

INTRODUCTION.

Mycorrhiza or fungus-root associations are common in many species of plants and though studied continuously since the latter end of the 19th Century results are surprising, often contradictory, and commonly hypothetical. An attempt has been made to review the main of these results and theories in the short review of literature, giving also their main constructive and destructive criticisms. Whatever the economic significance of any specific mycorrhiza, the common occurrence of this habit in nature warrants a scientific examination.

Pyke(23) describes the common occurrence of a mycorrhizal association in cacao growing in Trinidad. Other than describing this association no attempts were made to ~~eliminate~~ ^{elucidate} its true significance. Interest in the biological status of Tropical Soils and crops growing in these soils has recently increased and this work is designed to supply data for the understanding of the mechanism of soil-root nutrient exchange of cacao. The work was started, therefore, entirely without guide from earlier work on this mycorrhiza, other than the description by Pyke. Most literary efforts on mycorrhiza are from the Temperate regions on temperate crops and conditions, ^{are} and therefore not too helpful for this cacao association. For this reason this work was designed to be a survey primarily to explore and recommend possible lines of work, with no fundamental idea of producing any conclusive results in the short time available. It is therefore a reconnaissance.

Methods used were based upon the immediate necessities with later modifications as guided by the experiences of the staff of the Imperial College and upon past experiences recorded in the literature. Firstly a survey was made of different cacao growing areas to find the distribution of the mycorrhiza.

From this initial survey it became apparent that no examined area was entirely without mycorrhiza and that comparisons between good and bad cacao areas would be desirable to find out if any correlation existed between mycorrhizal density and the productivity of the cacao in each area. Two contrasted areas of productivity were chosen and surveyed, and incidently gave rise to certain unclear points in the description of the mycorrhiza given by Pyke. The methods, results and discussion of the survey and a critical discussion of the description recorded by Pyke is given.

As no examined area was found to be entirely without mycorrhiza only comparative field observations can be taken. However useful these observations are, only studies on controlled production of mycorrhiza can give access to the finer details of the association. Controlled production of mycorrhiza requires a pure culture of the fungus and efforts to obtain such a culture were made but were unsuccessful. The necessity of such a pure culture is stressed and cannot be over stressed.

Under natural conditions some species of plants depend upon mycorrhizal infection for germination and for later healthy growth. It was desirable to know if mycorrhiza in cacao plays such a fundamental part in the growth of seedlings or productivity of older trees. Mature pod-bearing trees can only be studied in the field at present, where mycorrhiza is always present in some degree. Therefore productivity of normally cultivated cacao without mycorrhiza, cannot be directly compared in the field against similarly cultivated cacao with mycorrhiza. This is a common comparative method in use in the temperate regions. No pure culture of the fungus is as yet available. Thus, by force of circumstance a pot experiment was designed to compare seedling growth without and with mycorrhiza. The limitations, criticisms, results, and interpretations of the pot experiment are given.

Most results obtained throughout the whole work were negative in character and were inexplicable on the present state of knowledge. However a discussion is given (even though it is considered to be premature) with the primary object of indicating future work, and not with the object of producing final conclusions.

Literature is confusing in many details and even the fundamental definitions of mycorrhiza occasionally vary. The following definitions are the ones whose limits are used in this survey.

The definitions are based upon the review of literature. With many plants a fungus-root association is seen. No apparent pathological harm is caused to the plant, but that true symbiosis exists has often been doubted. Therefore it appears that the safest definition of a mycorrhizal state is one in which a specific fungus (or fungi) is found in constant association with the root system of a particular species of plant, with no apparent pathological effect of the fungus on the root, or the plant as a whole.

Two main forms of such associations exist:-

- (1) ECTOTROPHIC mycorrhiza in which the fungal elements are arranged intercellularly and also on the root surface;
- (2) ENDOTROPHIC mycorrhiza in which the mycelium is characteristically intracellular and appears on the surface of the root as individual hyphae only at the points where they enter the root from the surface of the soil particles.

Although strict ectotrophic and endotrophic mycorrhiza occur, other mycorrhiza exist in which characteristics of both groups are seen in one association. To these the name ECTENDOTROPHIC mycorrhiza is given.

Mycorrhiza of abnormal types also exist, the structure indicating one sided parasitism on the part of the constituent fungi. To these the name PSEUDOMYCORRIZA is given.