

products and the value of stock on hand amounted to Rs. 1,421—14—4. The difference of Rs. 594—10—6 represents the total expenditure purely on research. This small amount expended on work on such a large variety of products over a period of over four years and with such encouraging results can never be said to have been disproportionate to the output or quality of work carried out. Much greater facilities and funds for the conduct and prosecution of research on this field of economic importance is considered most necessary, if the interests of fruit industry in all its bearings is to be properly safe-guarded, and its expansion and development adequately regulated and stimulated.

Preliminary Studies on the Cardamom Thrips (*Taeniothrips Cardamomi* Ramk), and its Control.

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Introduction. The problem of cardamom thrips and their control is one of very recent investigation. Practically nothing was known of them till 1934, when they were first discovered by the junior author to be the sole agent concerned in causing unsightly scabs on the cardamom capsules. Ramakrishna Ayyar (1935) has described the thrips; Ramakrishna Ayyar and Kylasam (1935) have given a short account of the nature and the extent of damage caused by them. Since then the thrips situation has steadily worsened. The cardamom industry for which South India holds a monopoly has been steadily deteriorating as a result thereof. In view of the importance of the cardamom industry which is computed to give a turn over of nearly Rs. 10,000,000 per annum from a total production of 8,000,000 pounds of capsules, it was felt that the problem of thrips control required immediate attention. Experiments were started by the Entomologist in collaboration with Mr. K. M. Thomas, Government Mycologist, in 1939 at the Korangumudi Estate, Valparai (Anamalais Hills), where damage by thrips was reported to be very severe. The object of the experiment was to find out if it was possible to secure significant diminution of scab injury of the capsules by a reduction of thrips population with the aid of toxic sprays and dusts at a time when the thrips population was high.

Host and its Environment. The host plant is a herbaceous perennial and is cultivated under the shade of primary forests at elevations of 2,500 ft to 4,000 ft. Blossoming would appear to be governed by the extent of rains received in February—March; if for any reason the rains hold off at this critical period flowering is held back and a very poor crop finally results. In favourable seasons the blossoming would start by April and reach the peak by the end of May. The flush would wane thereafter but the plants will continue to produce scattered flowers till the end of December. Molegode (1938) and Subbiah (1940) have given detailed accounts of the

host and its habitat, from which it is possible to visualise the conditions under which the thrips thrive and assume pest proportions year after year.

Nature and Extent of Damage due to thrips. The scabbed patches seen on the affected pods are the result of the injury caused by the thrips feeding on the ovary in the tender stages of the blossoms. Both the adults and the nymphs get access to the deep-seated ovary long before the outer, closely adpressed bract opens out, and cause severe injury to the tender tissue through extensive feeding before the flower normally opens. Minute droplets of sap exudations could be seen oozing out from the ovary at the spots where thrips had lacerated the tissue and sucked the sap. The injured portions of the ovary gradually develop corky encrustations which persist as scabs on the outer skin of the capsules long after the actual damage is done. In cases of severe infestation, the scabs on the capsules are numerous and extensive. Roughly 75% to 80% of the fruits were found scabbed in varying degrees in the samples examined from Korangumudi Estate in 1939. About half the damaged fruits showed very severe scabbing, the scabs extending all over the outer skin of the capsules. The loss caused by way of shedding of flowers and tender fruits due to thrips is estimated by Mr. E. N. House to be about 30%. No further damage to the capsule is caused by the thrips after it has attained the size of about 6 mm. No appreciable damage is done to the shoots. The scabbed capsules are not commercially favoured and fetch a low price.

Seasonal Incidence. As the host plant is a perennial, the pest finds it easy to breed right through the year on the same host. But its incidence varies with the season; it is lowest in the months of November, December and January; a sharp rise is noticeable from February onwards. Thereafter it reaches the peak in May and June after which it appreciably drops. The downward trend noted in its population after July may be due to the heavy monsoon rains which would seem to bring it down. The peak period of the pest unfortunately synchronizes with the heavy flowering noticeable in May, and the fruits that set at this period, therefore, show invariably a high percentage of scabs. All the stages of the insect, i. e., nymphs, prepupae, pupae and adults are passed on the plant itself.

Distribution of the thrips on the plant. Adults and nymphs are found in various protected situations; they are found in the inner-most leaf of the spindle, inside the basal sheaths of the old leaves, on the flowering branches, and inside the perianth and round the ovaries. The massing of nymphs and adults is particularly confined to the gaping sheaths of old leaves. Prepupae and pupae are seen only within the perianth and the leaf sheaths.

Regional Distribution. The thrips are well distributed in all the cardamom growing areas such as Anamalais Hills, Mysore, Travancore and Nelliampathy Hills; in the last mentioned place, however, the capsules are exceptionally free from scabs and the pest does not occur on a scale like what is seen in the Anamalais area.

Control Experiments. Experiments were laid out in randomized blocks in a twenty-five year old estate in Korangumudi; each block consisted of five treatments including the control and there were six replications. Each plot consisted of twenty clumps distributed in four rows. The capsules borne on the ten clumps of the two inner rows of each plot were separately harvested and cured after each picking; the produce of each plot of each picking was examined for scabs later on. There were four pickings for each treatment. The effectiveness of the treatments was judged by the presence or absence of scabs on the capsules. For this purpose four random samples were drawn from the material of each plot and each sample was graded as 'good', 'light' and 'bad' depending on the total freedom or otherwise from scabs. 'Good' indicates total absence of scabs; 'light' indicates slight scabbing and included capsules having only two streaks of 2 mm. and less in width and the 'heavy' the rest. Percentages for the three grades were determined on the basis of the sum totals of the four samples of each treatment.

The treatments consisted of spraying with (1) tobacco decoction extracted from the tobacco stems and soft soap; the decoction tested 0.028% nicotine after dilution with an equal volume of water; (2) potash fish oil soap of the Kerala Soap Institute at dilutions of 1 lb. in 6 gallons of water; (3) Bordeaux mixture (0.5%) with coconut oil for improving the adhesiveness; (4) dusting with Cooper's special spreading sulphur of 300 fineness and (5) the control, in which no treatment was given. The first round of treatment was given to the blossoms in the last week of May 1939, with a view to reduce the heavy population of thrips that was then prevalent in them. The first three treatments were carried out with the aid of an "Eclipse" sprayer and the fourth with the help of a "Pfalzgraf" bellows hand duster. Since two gallons of spraying fluid were required for each clump, about 1,400 gallons of the spraying fluid is required for one round of spraying for an acre. Difficulty was experienced in securing easy penetration of the spray fluid even under high pressure into the region of the ovary owing to the presence of the closely fitting bract surrounding the flower which obstructed the passage of the fluid. A higher mortality of thrips could not be secured in view of this handicap. Thrips lodged in the ovary region were therefore found less affected.

The data collected were analysed statistically, and the results are presented in Table I.

It will be seen that the treatment differences are significant at 5% level for 'good' pods in the third picking and for all the pickings put together. Significance is not established in the case of treatment differences for the first two and the fourth pickings. Amongst the treatments tobacco decoction spraying alone has given a mean difference well above the critical difference. The absence of significance in the first two pickings is explained by the fact that the material of the two pickings chiefly consisted of capsules

TABLE I.

Statement showing the percentages of "Good", "Light" and "Bad" capsules for all the pickings.

Nature of treatment.	1st picking. 13-10-1939.		2nd picking. 10-11-1939.		3rd picking. 15-1-1940.		4th picking. 15-2-1940.		Total for all the pickings.	
	Good.	Light. Bad.	Good.	Light. Bad.	Good.	Light. Bad.	Good.	Light. Bad.	Good.	Light. Bad.
1. Sulphur dusting.	61.4	19.8 18.8	52.4	17.1 30.5	55.6	24.8 19.6	65.1	18.8 16.1	58.5	20.2 21.2
2. Tobacco decoction spraying.	56.9	16.9 26.2	59.4	28.4 11.9	80.1	11.5 8.4	77.9	12.9 9.2	70.6	17.3 12.1
3. Potash fish oil soap spraying.	49.3	24.9 25.8	48.5	33.5 18.0	64.0	21.9 14.1	67.3	19.0 13.7	58.6	24.3 17.1
4. Bordeaux mixture spraying.	47.6	26.4 38.0	44.5	26.0 29.5	62.9	22.3 13.8	59.8	20.8 19.4	56.0	24.2 19.7
5. Control.	45.3	18.2 36.5	43.4	13.5 43.1	64.8	18.0 16.6	60.6	18.6 20.8	55.3	16.9 28.6
Critical difference for significance $P=0.05$.	...	...	...	12.9%	9.9%	3.9%	...	...	3.6%	9.5%
Whether the treatment differences are signi- ficant or not.	no.	no. no.	no.	yes.	yes.	no.	no.	no.	yes.	no. yes.

that had set a couple of months before the spraying was given and as such could not have had the benefit of the treatment.

Conclusions. (1) Reduction of scab injury due to thrips attack is possible through insecticidal treatment.

(2) Tobacco decoction spraying alone has been found to give statistically a higher percentage of good pods totally free from scabs.

(3) Early and later rounds of sprayings are indicated to be necessary if effective control of scab injury in capsules is desired in the first two and later pickings.

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A Short note on dry-land paddy in Udayarpalayam.

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The Udayarpalayam taluk of the Trichinopoly district is noted for the cultivation of dry (purely rain-fed) paddy. This occupies about 30,000 acres of red sandy soils. The average rainfall of the tract for the preceding five years is 13.9 inches in the South-West Monsoon (June to September) and 23.4 inches in the North-East Monsoon (October to December). The important dry paddy varieties are (1) *Perunel*, (2) *Kaivirai samba*, (3) *Kalian samba*, (4) *Kattaikar* and (5) *Motta kuruvai*, and all these varieties are invariably sown broadcast. Taking advantage of the summer showers, the lands are ploughed 4 or 5 times, cattle manure at the rate of about 12 cart-loads per acre applied and the fields kept ready for sowing on the receipt of the first rain.

Peru nel is a coarse variety of about 8 months' duration and is confined to low lying lands where water stagnates till January. This is, therefore, sown early before the land gets too wet for sowing. *Kaivirai samba*, *kalian samba* and *kattaikar* are also coarse varieties but 6 months in duration.