https://doi.org/10.29321/MAJ.10.A04751



| | | | | |
|---|---|---|---|---|
| **Receipts.** | | | | |
| 600 bunches of 40 fruits each | 24000 | | | |
| 100 ,, 30 ,, | 3000 | | | |
| Total. | 27000 | | | |
| @ Re. 1 per 100 | | 270 | 0 | 0 |
| 700 saleable suckers | | 21 | 14 | 0 |
| Cost of fibre, flowers, etc. | | 14 | 0 | 0 |
| | Total. | 305 | 14 | 0 |

Net profit per acre. Rs. 227 or 225. More profit can be obtained in seasons of favourable price or if all the suckers produced are sold as seed material.

**Conclusion.** Cultivation of *Nendran* plantain is generally very paying and it is sure to tempt anybody in venturing on a large scale plantation. But there is the other side of this picture. In spite of all precautions taken very often large areas of this crop are damaged by high cyclonic winds causing irreparable loss to the ryots. The loss in such cases will be immense especially if large areas are owned by one individual. For this reason large areas are conjointly cultivated by many ryots or each individual owns only a limited number of plants. The *Nendran* is and will continue to be the plantain of Malabar.

## Ecological Notes on the Sugarcane stem borer (*Argyria, sticticraspis*, Hmp) in the Irwin Canal Area, Mysore.

By D. SESHAGIRI RAO, B. Sc.,

*Assistant Entomologist, Mysore.*

**Introduction.** The observations recorded in this paper were made in 1938 in a small plot $\frac{1}{4}$ acre in extent, situated amidst large blocks of sugarcane at Satnur Farm 3 miles from Mandya in the Irwin Canal tract, Mysore. This plot was divided into ten equal sub-plots of one gunta ($\frac{1}{40}$ acre) each which were planted, one in the middle of every month from February to November 1938. The observations recorded herein were made on each month's planting from the third till the twelfth week after planting. No control measures of any kind against the borer were undertaken, and there was no other deviation from the usual cultivation routine.

This work was undertaken with the purpose of obtaining comprehensive data relating to (a) Egg-deposition rate of *Argyria sticticraspis* Hmp* in different months of the planting year, (b) the percentage of egg mortality due to the egg-parasite (*Trichogramma minutum*, Riley) and other natural factors, and (c) the effect of the resultant hatch of larvae on the young crop. This enquiry was suggested to the author by Tucker's work (ii) in Barbados; but owing to the great difference in the bionomics of the pests concerned,

* No mention of *Diatraea Venosata* Hmp, which also attacks sugarcane in its younger stages is made in the paper to avoid confusion, as its incidence is extremely slight.

and the methods of cultivation, a considerable deviation from his plan of work was inevitable.

The plot selected for this study, while situated in an extensive sugarcane block was carefully excluded from borer control work, so that, while allowing for normal incidence of attack, there was no artificial check imposed on the pest, or disturbance of the effect on it of its egg-parasite and other natural factors tending to reduce its severity. Thus the data presented in this paper are based on the incidence of the borer in its natural (without control) state and it is believed they can therefore be utilised as a working guide for the application of control measures on a field scale

**Methods of study.** In each sub-plot 24×15 feet furrows in 3 rows (of 8 furrows each) were opened and 250 setts of H. M. 320 cane were planted in the middle of every month from February to November 1938. January and December were left out as it is not usual to plant sugarcane in those two months in this area. Irrigation, manuring and weeding were on the usual lines and at proper intervals. Observations were begun in the third week after planting and were continued till the twelfth week, after which a detailed study became difficult on account of the great mass of foliage developed by them. Besides, the marked diminution in the density of egg-laying as the crop approached this age made it unnecessary to continue weekly examinations beyond this age.

At every weekly examination every plant in the sub-plot concerned was carefully searched for *Argyria* egg-masses deposited on it. Immediately one was located, its condition (see below) together with the number of eggs in it was recorded. The egg-masses located at the weekly examinations fell into the following four categories, depending on the interval between actual oviposition and the day of examination. (a) *Fresh-laid.* Uniformly pale yellow or dirty white in colour, (b) *Parasitised.* Completely blackened, if parasites were still inside, or black egg-shells with a circular hole in the middle, if parasites had emerged, (c) *Hatched.* If hatching had occurred, pale silvery egg-shells were left intact ; in eggs ripe for hatching, the larval head was seen as black spot in the middle of the yellow egg and these eggs were taken as hatched out for record purposes, and (d) *Damaged.* Torn open or eaten up entirely (by ants, etc.) with only silvery scar left of the individual eggs.

Obviously, except the fresh-laid eggs, those belonging to other categories were laid within about 3 days after the *previous* weekly examination so that there was sufficient time for them to show their final condition at the first examination. The number of eggs in such egg-masses and their condition were noted and they were then left in position. It is possible that a number of egg-masses washed away entirely by rain or irrigation water before examination have not come into account but as they could not have been numerous except during rains, and as they do not affect conclusions relating to egg parasitism or damage to crop, it is believed that they may not vitiate the data presented in this paper.

When a fresh-laid egg-mass was found, the blade or the leaf-sheath carrying it was marked in white lead and the plant noted with a stake near it. Such marked egg-masses were examined, first of all, at the next weekly examination and their fate—whether parasitised, hatched, damaged or washed away was duly noted. An egg-mass located at one examination was rarely missed at the next, and in fact whatever happened to it, unmistakable evidence of it was invariably available, thus showing that observations at intervals of less than a week were not necessary.

Thus, the history of a batch of egg-masses was normally fully worked out in two weeks.

Along with the study of egg-deposition on the above lines, the percentage of attack on the young crop in the sub-plot under examination was calculated by actually counting the number of dead hearts and healthy seedlings separately every week the observations were in progress. This served as a ready (if rough) index of *larval survival*. Except for merely counting them, dead hearts were not examined for the presence of larvae in them nor were they removed or disturbed otherwise.

Incidentally the percentage of germination for each month's planting was also calculated on the assumption that with 250 three-eye-bud setts planted in each sub-plot, 750 primary shoots would represent cent per cent germination. The progressive increase in the percentage of germination was worked out for each sub-plot from the first week of observation for 3 or 4 weeks afterwards till the last eye-bud had a chance to sprout.

The sub-plots were harvested in due course in 1939 and both the number of millable canes and the actual weight of cane obtained were recorded separately for each sub-plot. The various data collected in the course of these observations are presented in a condensed form in Tables I and II.

**Discussion.** (a) *Egg-deposition rate: Argyria* ovipositional activity reached its peak in May (on March and April planting) and was negligible in December on October and November-planted cane. This is in accord with field observations of borer incidence in general; summer planting is subject to serious borer attack while "B" season planting (planting after June) is usually fairly free from the pest. This difference in infestation between the two seasons of planting may be ascribed, among other reasons to the effect of rain, beneficial to the crop, and adverse to the pest. The "B" season crop is more vigorous and profuse in tillers than the earlier planting; for the pest, ovipositional activity is greatly reduced (see below) and a number of egg-masses are washed away before hatching.

Further, in every sub-plot there was heavier egg laying in the first half of the period of observation than in the second half, i. e., the crop during the first month after germination appears to be more attractive for egg laying than in the second month, as seen from the following table :—

**TABLE I. Planting, Germination, Borer attack, and Harvest data.**

| Planting. | | Germination. | | Borer-attack. | | | | Harvest. | | | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month. | Date. | Percentage. | Recorded on | Total No. shoots. | Number healthy. | Number attacked. | Percentage of attack. | Date. | Age of crop. | No. of canes. | Weight of canes. | |
| | | | | | | | | | Months. | | lbs. | |
| Feb. | 18—2—38 | 64·0 | 5—4—38 | 1522 | 914 | 608 | 40 0 | 31—3—39 | 13½ | 465 | 541 | |
| March | 18—3—38 | 53·3 | 21—4—38 | 449 | 114 | 335 | 74·6 | 7—5—39 | 14 | 160 | 169 | Canes thin and short. |
| April | 15—4—38 | 64·4 | 12—5—38 | 576 | 100 | 476 | 82·6 | 7—5—39 | 13 | 330 | 690 | Canes thin and tall. |
| May | 16—5—38 | 33·3 | 16—6—38 | 289 | 106 | 183 | 63·6 | 28—7—39 | 14½ | 250 | 952 | " well grown. |
| June | 16—6—38 | 73 2 | 28—7—38 | 1711 | 1227 | 484 | 28·2 | 15—8—39 | 14 | 760 | 2688 | Very good growth. |
| July | 14—7—38 | 62·4 | 18—8—38 | 1012 | 850 | 162 | 16·0 | 15—8—39 | 13 | 826 | 2940 | " |
| August | 18—8—38 | 82·5 | 15—9—38 | 1630 | 1384 | 246 | 15 0 | 29—9—39 | 13½ | 767 | 2268 | " |
| Sep. | 14—9—38 | 61·0 | 27—10—38 | 853 | 759 | 94 | 11 0 | 31—10—39 | 13½ | 804 | 2352 | " |
| Octr. | 14—10—38 | 30·4 | 24—11—38 | 428 | 421 | 7 | 1·6 | 21—11—39 | 13 | 455 | 1260 | Stunted and bushy. |
| Novr. | 17—11—38 | 48·1 | 29—12—38 | 511 | 500 | 11 | 2·1 | 21—11—49 | 12 | 515 | 1460 | " |

**TABLE II. Egg-Deposition Data.**

| Planting month. | Date of | | Egg-Deposition. | | Parasitisation. | | Hatching. | | Eggs lost & Damaged. | | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | First Examination. | Last Examination. | No. of Masses. | No. of eggs. | No. of eggs. | Percentage. | No. of eggs. | Percentage. | No. of eggs. | Percentage. | |
| February | 8—3—38 | 28—4—38 | 33 | 1352 | 378 | 27·9 | 822 | 60·8 | 152 | 11·2 | |
| March | 5—4—38 | 26—5—38 | 119 | 5311 | 3151 | 59·3 | 1018 | 19·1 | 1142 | 21·5 | |
| April | 5—5—38 | 30—6—38 | 197 | 8392 | 5643 | 67·2 | 582 | 6·9 | 2167 | 25·8 | |
| May | 2—6—38 | 28—7—38 | 36 | 2007 | 907 | 45·1 | 765 | 38·1 | 335 | 16·6 | |
| June | 7—7—38 | 25—8—38 | 80 | 3127 | 736 | 23 5 | 1449 | 46·3 | 942 | 30·1 | |
| July | 4—8—38 | 22—9—38 | 13 | 441 | 104 | 23 5 | 155 | 35·1 | 182 | 41·2 | |
| August | 1—9—38 | 3—11—38 | 5 | 136 | 17 | 12 5 | 75 | 55·1 | 44 | 32·3 | |
| September | 6—10—38 | 1—12—38 | 6 | 219 | 81 | 37·0 | 138 | 63·0 | ... | ... | |
| October | 3—11—38 | 29—12—38 | 4 | 166 | 78 | 47·0 | 57 | 34·3 | 31 | 18·6 | |
| November | 8—12—38 | 26—1—39 | 1 | 18 | 18 | 100 0 | ... | ... | ... | ... | |

**TABLE III. Showing rate of Argyria Egg-deposition.**

| Sub plot planted in | No. of eggs laid during | | No. of eggs noticed | | | Remarks. |
|---|---|---|---|---|---|---|
| | I period. | II period. | on this plot | on next month's plot | on (date) | |
| February | 1028 | 324 | 73 | 80 | 5—4—38 | The dates are those on which the second period of observation for the concerned plots commenced. |
| March | 2911 | 2400 | 433 | 1478 | 5—5—38 | |
| April | 7616 | 776 | 214 | 179 | 2—6—38 | |
| May | 1763 | 244 | 117 | 1007 | 7—7—38 | |
| June | 2786 | 341 | 241 | 174 | 4—8—38 | |
| July | 381 | 60 | ... | ... | 1—9—38 | |
| August | 44 | 92 | 92 | 42 | 6—10—38 | |
| September | 135 | 84 | 84 | ... | 3—11—38 | |
| October | 142 | 24 | ... | 18 | 8—12—38 | |
| November | 18 | 0 | ... | ... | ... | |

(b) *Egg-parasitism.* The percentage of natural egg-parasitisation (by *Trichogramma)* like the egg-deposition rate, was highest in May but registered a sharp fall from July onwards; the total absence of parasitism in September and cent percent parasitism in December may be left out of consideration as being abnormal due to poor egg-laying registered in those months. This decline in the activity of the egg parasite coincides with the season of rain and heavy wind in this tract,—factors which are likely to operate unfavourably against a fragile parasite like *Trichogramma.*

**TABLE IV. Showing the monthly percentages of Egg-parasitisation (a) in general and (b) in the experimental area.**

| Month | General collection | | Experimental area | | Remarks |
|---|---|---|---|---|---|
| | Number of eggs | Percentage | Number of eggs | Percentage | |
| March | 4107 | 23·5 | 1028 | 15·3 | |
| April | 4967 | 48·3 | 3235 | 51·4 | |
| May | 6191 | 43·4 | 10,016 | 64·6 | |
| June | 2433 | 17·9 | 2574 | 65·4 | |
| July | 5233 | 19 8 | 2995 | 25·2 | |
| August | 4973 | 27·6 | 772 | 25·4 | |
| September | 5402 | 35·2 | 104 | ... | |
| October | 3372 | 22·8 | 227 | 26·0 | |
| November | 2637 | 63·8 | 226 | 41·1 | |
| December | 3072 | 28·6 | 42 | 100·0 | |

During the entire period of this work a separate monthly record of egg-parasitism was maintained by collecting a number of *Argyria* egg masses from different parts of the tract every week, and working out the percentage of parasitisation from this material for each month. These monthly percentages are given below along with corresponding figures from the experimental area. It will be noticed that there is a rough similarity between the two sets of figures except those for June, September and December. The difference in September and December may be ascribed to the small number

of eggs laid in those months in the experimental plot, but, as regards June it may be presumed that sufficient host material (*Argyria* eggs) was available in a compact nearby plot in the experimental area, to induce an exceptionally high percentage of parasitisation. These exceptions apart, there is sufficient resemblance between the two sets of figures to warrant the assumption that the figures from the experimental area represent the normal seasonal fluctuations of the parasite.

(a) *Hatching and attack.* The number of dead hearts caused by the entry of *Argyria* larvae was much less than the number of larvae that actually hatched out; on the total it was about half (total number of hearts; 2,575 and total number of larvae hatching out 5,061). It is obvious, therefore, that initial larval mortality (i. e., prior to actual penetration) is fairly high, especially as successful larvae are liable to damage more than one shoot each. Further, initial larval mortality appears to be proportionate to the number of larvae hatching out, or in other words, the larger the number of larvae hatching out, the smaller, *proportionately*, the number of shoots attacked. Thus in the plots planted from February to June 4,636 larvae hatched out and only 2,086 deadhearts appeared, while in the plots planted from July to November 425 larvae hatched out and 489 dead hearts were counted. Probably the lack of a sufficient number of young shoots suited for boring into, might be one of the reasons for heavy larval mortality during the period February to June; thus, for 4,636 larvae that hatched out there were only 4,547 shoots (including tillers) available, while in the latter period (July to November) 4,434 shoots were available for only 425 larvae to bore into.

Although stray dead hearts were noticed in every plot from even the first week of examination, a sudden and conspicuous increase in their number was observed somewhere about the 6th week after planting; obviously this stage marks the beginning of real borer attack on the crop. Incidentally the first batch of larvae to hatch out in the plot had done so a fortnight earlier (see following table) and allowing them this interval for dispersal and entry into the shoot as described by Subramaniam and Ramiah (i) it may be persumed that they were responsible for initiating attack. The peak of attack was reached round about the 8th week after planting and in the next 2 or 3 weeks dead hearts were seen in such numbers as to constitute a serious attack. Subsequently, with the appearance of tillers and the crop reaching the age of final earthing up a marked fall in the percentage of attack followed, showing that the age of vulnerability for *Argyria* attack had passed.

(d) *Attack and tonnage.* It is not possible to correlate directly the percentage of borer attack with the tonnage of cane harvested owing to the long period of growth (nearly a year) occurring after the severity of borer attack ends and during which the crop is able to recover from the set-back imposed on it by the pest. Besides other variable factors like cultivation factors (including manuring) and the effect of Top Borer (*Scirpophaga* spp.)

infestation also affect the tonnage. But it is evident from general observation and a study of data presented in this paper, that *Argyria* attack, especially when serious, not only causes a temporary set-back in the initial stages (involving delay and extra expenditure) but also affects the tonnage adversely. Thus the weight of cane harvested from sub-plots planted from February to May (see table I) which suffered from a serious infestation was much less than that obtained from sub-plots planted in the subsequent months. Generally, a bad infestation confers a patchy appearance on the crop which is not erased to the last and which results in an unequal stand of cane and consequent loss of tonnage; repeated attack on a stool turns it into a busy growth from which no millable canes are obtained at harvest. Again it is common experience that "B" season (July to November) planting with little or no borer attack on it yields a higher tonnage in this area than the "A" season cane (planted from February to June) which is normally subject to severe attack. While seasonal conditions and other factors have their own share in it, it is apparent that the severity or otherwise of borer attack is one of the factors responsible for this difference in tonnage between the two planting seasons.

**TABLE V. Showing the course of Argyria attack.**

| Planting. | Attack began in | Percentage. | Peak of attraction. | Percentage. | First batch of larvae hatch out in. |
|---|---|---|---|---|---|
| February | 7th week | 31·5 | 8th week | 42·1 | 5th week |
| March | 6th ,, | 61·0 | 9th ,, | 75·0 | 4th ,, |
| April | 5th ,, | 34·4 | 9th ,, | 84·4 | 3rd ,, |
| May | 6th ,, | 43·4 | 8th ,, | 69·3 | 4th ,, |
| June | 6th ,, | 20·4 | 10th ,, | 28·2 | 4th ,, |
| July | 6th ,, | 12·7 | 8th ,, | 25 6 | 4th ,, |
| August | 6th ,, | 15 8 | 7th ,, | 16·7 | 8th ,, |
| September | 6th ,, | 6·0 | 9th ,, | 10·3 | 4th ,, |
| October | 6th ,, | 3·9 | 7th ,, | 4·0 | 7th ,, |
| November | 7th ,, | 1·4 | 10th ,, | 2·1 | ... |

**Summary.** This work was undertaken with the object of obtaining data concerning the egg-deposition rate and the percentage of egg-parasitisation of *Argyria sticticraspis Hmp.*, the sugarcane stem borer, under natural conditions. A plot of land ¼ acre in extent was divided into ten equal sub-plots which were planted, one every month from February to November 1938. No borer control measures were adopted.

Weekly observations were made on each sub-plot from the 3rd to 12th week after planting; every plant was searched for *Argyria* egg-masses, and when one was located, the number of eggs in it and its condition (whether fresh laid, parasitised, hatched or damaged) was immediately recorded. Fresh-laid eggs were marked for examination during the subsequent week.

The percentage of attack was calculated from the number of dead hearts and healthy seedlings counted separately. Dead hearts were not removed.

The percentage of germination wss also worked out. The harvesting was attended to in due course in 1939.

*Argyria* egg-laying reached its peak in May and was negligible in December. The crop in the first month after germination appeared to be more attractive for oviposition than in the second month.

The percentage of egg-parasitisation by *Trichogramma* was highest in May but declined sharply from July onwards probably due to rain and heavy wind. There was a fairly close similarity between the monthly percentages of egg-parasitisation derived from the experimental plot and from general collections.

The rate of initial larval mortality was apparently fairly high, especially in the "A" season, probably due to an insufficient number of shoots available for boring into. Actual attack began round about the 6th week after planting and could be traced to the first batch of larvae hatching in the plot a fortnight earlier. The peak of attack was attained in about the 8th week after planting.

No direct correlation between percentage of attack and tonnage at harvest was found, as the crop had nearly a year to recover from the effect of borer attack, but the weight of cane harvested from the sub-plots planted from February to May (which suffered from severe attack) was much less than that obtained from the later planted sub-plots.

**Acknowledgments.** The writer wishes to express his gratitude to Mr. T. V. Subramaniam, the Mysore State Entomologist, for the encouragement and help given by him, to Mr. S. H. Bennur, Superintendent of Farms, Mandya, for affording facilities during the course of the work and Mr. M. Puttarudriah, Assistant Entomologist, for harvest of the experimental area in 1939 when the writer was absent from the Station.

## References.

Subramaniam T. V. and Ramiah C. V. (1938)—"Sugarcane borer control in the Mysore State", Circular No. 55, Department of Agriculture, Mysore State.

Tucker R. W. E. (1933)—"Rate of egg Deposition of *Diatraea saccharalis* and extent of larval mortality in cane fields and their relation to control of Diatraea by *Trichogramma minutum*". *Agri. Jour.* Barbados, Vol. 2 pp 33-52.

# EXTRACT

**The Production of High Vitamin A Milk by Diet.** H. J. Deuel, Jr., Nellie Halliday, Lois F. Hallman, Cornelia Jonston and Albert J. Miller. The vitamin A content of the butterfat obtained from cows on a diet high in fresh alfalfa was coniderably increased by the administration of shark liver oil in daily doses of approximately 700,000 I. U. although lower amounts were ineffective.

The vitamin A in butterfat averaged 113 I. U. after administration of the vitamin A supplement at a level of 1,400,000 I. U. daily. In one cow, the level reached 170 I. U. per gram which value was also noted a month later. The increased amounts of vitamin A in the butters persisted without diminution over a five month period during which the experiments were continued.