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STUDIES OF SIND-LAC HELPFUL IN ITS CULTIVATION

Part II. Sex Ratio Determination in Early Second Stage Larvae of Sind Lac-Insect

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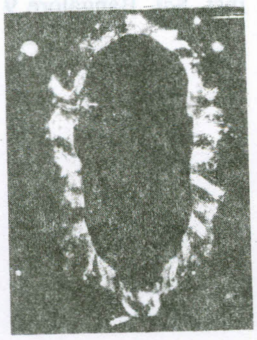
Lac production depends upon a colony of lac insects in which the females are in a favourable percentage. It is then possible to predict an expected crop of lac early enough by determining the sex ratio soon after the larvae have settled on the host plant. During early first larval stage a magnification of x 30 may be necessary. But when the first stage larvae are full grown, or a little later, when the first exdysis has occured sex-ratio can be determined with a pocket magnifying lens giving the magniification of x 10. Pictures of lac larvae have been offered showing fully formed first stage cells and also fully formed second stage cells in which the sex-ratio can be determined.

Key words: Lac, Insect, Cultivation.

When a cultivator undertakes to grow a crop he anticipates the size of the expected harvest. The same applies to lac when it is artificially propagated on its favourite host plant. Here however comes many factors pertaining to the biology of the species of lac insect used. One such factor is the proportion of females in the colony of larvae that have swarmed from the brood-lac that has been used. In South India there is the species *Kerria communis.* In Mysore State it is occasionally seen on its favourite host plant *Ficus mysorensis.* But no one ever uses its insect, *K. communis* for cultivating lac. With this objective, they use another species, *Kerria mysorensis* and the host plant exploited is *Shorea talura.* Thus for regular cultivation of lac they use only the insect *Kerria mysorensis.* Why *K. communis* is not used as well is not known to them. But the biology of the insect species gives the required answer, Brood-lac of *K. communis* can regularly give rise to a generation which becomes one and all winged males so that no encrustation of lac is formed and thus no crop of lac can be harvested. Turning now to the other species, *Kerria mysorensis,* with its host plant *Shorea talura*, the mother insects give rise to a generation which always contains enough females so that a crop of lac can be obtained, large on small, but always some. A systematic cultivation of lac then can anticipate the corp to be harvested. In as much as the female alone lives long enough to produce some lac the ratio between the sexes in the generation that is growing would be an important factor in forecasting the crop to be harvested.

Now comes the time when the sex ratio can be determined. In effect it means the time when the sex-ratio among the larvae can be determined. Naturally the earliest time would be within a week of the larvae having settled on the host plant. Previous authors were not able to differentiate early enough between the male and female larvae. This however has been shown to be possible in a communication dated (1926) which is sufficiently illustrated for the purpose. This however requires the insects to be examined under a dissecting binoccular microscope which gives a magnification of x 30. In Mysore there are three crops of lac a year. But elsewhere there are only two. One life cycle is completed in the humid season of the year of five months, from June to October, and the other in dry season of the year, of seven months from November to May. The crops differ to quantity and it has been shown to be a function of sex-ratio. This suggests the cultivator to know the sex ratio at least by the time the first stage larvae are full grown or about to moult for the first time. This would be about 3 weeks as the latest after the larvae have fixed themselves to the host plant, when the life cycle covers five months. With the object of identifying the earlier stages of male and female larvae, in the light of what is more conspicuous in the more developed forms, we turn to Fig. 1. It shows a female larva in its second stage, some time after its first moult. Its head is broad and likewise the posterior region. From its sides it has produced hard wax filaments. In the anterior region to our left there is an arrow. It marks the place where a structure, called Brachium, is situated. It is a chitinous plate full of pores from which soft wax filaments arise. Below this spot, on the ventral side, lies the major spiracle. To compare a male larva of the same stage as Fig. 1, there is Fig. 2. It is elleptical with a norrower head and pointed posterior region. By now we have seen how the larvae in their second stage differ from each other as do Fig. 1 and 2, as also other cells, Figs. 3 and 5. Incidentally while dissecting some cells I found a second stage male larva was attacked by the larvae of a chalcid parasite. This is shown in Fig. 4 and is included here because nothing similar has been illustrated before in the literature. The cell moreover is typical of a male larva. By now we have some idea of the difference in the cells of early second stage male and female larvae.

We now turn to Fig. 7, where a few representative cells are all fully grown first stage male and female. The major



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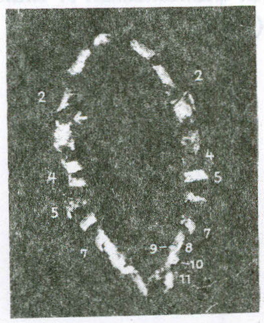

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Fig. 1. Early second stage female lac insect. It has a broad head and also a broad posterior region. It is secreting hard wax filaments from the sides which would support lac secretion from all over the body.

Fig. 2. Early second stage male larva. Hard wax filaments are secreted from the body segments indicated by numbers.

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Fig. 3. Cell of early second stage female larva.

Fig. 4. Cell of early second stage male larva showing the larva of a parasitic chalcid. The elleptical elongated shape of cell indicates its belonging to the male.

Fig. 5. Fully formed second stage cell of male larva. An adult wingless male has emerged from it.

apical hairs at the posterior end can be seen if carefully observed. The cells of the male bear odd numbers and of the female even numbers. Thus we can compare cells nos. 1, and 8, the former belonging to the male and the latter to the female. We may focus attention on the dorsal wax shield which was secreted soon after the crawling larva had fixed itself to the host plant. In the cell of the female larva, cell no. 8, the dorsal wax shield has remained practically undisturbed except in the posterior region. There are 11 segments of such a wax shield all near one another. In cell no. 8, the last four segments are down below and challenge observation, while the main wax shield is quite obvious. On the contrary in the cell of the male, cell no. 1, the entire shield is disrupted. Moreover the posterior region is pointed in the cell of the male, Fig. 1, while the corresponding portion in the cell of the female, cell no. 8, it is sufficiently broad. Other cells in Fig. 7, bear this difference out. We now consider Fig. 6, where the cell marked II belongs to early second stage female larva. It is much smaller than the cell of the male also in the second stage. This cell is indicated with the marking of the male sex as ♂. A cell of early third stage female larva, which means early young adult female, is marked III. Fig. 6, the sex and the larval stage both are easily ascertained. We are finally left with Fig. 8, it contains larvae of male and female practically in equal numbers. The cells of male bear odd numbers and of female even. Cells 1, and 3, belonging to second stage male larva, are much larger and elongatged then those of the fe-

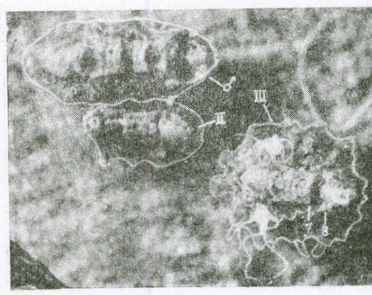

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Fig. 6. A fully formed second stage male cell on the top left. Below it is second stage female larvae cell marked II. An early adult female cell is marked III, with the dorsal wax-shield not much disrupted. Its segments 7 and 8 are near each other.

Fig. 7. A colony of larvae in their first stage retaining the long anal apical hairs. Cell no. 1, is elongated and is male, cell no. 8, of female has largely retained its dorsal wax shield. Cells bearing odd numbers are males, female cells bear even numbers.

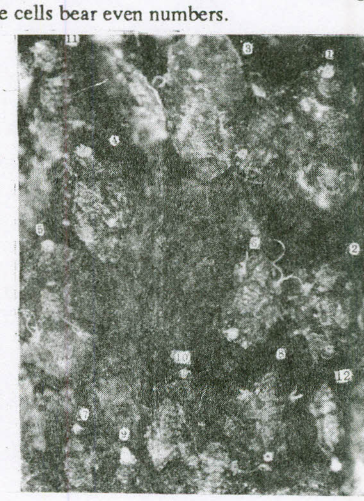

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Fig. 8. A colony of fully formed second stage larval cells. Cells of male nos. 1 and 3 are longer withdorsal wax shield disrupted due to lengthwise growth. Cells of female nos. 2 and 6 are broader. The female grows in hight and the original wax shield is not much disturbed.

male cells, numbered 2 and 6. In Fig. 8 cell no. 1, as male, is larger than cell no. 6 as female and recalls the same difference observed in Fig. 6 where the male cell is much larger than that of the female marked III. In Fig. 8, cell no 9, shows a male which has moulted only recently also and has a thicker and hair brush. Cell no. 2 belongs to the female and shows its characteristic posterior region as broader in contrast to that of cell no. 9 where it is pointed. Any one who has studied Figs. 6 and 8, and 1 and 3 should be able to determine sex ratio in a colony of young larvae using a pocket lens, giving a magnificatin of x 10.

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