A NOTE ON THE ASSOCIATION OF *CHLOROCOCCUM HUMICOLUM* IN THE ROOTS OF *CYCAS REVOLUTA*

DURING the course of their investigations on the microbial flora associated with the nodules and root-forms of some non-leguminous plants, the work on *Cycas revoluta* was planned with a view to ascertain the synergetic action of all the biological entities present within the roots. Special attention was paid to the study of the well-known *Anabœna cycadœ*, an alga of ecological interest. For isolating this alga various media, including Beijerinck's basal ammonium nitrate solution, Benecke's solution and a new medium (nitrogen-free) devised by the authors, were tried.

It was observed that the coral roots of one of the many *Cycas revoluta* plants they had examined consistently gave rise, in the new medium referred to above, to a new type of algal growth (which on examination for morphological features proved to be *Chlorococcus humicolum*) not hitherto recorded. It was also observed that the preliminary growth of this alga (which is presumably new for the roots of Cycas) appeared only after about three months of incubation at the room temperature (about 27° C.), whereas the sub-cultures of the same made evident its growth in the same medium within a brief period of fifteen days. It must also be mentioned in this connection that the algal growth was absolutely free from any other growth, microbial or otherwise.

The medium above referred to had the following composition:—

Water (distilled)—1,000 c.c.
Di-potassium-hydrogen phosphate—0·20 gm.
Potassium chloride—0·10 gm.
Calcium carbonate—0·10 gm.
Ferric chloride—0·10 gm.

A glance at the ingredients will at once reveal that it is a purely synthetic medium, and what is more striking, is that it contained no nitrogen in either organic or inorganic form.

As far as the present authors are aware, *Chlorococcum humicolum* has not been recorded to occur as an endophytic organism in the corolloid roots of Cycas, though it is a widely distributed algal species, occurring in a diversity of habitat such as damp soil, brick-work, etc.

This alga grows luxuriantly in both Beijerinck's and Benecke's media, yet the fact that satisfactory growth of the alga takes place in the nitrogen-free medium also, suggests that the alga can tolerate an absence of combined nitrogen and leads to the presumption that it is a nitrogen fixer. Its presence together with various other biological entities associated in the roots of Cycas points to the role of these organisms in the nitrogen metabolism of the plants in whose roots they occur. And the recent observations of Yoshimura amply support such a view.

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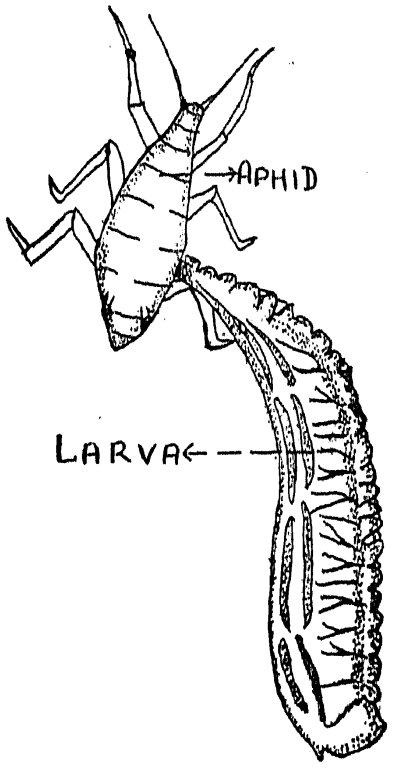
NOTES ON A SYRPHID (*SPHAEROPHORIA SCUTELLARIS* FAB.) FLY PREDATOR ON MUSTARD-APHID (*RHOPALOSIPHUM PSEUDOBRASSICAE* DAVIS)

DURING the course of my study of biology of the mustard-aphid, *Rhopalosiphum pseudobrassicæ*, syrphid-fly larvæ were observed among the aphids. It was rare to find any colony of the aphids that did not have from one to many elongate larvæ preying upon them. Hidden among the aphids, these larvæ (Fig. 1) grasp aphid after aphid by their pointed jaws, raise it in the air, slowly pick out and suck out all the body contents, finally discarding the



empty skin. It has been observed that sometimes a larva destroys aphids at the rate of one every minute and this process continues for a considerable period. In fact, the rate of

destruction depends on the age of both the larvæ and the aphid, *i.e.*, a full-developed larva can destroy larger number of aphids of younger ages. It has also been observed that the larva attacks not only apterous aphids but can attack and destroy even the winged aphids when they come within its reach. The predator appears to be of a very great importance, and, therefore, a short account of it is given here.

Egg.—The eggs are laid by the adult fly among the aphid-colony. The eggs are pearl-white and more or less elliptical in shape with gently rounded ends. The anterior end is somewhat flattened, it is the place where opening is formed at the time of hatching of the egg. The egg-surface is covered with longitudinal ridges which are connected with one another through transverse ridges and thus a number of quadrangular areas are formed all over the egg-surface. The egg is about 0·9 mm. long and about 0·4 mm. thick.

Larva.—The full-grown larva is slender, with the ventral aspect flattened and the body much attenuated anteriorly. The cuticle is tough and leathery and greenish or brownish. The segmentation is more or less obscure owing to the transverse corrugation of the body. However, a closer study shows that there are eleven segments. The general appearance is rather slug-like. The technical system is of amphipneustic type, *i.e.*, only the prothoracic and the posterior abdominal spiracles are open. The anterior spiracles are on the second apparent segment, while the posterior pair is situated on two tubes which are very short and are fused together down the median line. From the sucker-like mouth located on the undersurface of the first segment, protrudes a pair of black-toothed hooks —the mandibles. These are supported by and connected to the cephalopharyngeal skeleton, which is a V-shaped structure extending back into the body as far as about the third segment. The cephalopharyngeal skeleton is a blackish scleritised structure and is usually visible through the integument of the larva. It differs in shape in different larval stages. In the first larval stage it is small and incompletely developed, while in the last larval stage it is completely developed and the parts are easily distinguishable. The full-grown larva is about 9 mm. long and about 2·5 mm. at the thickest place.

Pupa.—Prior to pupation the larvæ come to rest near their habitat, the caudal segments become cemented to the leaf or to the cage-wall with a black secretion apparently exuded from the hind gut. The pupa becomes again cemented if it is decemented. This shows that the secretion restarts when required. The pupa forms inside the last larval skin. The puparium is inflated dorsally and laterally. Spiracles are present on the puparium in the region of the fourth segment and are elevated upon conspicuous horns. The pupa is about 1·5 mm. thick and about 6 mm. long. The anterior end is more or less cap-like while the posterior end is more or less flattened. The eclosion of the imago takes place by means of a transverse rupture of the puparium near the anterior end.

Adult.—In general, the male is distinguished from the female by its larger size, and the unequal facets of the contiguous compound eyes. *Head:* Face yellow; compound eyes, deep maroon having a golden hue, and separated from each other at vertex region by a distance of about 0·5 mm. Antennæ are brown or black dorsally and orange ventrally. Arista brown or blackish. Proboscis dark brown. *Thorax* deep blue with a narrow streak at the sides. Scutellum yellow with a smoky pubescence. *Abdomen* shining black dorsally with a pair of yellow spots on the second segment and a yellow band on each of the third, fourth and fifth segments; the band on the fifth segment is thinner than the bands on the third and fourth segments which are more or less equally thick. Distal margin each of the third and the fourth segments has a thin brown border and that of the fifth segment a thick brown one. *Legs* are brownish yellow with their coxæ and trochanters slaty coloured and with their tarsals blackish.

The life-cycle is completed within 15 to 20 days. The incubation period is 3 to 4 days, larval period 7 to 9 days and the pupal period 5 to 6 days.

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A detailed account will be published elsewhere showing its importance in biological control. The work is in progress.

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POTATO SPROUTS AS A SOURCE OF "SEED"

IN the past various workers have attempted to devise ways of propagating the potato plant by such methods as would reduce the seed rate. The usual method is to plant either the whole or a part of the seed tuber. This asexual mode of propagation is now the universally-employed method of planting potatoes. The only other method so far known is to raise the plants from the true seed. The potato plant being heterozygous yields a variety of new types when either selfed or crossed seed, obtained from the berries, is sown. It is apparent that by this method it is neither possible to maintain a type nor is it profitable to raise a commercial crop, and its usefulness is, therefore, limited to scientific investigations and for the breeding of new varieties.

Seed tubers may be planted whole or as cut-seed-pieces and it has been determined that a seed piece weighing about two ounces is the most desirable size to plant. Thus, for every plant about two-ounce weight of seed tuber is required as an initial start. This high seed rate has come in the way of expansion of potato cultivation, particularly due to transport and other difficulties created by the war. Scientists have, therefore, been busy in