their minuteness, the nematode larvae are invisible to the naked eye. They bore through the soil and, on finding a root, bore their way into it, usually near its tip. Once inside, the young nematode ceases its active movement, begins to enlarge, and by means of a hollow, spear-like organ, within its mouth, absorbs its nourishment, from the root. As stated, the presence of the nematode in the root irritates the tissues in such a way that the root enlarges forming a swelling (root-gall) that may be two or three times as thick as the diameter of the root. These swellings may become very large, especially as the root gets older.

The conditions favourable for the growth and development of the nematode are: (1) a certain degree of warmth; (2) loose-textured soil; (3) abundant moisture; and (4) a suitable host plant, like Manilla hemp.

The larvae of the nematodes move through the soil by their own motion and may also be disseminated from field to field by the earth clinging to implements, the hoofs of animals, the feet of labourers, etc., by heavy rains that wash infested soil to non-infested fields; by the roots of affected Manilla hemp suckers; and by manure which has stood on infested soil.

Control Measures.

In the light of what is known about the life histories of the pathogenes, the difficulty of combating these maladies successfully becomes plain. It is still further augmented when one considers the fact that, unlike other annual crops, Manilla hemp cannot be replaced year after year, and crop rotation cannot be practised to advantage without effecting a great diminution in the yearly output of the fibre. The use of any chemical compound known to be efficacious in checking other diseases is not advisable and is in fact impracticable. The main hope lies in the development of resistant varieties. For this reason, a search is being made to discover more resistant varieties to supplant the susceptible ones.

Control measures, therefore, for these diseases may be sought along the following general methods:

1. Exclusion (quarantine).
2. Eradication.
3. Inhibition.
4. Cultural improvements.
5. Disease resistance.

It must be understood that some of these methods may not be very effective. Nevertheless, pending the discovery of more specific practical means of controlling these diseases, they will help.

Exclusion (Quarantine).—These diseases may be kept out by provincial or local quarantine, but it must be understood that quarantining is valuable only in localities where the diseases are not present or where they are not yet firmly established. In other words, the very general distribution of the diseases in a particular locality makes exclusionary measures futile there. However, to prevent the introduction of suckers into other localities the effected region or regions should be put under quarantine.

Eradication.—Eradicatory measures are possible but very difficult of successful execution. However, attampts should be made in this direction.

Complete eradication of all infested plants should be done to control both diseases. Badly infected fields should be completely cleared out by digging up the plants, chopping them into pieces, and burning them.

In dealing with newly infected plantations where only a few scattered stools are infected, the thing to be done is to cut down all diseased stools as well as other apparently healthy stools within a radius of ten meters from the diseased plants. This must be done due to the fact that the diseases may be present but it will take several months for the plants to show any suspicious external symptoms.

Vigilance against the recurrence of the disease is necessary and when a case is noted the plant should be eradicated with the least possible delay. The hands and shoes of the labourers as well as the tools used in the operation should be disinfected with mercuric chloride solution (1: 1000) or some other disinfectant soon after eradication on one spot is finished or before moving to another spot, so as to avoid the danger of spreading the pathogene.

Covering the chopped material with lime will perhaps help to exterminate the pathogenes.

After making a clearing the grower should estimate the amount of lime required. The plants then are dug out by the roots, chopped into three-inch pieces, and well mixed with lime. The holes should be treated last: if few in number the plants should be dug up and burnt, until each piece is charred to the center: if numerous and burning is impracticable owing to the amount of sap in the plants they should be treated with lime. By burning the diseased material a great reservoir of potential infection is destroyed at once. Lime is less certain in its action. As infected soil, especially if wet and sticky, can be easily carried away by persons working on a treated area, the workers' clothes should be scraped clean and the tools used wiped and passed through flame before the men leave the spot and their feet and boots washed in a disinfectant prepared at the edge of the place. The area should finally be securely fenced around and left to itself. No cultivation should be done on the infested land for at least three years,

Inhibition.—Keeping the land free from vegetation of all kinds from two to three years, so as to starve out the nematodes is recommended. This is the most effective method, though it seems impracticable from the cultivators' view-point, since most of them cannot afford to let their lands lie fallow so long.

Planting the land to non-susceptible crops in succession for a few years, say at least two (perhaps better three) years, using rice, corn, peanut, camotes, etc. This will renovate the land and restore its fertility, as well as check the organisms present in the soil.

Cultural improvements—Making heavy applications of fertilizers, especially those containing potash, except where the soil already contains this in abundance. This treatment is said to be often most effective in reducing nematode injury.

Where rain is not likely to interfere, ploughing and allowing the soil to dry out for several months.

Preventing by the use of enbankments, ditches, etc., the washing of soil from infected to clean fields. The introduction of the pest by tools, wagons, farm animals, etc., should be prevented.

Clean cultivation is absolutely essential in any plantation to keep out pests and diseases.

Immunization (disease resistance).—The solution of the problem of the control for these diseases seems to lie finally in the development of resistant, commercially valuable varieties. This consists of the securing of Manilla hemp varieties that will not succumb to these diseases.