THE PHYSIOLOGY OF PARASITISM OF ROSELLINIA PEPO (Pat.)

I INTRODUCTION.

The object of the following investigation, which is a continuation of the work of Toovey (1935), was to assess the part played by environmental factors, in determining the incidence and spread of the root disease caused by Rosellinia Pepo. This disease was studied together with root diseases caused by other species of Rosellinia under local conditions on three islands in the Lesser Antilles; - Trinidad, Grenada and St. Vincent, in order to determine any common features present. Nowell (1916), records the following five species in the West Indies, the first three of which he associates with root diseases of cacao and other cultivated plants:-
Rosellinia Pepo Pat., R.bunodes B. et Br., R. (paraguayensis Starb.?), R.bothrina B. et Br. and R.subiculata (Schw.) Sacc.
The present investigation deals primarily with Rosellinia Pepo Pat. a species originally described by Patouillard (1908) from material on the bark of Hymenaea Courbaril collected by Duss in Guadeloupe. The perithecial stage has been recorded in the British Antilles from Dominica, St. Lucia, Grenada and Trinidad and the disease is also established in Jamaica, Porto Rico and Martinique. Cacao is recorded as its most important host although many other crop plants which are planted on land recently cleared from forest can also be susceptible. Temporary shade plants which have been planted to replace cacao trees killed by the fungus, such as dasheen, banana, pigeon pea, horse bean (Canavalia) and cassava may all be attacked. Sugar-cane is noted to possess considerable resistance and coconut appears entirely immune.

In the absence of the perfect stage, the fungus is distinguished/

distinguished in the field by the production of fans or stars of white mycelium in the region of the cambium between the bark and the wood of the roots. Rosellinia paraguayensis Starb. has a somewhat similar appearance but a much less vigorous growth.

Attention may be drawn here to the difficulty of naming species of Rosellinia by mycelial characters alone in the absence of the perfect stage. The present writer was unable to find the perfect stage of Rosellinia Pepo on Cacao and Nutmeg although a search was made in both Trinidad and Grenada. The perfect stage of Rosellinia bunodes was however readily found in Grenada on Hibiscus mutabilis and on Grapefruit, Citrus paradisi, a new host record for this species.

It would appear that a rarely produced perithecial stage is a specific character of Rosellinia Pepo and this coupled with its parasitic tendencies should serve to distinguish it from Rosellinia paraguayensis. The latter species has been observed by the writer in Grenada fruiting freely and behaving as a saprophyte under environmental conditions identical with those in which Rosellinia Pepo in the mycelial stage was found as a parasite.

In the opinion of the writer Rosellinia Pepo is the species responsible for Rosellinia root diseases of Cacao and Nutmeg in the West Indies. The reasons for this view will be given in a later part of this dissertation.

It will be observed in the following historical summary that our knowledge concerning the parasitism of Rosellinia Pepo has in the past been based on field observations and that no isolation of the fungus and experimental proof of its parasitism has been obtained. Proof of parasitism within the genus has however been obtained by Nattrass (1926) using cultures of Rosellinia necatrix (Hart.) Berl. the causative agent of white root/

root rot of fruit trees in England, by Gadd (1928) who used pure cultures of Rosellinia arcuata to successfully inoculate tea seedlings in Ceylon, and by Thomas, Hansen and Thomas (1934) who demonstrated the pathogenicity of Rosellinia necatrix on small apple and pear trees in California.

Further reference will be made to these species as well as to other parasitic species of the genus Rosellinia occurring in both Tropical and Temperate countries as there is evidence that these Rosellinia diseases have a common method of spread in the fields by means of mycelial strands. Wilson (1922) emphasises the important bearing of this character on the type of disease produced by these species, in his following description:- "Long strands or filaments made up of a number of longitudinally arranged hyphae are produced which not only penetrate the stem and root of the diseased plant, but spread through the soil and over the substratum and bring about the infection of other plants in the vicinity.

The serious nature of the diseases produced depends largely on this character, for distribution by means of the mycelial strands is rapid under suitable conditions, and it is a difficult matter to exterminate the fungus in the soil when the latter has become thoroughly infected." It was appreciated after a preliminary survey of the literature on Rosellinia root diseases that a study of the physiology of parasitism involves three main considerations, the pathogenicity of the parasite, the susceptibility of the host and the environmental factors predisposing towards infection and favouring the progress of the parasite. The relative pathogenicity of the parasite and susceptibility of the host can not readily be distinguished one from the other in disease but are largely influenced by environmental conditions.

In the past, the environment in the opinion of the practical/

practical planter has been considered all important, to the exclusion of the parasite, and according to Butler (1932) has been overstressed. The following is quoted from his article in Nature. "The practical man is often slow to admit that a destructive disease in a plant is due to agencies outside his control. Confronted with such he is inclined to seek for explanations other than the true one. He looks first for some disorder brought about by cultivation or inbreeding or meteorological phenomena. Or he thinks that the soil is unsuitable or has become exhausted or that the plant, if an exotic, has failed to become acclimatised. It is often not until all these have been tested and found wanting, that the true cause is fully realised. Experience has shown that it is unfortunately rare to find the explanation of serious disease in these directions and the dominating factor is usually the presence of a parasite however much its activities may be favoured by secondary causes."

On the other hand, the tendency on the part of pathologists has been to devote all their attention to the parasite with only a passing interest in the environment. This is particularly true of root diseases, which are the least satisfactory of any to investigate. Experimental research is beset with difficulties particularly when the attempt is made to interpretate cause and effect.

We thus find two schools of thought with regard to root diseases and their control. The one sponsored by Nowell (1916) regards the parasite as all important and recommends removal or quarantine of the fungus to remove the disease. According to his authority, "in the case of Rosellinia disease of limes the conditions which best suit the tree best suit the fungus also, with the result that the finest trees are most liable to attack and are most frequently killed."

The other advocated by Napper (1932), de Jong (1933) and Briton-Jones (1934) regards the problem as fundamentally an oecological one.

The two different attitudes are of some importance in economic plant pathology where the efficacy of the control measures adopted depends on the degree of accuracy of the interpretation of the disease complex.
