garden, field and grass soils were taken and portions of these dissolved in Detmer and Bristol culture solutions. The flasks were put in the green house and after about a fortnight onwards different forms of Algæ which appeared were studied and recorded. The material was fixed in 4 per cent. formalin in test tubes for future work. Permanent slides were made in pure glycerine.

Myxophyceæ: A number of species of Oscillatoria and Lynbgya have been described. One species of Oscillatoria seems to be new.

Chlorophyceæ: The interesting forms recorded here are a species of Pandorina and Phacotus. Both these two genera have not been reported before from the soil as far as it has been possible to ascertain from the literature.

Euglenaceæ: Here a new form from the soil, namely, Trachelomonas has been recorded.

Altogether three new genera, namely, Pandorina, Phacotus and Trachelomonas have been recorded from the soil and which have not been reported before. Full details of this work will appear in due course and intensive study of soil Algæ is in progress.

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A NOTE ON THE DEVELOPMENT OF THE FEMALE GAMETOPHYTE IN *ABROMA AUGUSTA* L. AND *PENTAPETES PHOENICEA* L.

Abroma augusta and *Pentapetes phœnicea* are both members of the family Sterculiaceæ. The former is commonly cultivated for its medicinal importance while the latter grows as weed in Bengal during the monsoon.

Literature on the embryology of the family Sterculiaceæ is meagre. Sharma[1] has referred to the relevant literature on the subject and recorded his observations on gametogenesis in three species in an earlier issue of this *Journal*.

The present investigation shows that the archesporial cell is hypodermal in origin in both the plants studied. It cuts off a parietal cell and then functions as the megaspore mother cell. The megaspore mother cell is pushed considerably inwards within the nucellus due to the division of the overlying cells. Two megaspore mother cells lying side by side have been observed in *Abroma augusta*. The reduction division is normal and a linear tetrad of megaspores is produced in both the plants, but in *Abroma augusta* some "T-shaped" tetrads have also been observed. The chalazal megaspore becomes functional in every instance. The usual course of development follows and a normal eight-nucleate embryo-sac is produced. In *Abroma augusta*, however, two binucleate embryo-sacs have been observed to lie side by side. It appears that this has resulted from the activity of the second megaspore mother cell. The mature embryo-sac shows the normal organization but the antipodals are ephemeral. The ovules have two integuments and the nucellus is completely enclosed by these.

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PHYSIOLOGY OF POLLINATION IN ORCHIDACEAE

IN Orchidaceæ, the stimulus of pollination is necessary not only for the continued development of the ovary but also for the initiation of the ovules in several species. Normally pollination shortens the life of the blossom and brings about changes in the colour of the perianth. The gynostegium enlarges and the ovary is stimulated to grow into a fruit. These

are some of the changes seen in the flowers as the result of the stimulus of pollination.

In the absence of pollination the life of the blossom continues longer, the perianth remains fresh and there is no growth of the gynostegium and the ovary is arrested in its growth to form a fruit. After a period the flowers may wither away or remain on the plant ultimately drying up.

Fitting[1] observed the growth response of the gynostegium and of the ovary of several orchids on the application of dead pollinia to their stigma. Laibach,[2] Morita[3] and others experimented on the growth responses of the ovary, to the application of dead pollinia, foreign pollen and pollen extracts to the stigma. The results were sometimes positive and sometimes negative. As the result of a series of investigations by them, the existence of growth promoting substances such as auxins, hormones, etc., were shown to be present in the pollen, pollen extracts, pollen tubes, in the wall of the ovary and also in the placental tissue of orchids. Fitting further believed that the substance extracted contained no nitrogen and that it was not an enzyme.

Gustafson[4] has induced parthenocarpy in several plants belonging to diverse groups of flowering plants, by the application of pollen extracts and other growth promoting chemicals. During the past few years a number of organic compounds which stimulate the growth of plants have been isolated. But no satisfactory explanation of the mode of action of many of these growth-promoting substances in the plant body is to be found in the literature.

Laibach[2] has investigated the nature of the substance obtained from the pollinia of orchid flowers and has found that it not only caused swelling in the gynostegium of orchids but also caused a stretching of the coleoptile of oats. So Laibach is of opinion that the hormone from the pollinia and the growth substance such as auxins are either identical or closely related.

The investigations of Boysen Jensen[5] clearly show that auxins promote growth by influencing the turgor of the cells there by bringing about stretching of the cell wall. Later new material will be incorporated in the stretched cell wall, thus bringing about permanent increase in size and hence growth.

FIG. 1

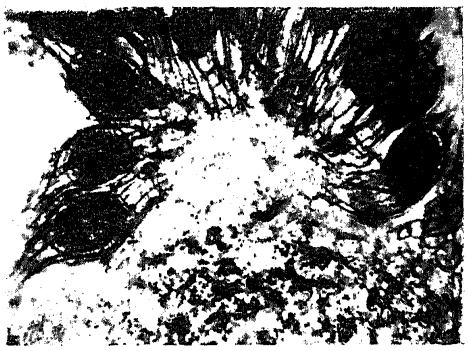

FIG. 2

FIG. 3

Flowering shoot of *Habenaria longicalcarata* showing the pollinated and the unpollinated flowers. Both are 40 days old from the time of the opening of the flowers. The pollinated ones have developed into fruits. ¼ Nat. size.

Transverse Section of part of the ovary of the pollinated flower showing the starch grains, strained with iodine in the placental tissue and the well-developed ovules with the embryos. 40 days old. × 80.

Armstrong and Armstrong[6] are of opinion that the main effect produced by hormones when they gain entry into the living cell is the stimulation of enzymic activity which influences the metabolism in plants and animals.

The results obtained by the work of the author appear to be highly suggestive and throw more light on this problem of stimulation in the physiology of pollination in Orchidaceæ and the mechanism by which the pollen hormone promotes growth of the orchid ovary. A brief note about it is given here with particular reference to *Habenaria longicalcarata* (Rich.). Two other species of *Habenaria* and one of *Ipsea* have been studied and the results confirm the observations made on *Habenaria longicalcarata*.

When pollinated the ovary of *Habenaria* grows into a fruit and becomes much bigger than the ovary of the flower which is not pollinated. Superficially much difference cannot be made out between the pollinated and the unpollinated ovaries except in their size (photograph 1). The ovary of the unpollinated flower though forty days old and of the same age as the ovary of the pollinated shown in the above photograph, remains rich green in colour but it is inhibited in its further growth.

Histological details show that in the pollinated ovary (micro-photograph 2) there is an abundance of starch in the inner wall cells of the ovary and particularly it is rich in the placental tissue where there are a large number of leucoplasts in which starch is elaborated from the simpler carbohydrates derived from the chloroplasts. In the outer wall cells chloroplasts can be made out and the stomata in the epidermis are very efficient. The ovules show normal development since they are well supplied with the plastic nutritive material synthesized in the wall of the ovary.

In the unpollinated ovary (photo-micrograph 3) absence of starch is conspicuous and naturally associated with it are the undeveloped ovules. The chloroplasts, the leucoplasts and the stomata though apparently normal looking are not functional. They seem to remain inhibited from their normal activity.

These facts clearly indicate the mode of action of the growth-promoting substance or pollen hormone present in the pollinia of *Habenaria*. This hormone stimulates the plastids to synthetic activity by its enzymic action as a result of which plastic substances in the form of carbohydrates are synthesized in the wall of the ovary thus providing special nutrition not only for the continued growth of the ovary but also for the normal differentiation and development of the ovules.

Laibach is of opinion that the pollen hormone from the pollinia of orchid, which he investigated, and the other growth-promoting substances like auxins are either identical or closely related. How far this view holds good in the case of *Habenaria* is under investigation.

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SPEARFISH ATTACKS AN OTTER BOARD

VARIOUS instances of attacks of swordfish and spearfishes on vessels have been recorded in a comprehensive paper by Gudger on "Alleged Pugnacity of Swordfish and Spearfishes".[1]

In this paper there is no record of any attack off Colombo. During minesweeping exercises of "M. S. Goliath" under the command of one of us (M.M.) off Colombo in August 1940 one of the otter boards (teak plank of 2" thickness) was pierced through by a *Makaira indicus* which left behind its sword attached to the board. The accompanying photographs (Figs. 1 and 2) by Lieut. Engineer A. Smith (Fig. 3