

PART V.

RATE OF SECRETION BY THE LAC INSECT.

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As already indicated¹ the rate of lac-secretion becomes perceptibly great after the emergence of males, and the secretion appears to cease about a fortnight before the actual swarming of larvæ. It was of interest therefore to study the phenomenon quantitatively with a view to determining the period of its intense activity which is the most critical in the cultivation of lac.

Sampling.—It has been found that the lac-content of cells growing on the lower portions of an inclined shoot is higher than that of cells situated laterally on the same shoot. Given a particular brood, the secretion is highest with those situated at portions of the shoot having a critical diameter. The extreme tops and basal portions of a shoot bear cells at a much younger stage of development than those lying in the middle, which is evidently colonised at the earliest opportunity by the larvæ. A single individual cell has a higher percentage of lac than each cell growing collectively in a fused mass :—

1,000	individual cells weighed at a certain stage,	16.7 grams.
„	cells growing collectively in a mass at the same stage,	11.9 grams.

In the selection of research material for analysis, attention was paid to the foregoing observations and the samples were collected periodically at intervals of about a week throughout the year, from the same tree which was inoculated only partially each season, for the purpose. The cells were gently scraped from the stick with the aid of an aluminium scalpel, without removing portions of the bark. In the later stages, after ten to twelve weeks, it was found difficult to remove the whole cell without a fragment of the incrustation adhering to the bark. In such cases the minimum quantity of the bark also was scraped out to recover the resin. This trouble was of frequent occurrence during the pre-monsoon season.

Analysis. The lac from the cells was extracted in a Soxhlet with methyl alcohol as being more volatile than ethyl alcohol. Evaporation of the extract in thin films *in vacuo*, facilitated the complete removal of the solvent without decomposition of the residual lac, whose re-solubility in alcohol was tried in each case, as a test for its

¹ See *Problems in Lac-cultivation*.

sound undecomposed condition. Most of the wax was extracted during the process, since heat was applied to the Soxhlet by means of an electric bulb, but the last traces of wax were removed by extracting the residue with petroleum ether (b. p. 40-60°).

The number of insects left in the residue was actually counted, and the combined weight of the extracts was taken to represent the lac secreted by them, at that stage. The results have been expressed as grams of lac per thousand insects. The following tables incorporate the results for the three successive seasons: monsoon, pre-monsoon and post-monsoon and the results have been plotted on a graph.

TABLE III.

Monsoon crop June-October 1922		Post-monsoon crop October 1922-March 1923		Pre-monsoon crop March-July 1923	
Days after settlement of larvæ	Grams of lac per thou- sand insects	Days after settlement of larvæ	Grams of lac per thou- sand insects	Days after settlement of larvæ	Grams of lac per thou- sand insects
28	0.183	27	0.189	30	0.198
35	0.294	34	0.213	41	0.264
42	0.432	41	0.296	52	0.489
49	0.638	51	0.310	59	0.970
56	1.30	63	0.453	66	2.26
63	2.87	70	0.562	73	3.93
70	6.64	77	0.719	80	6.01
77	9.65	84	0.867	87	7.69
85	11.72	91	1.13	98	10.34
92	13.19	98	1.56	105	11.29
99	14.44	104	1.98	112	11.70
105	15.50	111	3.29	119*	11.90
112	16.11	118	5.27	...	...
119	16.30	125	6.31	...	...
125*	16.30	132	7.44	...	...
...	...	139	7.99	...	...
...	...	146	8.30	...	...
...	...	153*	8.41	...	...

* Swarming of larvæ occurred.

Interpretation of the table and the graphs.

During the monsoon the insect completes its life-cycle in about eighteen weeks, whilst during the post-monsoon it takes about twenty-two weeks. During the pre-monsoon season, however, the shortest period of about seventeen weeks is sufficient. The monsoon season yields the richest harvest of lac as will be seen from the figures, whilst the poorest crops are obtained during the post-monsoon.

In the two seasons—monsoon and pre-monsoon—males emerge fifty-two days after the settlement of larvæ whilst during the post-monsoon their emergence is delayed by another sixteen days. It will be seen from the curves that the resin produced by a thousand insects at the time of male emergence is the same in the two seasons, post-monsoon and pre-monsoon, showing that the precise stage in development is necessary before males emerge irrespective of season and time for maturation.

The curves show that an abrupt rise in the secretory activity of the insect occurs after the emergence of males. Although the results vary with the three seasons, the curves maintain the main characteristics and are comparable with one another. The intense secretory activity of the female lac insect, developed after impregnation, is more or less steadily maintained for the subsequent seven to eight weeks, after which the curve tends to fall, indicating the declining activity of the secretory glands. In fact the insect mothers practically cease to feed about ten days before the actual swarming of larvæ.

The rate of lac-secretion is high during the monsoon period which affords the necessary moisture and optimum temperature for the activity. The host-plants provide the insect with an unfailing supply of nutrition. During the post-monsoon period, however, moisture content of the soil is very deficient, the temperature is low and the climate dry, with the result that the rate of secretion is small.

Lac-secretion may be taken as a measure of the general activity of the insect organism. The vital functions of the insect are intensified during the seven or eight weeks following the emergence of males, when it is most important that the host-plant should successfully withstand the voracity of the lac insect. In practice, at least 50 per cent. of the failures to cultivate lac are traceable to the inability on the part of the host, to meet the heavy demands of the insect, resulting in a high mortality due to starvation of the insects; or often in the death of the colonised shoot.

Seasonal Variation in the Rate of Lac Secretion.

