Table VI.

Economics of the modan land cultivation as ordinarily practised, rotated at the Agricultural Research Station, Pattambi.

(Estimated Cost).

Year.	Rotation adopted.	Cost of cultivation.	Value of produce.	Net profit.
1933-34	Modan Paddy	16—8—0	27—0—0	10—8—0
,,	Gingelly	15—4—0	25—0—0	9-12—0
1934-35	Samai	8—0—0	13—0—0	5—0—0
,,	Horsegram	4—0—0	7—0—0	3—0—0
1935-36	Modan paddy	16—8—0	27—0—0	10—8—0
,,	Gingelly	15—4—0	25—0—0	9-12—0
	Total.	75—8—0	124—0—0	48—8—0

Profit when pine apple is grown ...	Rs.	383—4—0
Profit when other crops are grown ...	,,	48—8—0
Extra profit when pine apple is grown	,,	334-12—0

Bibliography.

1. Philippine Journal of Agriculture, Vol. II.
2. Queensland Agricultural Journal, Feb. 35 and July 35.
3. Assam Agri. Dept. Leaflet No. 1, 1928.
4. Tropical Agriculturist, Vol. 61.
5. Health and Wealth, Calcutta, Vol. 10 (IV).
6. Pine apple by Max O. Johnson, 1935.
7. Annual reports of the Agricultural Research Station, Pattambi.

and 8. Pine apple cultivation in Malabar, Madras Agricultural Journal, Vol. XXII, September 1934.

ON SOME CONTROL EXPERIMENTS ON THE DECCAN GRASSHOPPER (*Colemania sphenarioides*, B).

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This paper deals with certain experiments carried out by the author in 1930 and 1931 in Adoni, Bellary. It is considered, a history of the pest for the past thirty years and a resume of the work done till now, will be a useful and fitting introduction for the problem dealt with in this paper and hence a brief introduction has been added.

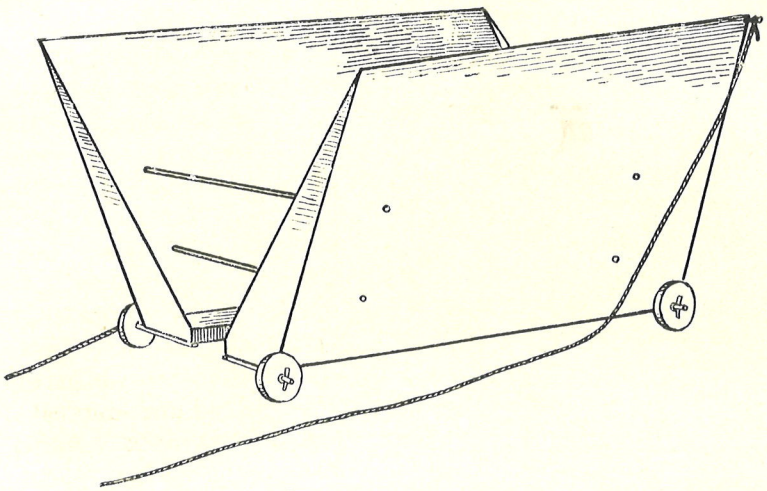
As for the systematic position of the grasshopper, it comes under the tribe *Pyrgomorphini* and is placed very near *Orthacris* which it very closely resembles. The pest would appear to be indigenous to Bombay Presidency, being chiefly confined to the Belgaum, Bijapur and Dharwar tracts; from thence they would appear to have spread south into Mysore, Hyderabad and Madras territories.

The zone of distribution for Madras would seem to centre round the Tungabhadra valley in Bellary and Kurnool districts. Adoni, Kudligi, Harpanahalli, Hadagalli, Siruguppa taluks of Bellary and Markapur, Kurnool, Pattikonda taluks of Kurnool, are the chief centres wherein the pest has been noted in a severe form, off and on. The hopper was first noted in a pest form in 1908; for nine years thereafter it proved very destructive. Subsequently, from 1917 the incidence became negligible. After an interval of nearly eight years the pest was again found to be on the increase from 1925 and continued to be so till 1931, when a slight subsidence was noted. Thus paucity and abundance would appear to move rhythmically in cycles of seven years.

The grasshopper is mainly a pest on dry cereals and attacks them in all stages from emergence of leaves up to the setting of grains. Damage to crop varies with the nature of the incidence, the loss being total when infestation is severe. More information especially on the life history details, mode of infestation of new tracts, etc., is given by Coleman (1911) in the Mysore Agricultural Departmental Bulletin No. 2 (Entomology) and by Ramachandra Rao in the Madras Agricultural Departmental leaflet No. 39.

Control measures that were tried are dealt with in detail. Bagging was found very efficient for Mysore conditions. But, for conditions obtaining at Adoni, where very stiff and severe winds are the feature in August and September, it is not a feasible proposition to try bagging. Nevertheless, trials were made and for the reasons mentioned below they never proved a success. Firstly, it is a strenuous and tiring job even for three men to go on the run with the bag ballooning against the wind. Secondly, it has been found by actual trials that nymphs were not in a mood to be dislodged easily when high winds prevailed with the result the catches were seldom large for the population of nymphs and for the time and labour spent on the operation. Therefore, bagging as a control measure was given up and other methods were put to test. The results obtained at these tests are embodied in this short paper.

Trials. (a) *Guntaka hoeing for destruction of eggmasses in the field.* It was suggested that the then newly designed H. M. Guntaka (Hilson and Munro) might prove an efficacious weapon for destroying the eggmasses in the soils of the field. Therefore, trials were undertaken with this implement. A field that was infested rather badly, the previous season, with hopper adults and with a high density of eggmasses, was selected for trials at Adoni in 1930; the actual operation was done in January 1930 under the supervision of Mr. C. V. Sundaram, then, in charge of the work. The object of this trial was to cut out the eggmasses laid in the soil and expose them to the weather and the dessicating action of the sun which is exceptionally severe from March



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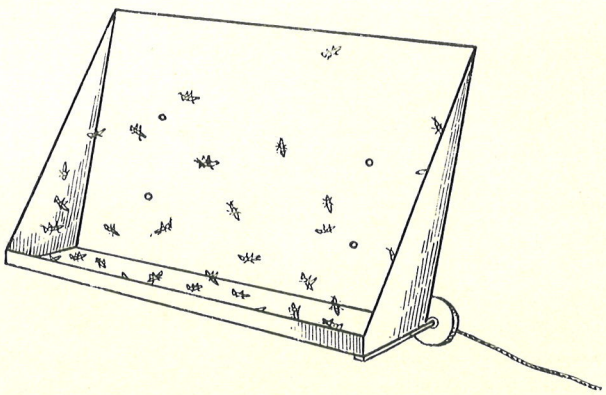

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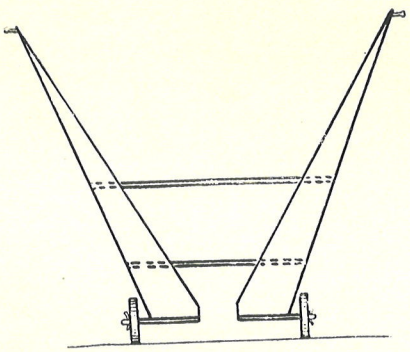

(3)

(1) Hopper dozer—Full view.
(2) Hopper dozer—Inside view showing catches.
(3) Hopper dozer – Front view.

to May. Subsequently, the ryot carried out the preliminary cultivation operations with country plough and *Pedda guntaka* in July. The field was sown to '*Korra*' *Setaria* (Tenai) in the last week of July. The hopper nymphs did not hatch out till the beginning of the 2nd week of August. The adjacent field was taken as the control. The difference in density of hopper nymphs in the unworked and worked fields should be the basis on which to judge the efficacy of '*Guntaka* hoeing' on the destruction of eggmasses. For this, a small tin box with a clearance in the centre was run through the lines on 16th August, a week after emergence and the nymphs that hopped out on either side were caught by the side walls, the inner side of which was painted with a resinous adhesive. The nymphs so caught were immediately counted for each row operated; similarly for the control rows. Discarding the few that escaped from the treated and untreated areas, the counts gave an average population of 27 nymphs for the treated and 15 for the untreated rows. Judged on the basis of these catches one should feel that '*Guntaka* working' had not produced the results anticipated of it and had not given encouraging results to deserve further trials.

(b) *Trapping with hopper dozers.* Therefore, the feasibility of trapping the young nymphs was next considered. Since the crops in Bellary are sown in drills, the idea of running a well designed hopper dozer along the lines seemed promising. The idea was not new. Mr. Ramachandra Rao had tried an ingenious method in 1911 to entrap the nymphs by running several flat boards joined together and painted with tar to serve as an adhesive. But the thing proved cumbersome and was not pursued further.

A hopper trap to operate for a single line, at a time, was designed by Mr. Charley, the Research Engineer, on the basis of suggestions given to him by the author. It was got up in time for trials in 1931 against the hopper nymphs. The hopper cart weighed about 80 lbs. and was mounted on two iron wheels; it was to be pushed from behind by a single person with the aid of the arms. The crop was to be passed through the central clearance and cross bars were provided to shake and jerk the hoppers into the bottom pans which were painted with the resinous adhesive. But, unfortunately, the dead weight of the cart proved too heavy for a single man to operate, especially in these soils where considerable resistance was encountered owing to wheels sinking into the soil. So, bullock power was substituted instead and tried in different villages on 13th August 1931. For 20 lines of *Korra* crop 6 to 9 inches high, 450 nymphs were secured but the difficulty of manoeuvring the trap with bullock power was great as the trap wobbled and sometimes ran over the crop.

Since the principle was acceptable to the ryots and showed some promise, a light tin cart model was made, on the same principle,

weighing not more than 20 lbs.; it was mounted on four wheels, two in front and two behind. The diagrammatic sketch of the model is separately shown so that one could get an idea of the trap. It was to be run through the rows of crops which were allowed to pass through the central clearance provided at the bottom of the trap. The two bottom pans of 5·5″ wide on either side of the clearance into which the nymphs usually hopped, were painted with the resinous adhesive. This served to fix them and keep them from straying out. Similarly, the side walls were painted. The trap measured 46″ along its length and 36″ in height from the surface level. Just as in the previous model, cross bars were provided to jerk the hoppers and to give firmness to the side walls and prevent them from sagging.

Working of the trap. The trap was to be dragged in from front by a couple of boys, by holding the ropes fastened to the rear. The boys were to pass along the adjacent lines of 'Korra', to avoid disturbing the hopper nymphs in the lines that were to be worked. As soon as the bottom pans and the sides got filled up, the resin was scraped off with the nymphs and a second coating was given. The adhesive was kept ready in a mud pot kept warm by paddy husk fire in a mud basin.

Trials. Extensive trials were given in the field of one Narasappa in August 1931. In the initial trials 198 nymphs were secured for 15 lines of 200 yards length despite the fact that a good many escaped slowly owing to the adhesive losing its adhesiveness on account of high winds. But this defect was subsequently corrected by addition of more of oil in the preparation of the adhesive to counterbalance evaporation and drying. At subsequent trials 238 nymphs were secured for 14 lines, 355 for another 14 lines. But when the winds abated a little, the catches mounted upto 709 in the morning and 635 in the evening for 20 lines. The average per line increased from 13 to 33·5 when the winds abated. This only indicates how winds tend to hamper the control operations of this kind. Further trappings gave 712, 718, 698 nymphs for 20 lines each, on different dates. The lines once operated were never again touched. In all 4344 nymphs were captured, of which 3473 represented catches for 100 lines of 1·5 acres.

Estimation of the residuals and the incidence of hopper nymphs per acre. Unless it was exactly known how many were actually left behind, it will not be possible to arrive at a correct estimate of the incidence of the pest. Moreover, without an idea of the residual population it will not be possible to judge whether a control method was promising or not. If the residual out-numbered the catches it would speak very poorly of the method. Hence the residual population was determined separately for each row. For this the trap was run forward on the first run; the nymphs so caught were immediately counted; the trap was reversed on the 2nd run and the number caught in the reverse run would give the residual population for that

line. In the first run 30 nymphs were secured; in the reverse run 12 more were secured; of these, a few might represent the immigrants from the adjacent line to which the persons have to keep close when dragging the trap in front. Several such trials indicated that roughly 75% population was easily secured in the first run itself.

A rough estimate of the severity of infection is certainly possible by multiplying the average population per line by the total lines in the field. On this basis, Narasappa's field of 4 acres containing 285 lines would give approximately a population of 10,000 nymphs. An occurrence of 2500 nymphs per acre, then, should be considered as a case of severe infestation, knowing full well how badly the crop was attacked.

Economics of working the trap. From a series of trials, it was computed that the trap could easily cover 20 lines per hour, at this rate a four acre field of 285 lines could be covered in two days. A ryot usually works from 6 a. m. to 1 p. m. in the Ceded Districts and does not work in the afternoons. He puts in 7 hours at a stretch and on this basis it should be possible to finish the 4 acre plot in two days.

Labour charges come to about a rupee for two days for two men but no ryot actually incurs this expenditure as his own family takes to the work.

The cost of adhesive comes to about 6 annas per acre as per the details—2 annas for the groundnut oil; 3 annas for resin; ½ anna for fire and ½ anna for mud pot. The adhesive was prepared in the ratio of 1:2 of oil and resin, by weight. The expenditure on the trap todate including all improvements comes to Rs. 5/— including the cost of a painter's brush; the trap could be used over and over again for a minimum of four seasons as not much is lost in the wear and tear.

Future of trapping as a method in the control of nymphs in the Ceded Districts. There is little doubt that trapping of this kind may have good future for the following reasons. It obviates the killing since the nymphs on the adhesive die a slow death and the general prejudice of the ryots against killing is overcome. Being light, handy and efficient, it is easy to operate. Boys can manage it and adults may attend to hardier work. No subsequent trapping is necessary as a high percentage of population is secured in the first run itself. The trap is durable and will serve for a minimum of four seasons for a small holder. Well organised demonstrations may be necessary for the ryot to get to know the utility of this method.

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