https://doi.org/10.29321/MAJ.10.A04393

Some Experiences with BHC and DDT

IV. The Paddy Grasshopper — *Hieroglyphus banian*, Fb.

By

S. RAMACHANDRAN
Government Entomologist

and

S. KANAKARAJ DAVID
Assistant Entomologist

The paddy grasshopper is one of the most destructive pests of this important food crop and its ravages are on record as early as 1888. Three species viz. *Hieroglyphus banian*, Fb., *Hieroglyphus oryzivorus*, Carl., and *Hieroglyphus nigrorepletus*, Bol., each having its own characteristic features and feeding habits have been observed in this country. Of these, *Hieroglyphus nigrorepletus* Bol. occurs both in short and full-winged forms and restricts its attention to dry crops cholam, maize, tenai and other lesser cereals and its zone of occurrence is limited to parts of the Ceded districts and Northern Circars. The other two species are specific pests of paddy. Of the two, *Hieroglyphus oryzivorus*, Carl., is mostly short-winged and occurs generally in the Northern Circars. *Hieroglyphus banian*, Fb., on the other hand, possesses full-sized wings, has a wider distribution and the present article deals with this species only. A comprehensive account of these grasshoppers are already appeared in the "Control of Rice Grasshopper" by Y. Ramachandra Rao and M. C. Cherian — (Indian Farming — Vol. I – No. 9 and 10 – 1940); but a short resume is given belowto render this paper complete.

The pest — *Hieroglyphus banian*, Fb. The species has been reported from all the paddy-growing areas of this Presidency, but its incidence appears to be chronic to parts of Northern Circars and Malabar. These grasshoppers also take to sugarcane in an equally severe form, in parts of Visakhapatnam. The very fact that the pest is well-known by vernacular names such as '*Midatha*' in Telugu, '*Pulpandu*' in Malayalam, '*Jittika*' in Oriya and '*Jitti*' in Kanarese bears testimony to its notoriety in different parts of the State.

Life history and habits: The adults pair during October — November and insert their eggs in small masses under the soil, generally on the sides of the field bunds to a depth of 2 to 4 inches. The entire egg mass is encased within a water-proof sheath, which enables it to resist the adverse effects of moisture as well as heat. The eggs are quiescent throughout the cold weather and summer and the development

of the embryo takes place after the receipt of showers during the next May–June. The hoppers hatch out with the monsoon rains during June–July and feed on the grass growing on bunds, there being no paddy in the fields at this period. With the normal planting and growth of paddy, the young hoppers transfer their activities to the transplanted crop. The nymphal period is fairly long and extends from 6 to 12 weeks. The hoppers continue their damage and reach the adult stage by October — November, when the paddy crop is generally in shot-blade. The adults then pair, lay their eggs in the nearest bund and die off. From the records available, there appears to be only one brood during a season. In the case of sugarcane, the hoppers have been found to freely oviposit on the sides of ridges in the field.

Nature and extent of damage: As already mentioned, the nymphal stage of these hoppers extends from 6 to 12 weeks. The damage commences from the seed-bed and continues upto 2 to 3 months, reaching a maximum when the crop gets into shot-blade. In parts of Ganjam, where paddy is not grown under ideal conditions, the crop is often reduced to mere stumps due to these hoppers. In the Krishna district, however, paddy grows luxuriantly to a height of five feet by September–October and as such the plants very soon outgrow the slight damage caused in the earlier stages. Further, the hoppers do not appear to relish the thick, coarse outer foliage of a well-established crop and are, therefore, content with nibbling at the leaf-bases, as a result of which the long leaves break down and lodge. This sort of damage is characteristic of the pest and can be discerned even from a distance. The more serious loss is at the shot-blade stage, when the hoppers take to gnawing at the neck of flag-leaf and more often at the base of the young flower head inside. The earheads are unable to come out on account of the injury and if at all they emerge, they get distorted in shape. Even these are likely to break down subsequently, the injured stalks being unable to bear the weight of grains. The adult hop about at the sightest disturbance during the mornings and in the evenings. During the hotter hours, they rest in the dense foliage, sneaking under cover by sideways movements when they scent any danger. In severe cases, the pest is capable of causing a loss of 75% of the probable out turn.

Previous control methods: Various methods of control had previously been tried from time to time. Huge drag nets, smaller hand-nets, etc., were used and though a fairly good percentage of the population was caught and killed, invariably a good many of the hoppers were left behind in the field. Spraying with arsenical poisons, the use of poison baits, ploughing up of the fields, etc., were all equally ineffective.

Another method which is extant even to-day in parts of Malabar, is a systematic and organised drive of the hoppers towards a convenient corner of the field, wher a bamboo mat screen is set up, to prevent the escape of the hoppers. Water is then splashed on the cornered hoppers, when they get temporarily dazed by the sudden contact with cold water, and are easily beaten to death. The local ryots are adepts in the art of driving and the process itself is quite interesting to watch. All these methods, however, took us nowhere nearer a real solution of the problem. By 1927–28 another way of tackling the pest in its egg stage was thought of. The sides of the field bunds being the favourite places of oviposition, a systematic campaign was organised to scrape the bunds upto a depth of 2 to 4 inches with the idea of exposing the egg masses to the action of weathering agencies and natural enemies. The method was given a fair trial on a large scale in Ganjam and Malabar, immediately after the harvest of the crop, when the bunds were still moist. A delay in the execution would result in the lands drying up and getting too hard, when the earth would break out only into big clods, without exposing the egg-masses. This method however created hardly any impression at all on the ryots, in spite of large-scale successful demonstrations by the department.

Work done: In September 1948 a serious outbreak of the pest occurred over extensive areas in Gudivada and Gannavaram taluks (Krishna District). None of the approved methods of control were practicable for controlling the pest. It was too late for bund-scraping nor was it possible to tackle the pest over such wide areas by the use of handnets. The only hope was in the trial of the two new chemicals, DDT and BHC, with which the Entomology Section had previously conducted laboratory tests. A severe incidence of the same paddy grass hopper was reported on sugarcane from Bobbili in September 1948. One of the members of the Section was deputed to this locality to try Gammexane (BHC) D. 025 and exploratory dusting trials were conducted in about half a dozen villages. The results were very encouraging. The lethal effect of the chemical was so clear-cut that the trials themselves served the purpose of demonstrations and also suggested the use of these chemicals against the hoppers on paddy in Krishna district. One hundredweight of BHC, D. 025 and smaller quantities of DDT were sent to the area and applied in some of the worst affected fields in a few villages as a preliminary trial. Here again the results of BHC D. 025 were far beyond expectations. A very high death rate of the adult hoppers and nymphs was observed within four hours after the treatment and there were no living insects at all in the dusted fields by the next day. The ryots being highly interested were closely following these experiments and got fully convinced about efficacy of the chemical. The good news spread like wild fire throughout the tract and there was a heavy demand for the insecticide and dusting appliances.

In all eight dusters and about 110 cwt. of BHC D. 025 were procured and the campaign was in full swing within a week of the preliminary trials. It was found difficult to meet all demands with the available quota of dusters; but the ryots themselves rose to the occasion and dusted their fields during night time also, so as to finish the work rapidly. They also applied the dust with their hands, just like broad casting seeds and very soon became adepts in the job. On the whole, the ryots were very grateful to the Department for this timely help and had no hesitation in meeting the entire cost of the insecticide themselves. The quantity of the chemical required for an acre was about 20 lb. and about 800 acres were treated during the course of three weeks. The loss caused by the hoppers was estimated at about 5 bags of grains per acre, worth about Rs. 60/-. The cost of the insecticide works out to Rs. 8/- thus leaving a clear margin of Rs. 52/- per acre. The campaign ended within three weeks of its commencement, since the pest itself was fast disappearing and the crop was getting into shot-blade, when it is not advisable to trample the fields. The North-East monsoon also broke out by this time, rendering all field work impossible.

Any type of hand rotary duster is quite efficient for the application of the dust, through a machine would cover a layer area of 2 to 3 acres in a day. A power duster (Root - 1 H. P.) was also tried. This machine was able to dust about 20 acres a day, but its use is not likely to become popular, as it was difficult to move it from field to field under the swampy conditions prevalent in the deltaic areas. Four to six men were required for carrying this machine into the field, besides two more for directing the discharge nozzles. The engine once it is started, goes on discharging the powder, there being no arrangment to close the outlet unless by switching off the engine itself. Added to these drawbacks, the adverse effect of trampling the fields by a gang of 6 or 8 men, the necesity for a competent mechanic to maintain the machine in working condition, the difficulty of getting petrol in remote villages, were also factors militating against its popularity.

Further Trials: Further tests were carried out in 1950 using BHC D. 025, Hexyclan 5% and DDT 3% in two centres, Malabar and Krishna District. The unit for each trial was one acre, replicated six times. Preliminary counts of the hopper population were taken for every replication in 6 randomised plots—each 10 sq. yards in extent—totalling in all 36 counts per treatment. Counts regarding the reduction in the population were taken on the same basis, 7, 24, 48 and 72 hours after the dustings. The figures are furnished in a separate statement.

The following are the conclusions that can be drawn from the data. The high lethal action of both BHC D ·025 and Hexyclan 5% against the paddy grasshopper is established beyond doubt. A slightly

higher quantity of Hexyclan is required as this preparation is heavier. The mortality in either case was evident in about 1½ hours and was more or less complete within 6 hours. The use of either BHC D ·025 or Hexyclan 5% brings about the annihilation of the entire hopper population at a cost of 8 to 9 rupees per acre, whereas the mechanical methods previously in vogue are neither efficient nor cheap. DDT dust had but a feeble action against this pest even upto 72 hours. The small-scale trials have also indicated the efficacy of lower concentrations of BHC at 2, 3 and 4%. BHC and Hexyclan are at present manufactured only in standard grades of 5% and above. It is also understood that no appreciable reduction of the prices would be possible by lowering the concentration since the cost of the diluent as well as the labour charges would remain more or less the same. Other trials with suspensions and emulsions of DDT and BHC as well as E 605 (Parathion) Toxaphene etc., also indicate the possibilities of effective control.

With the knowledge gained in this campaign, the insecticide was tried against the other insect pests also and the results have been equally successful. To mention a few examples, over 2,000 acres of dry crops infested by *Hieroglyphus nigrorepletus*, Bol., in Cuddapah and another 200 acres of paddy attacked by *Oxya velox*, F., at Guntur were saved by the use of about 27 tons of BHC D ·025. The lesser grasshoppers viz., *Chrotogonus saussurei* B., and *Aeolopus* sp., were also effectively controlled in isolated localities.

During the conduct of these large-scale control measures, a few other interesting factors also came to light. *Aeolopus* sp. appears to succumb almost within an hour after contact with the chemicals, while the earliest mortality is noted in 1½ hours in the case of *Hieroglyphus banian* Fb. The ground grasshopper, *Chrotogonus* sp., appears to die more slowly. An interesting finding in the course of the work is that the nymphs of the Deccan grasshopper, *Colemania sphenaroides* B., require a higher concentration of 7 to 10% of BHC or Hexyclan for a complete kill, the 5% dosage not being effective.

Conclusions: BHC D. 025 was used with remarkable success on a large scale for the first time in the Department, against the paddy grasshopper.

2. About twenty pounds of the dust are required to dust an acre and the cost is about Rs. 8/-.

3. Hexyclan 5%, a similar compound, is equally effective.

4. Lower concentrations of BHC also produce the desired results, but are is not likely to bring about any appreciable reduction in the cost.

5. The chemicals may be applied during September—October before the crop comes into shot-blade. The dusting, if done later, will be useless since the pest dies off by the end of October after causing enough havoc and ensuring the next generation also by laying eggs. The probable outbreak of the North-East monsoon would be another impediment for the satisfactory application of the dust.

6. Any pattern of a rotary duster is quite efficient, failing which the dust can as well be broadcasted by hand with a little practice.

7. Other chemicals, like Toxaphene, E 605 (Parathion) DDT emulsion and BHC spray have indicated their efficacy, but their practical application depends upon their easy availability and the comparative cost of the treatment.

REFERENCES

1. Allman, S. L. (1946) BHC in grasshopper baits—Agricultural Gazette, New South Wales—Vol. 57. Part IV.
2. Due Plessis C. and Smit C. ((1946) Preliminary laboratory experiments with DDT and 666 as locusticides—Journal of Ent. Society. South Africa—Vol. 9. No. 1.
3. Gunn D. L. and others (1948) Locust control by aircraft in Tanganyika — An experimental campaign with BHC against adult red locust–Anti-locust Research Centre, Pretoria Locust Control Research Station — Department of Agriculture, South Africa.
4. Hinnman, E. J. (1948) Laboratory cage tests of DDT in grasshopper baits — Journal of Econ. Entomology. Vol. 37.
5. Hussein, M. (1946) Preliminary tests in the use of crude BHC against locusts and grasshoppers — Bull. Soc. Fouad. Jour. Ento. 30 — Cairo — 1946.
6. Ramachandra Rao, Y. and Cherian M. C. (1940) Control of Rice grasshopper — Ind. Farming — Vol. I. 9 and 10.
7. Weinmann, J. and George C. Decker. (1947) An analysis of certain factors relating to control of grasshoppers with some chlorinated hydrocarbon insecticides — J. Econ. Entomology Vol. 40.
8. Weinman, C. J., George C. Decker and J. H. Bigger. (1947) Insecticidal sprays and dusts for control of grasshoppers — Vol. 40.
9. Wilson, C. C. (1944) Efficiency of DDT as a dust and in baits for grasshopper control — J. Econ. Ent. Vol. 37

STATEMENT

Place.	Treatment.	Before treatment.	After treatment.								Percentage reduction in population	Earliest time taken for death.	Qtantity consumed per acre.	Cost per acre.	Remarks.
			6 hours.		24 horus.		48 hours.		72 hours.						
			Live.	Dead.	Live	Dead	Live.	Dead.	Live.	Dead.					
1	2	3	4		5		6		7		8	9	10	11	12
Malabar I Field Trials.															
Alathur	BHC D. 025	93	3	44	...	8	...	4	...	...	100	1½	23	8/-	...
Village	Hexyclan 5%	84	1	86	1	13	...	5	...	1	100	1½	28	9/-	...
	DDT 3%	80	93	...	48	1	35	2	44	...	45	24	29	14/-	...
	Control	75	...	...	81	...	93	...	107	...	...	...	...	...	...
Circars.															
Gudivada.	BHC D. 025	64	24	...	8	...	...	...	...	...	100	1	20	7/-	...
	Hexyclan 5%	72	8	...	...	...	56	...	44	...	100	1	20	8/-	...
	DDT 3%	80	88	...	48	...	56	....	44	...	45	24	20	10/-	...
	Control.	72	88	...	86	...	112	...	90	...	...	...	...		...

The counts were taken in randomised plots eat 10 sq. yards in extent @ 9 plots per acre and the figures represent the average of the 6 replications

II Small Scale trials.															
Alathur.	BHC 3%	12	...	...	1	...	...	...	...	...	92	3			...
	Toxaphene 10%	8	...	...	...	...	...	...	...	...	100	3	...		...
(Sprays)	BHC 0·5%	7	...	...	...	...	...	...	...	...	100	1½	...		...
,,	Hexyclan 0·05%	5	...	...	...	...	...	...	...	...	100	1½	...		...

Place.	Treatment.	Before treatment.	After treatment.								Percentage reduction in population	Earliest time taken for death	Quantity consumed per acre.	Cost per acre.	Remarks.
			6 hours.		24 hours.		48 hours.		72 hours.						
			Live.	Dead.	Live.	Dead.	Live.	Dead.	Live.	Dead.					
1	2	3	4		5		6		7		8	9	10	11	12
,,	DDT 0·25% wettable power.	15	No reduction.								Nil	...	...		...
	DDT A-emulsion 0·25% spray.	24	...	...	3	...	...	...	...	...	88	8	...		...
,,	DDT MKE emulsion 26% spra.	12	...	...	1·5	...	...	...	...	...	83	1	...		...
,,	E. 605 – 0.005% (Parathion spray.	9	...	...	...	...	...	...	...	...	100	1	...		...
Gudivada.	BHC 2% dust.	14	3	9	...	...	...	...	...	...	100	1½	...		...
	BHC 3% dust.	20	7	12	...	...	...	...	...	...	100	1½	...		...
	BHC 5% dust.	17	4	15	...	...	...	...	...	...	100	1½	...		...
	DDT concentrate 0·1%	15	...	...	2	...	...	...	...	...	76·7	7	...		...
	E. 605 (Parathion) 0·0025% spray.	12	...	...	...	...	...	...	...	...	100	1	...		...
	DDT-A-emulsion 0·25% spray.	8	...	...	1	...	...	...	...	...	77·5	7	...		...
	Toxaphene 10%	5	...	...	...	...	...	...	...	...	100	3	...		...

(These trials were conducted in observation plots and the counts taken in made plots each 48 sq. yds in extent.)