SHORT COMMUNICATIONS

Preliminary Field Evaluation of the Sterilant Activity of the Herbicide EPTC against the Egyptian Cotton Leafworm, *Spodoptera littoralis* (Lepidoptera: Noctuidae)¹

Resistance to several insecticides in the Egyptian cotton leafworm, *Spodoptera littoralis* BOISDVAL is now well recognized (*e.g.*, MAHER *et al.*, 1962). Possible methods of control other than those with insecticides acting in a conventional manner were therefore considered. Among such methods was the use of chemicals that induce sterility. Efforts were made to find some agents out of the major classes of insect chemosterilants (BOŘKOVEC, 1966) to induce sterility in adults of *S. littoralis* by subjecting the immature stages to them. But, none of the compounds tested has induced complete sterility (TOPPOZADA *et al.*, 1966; ABOUL-NASR *et al.*, 1971). Very recently, however, EL-IBRASHY (1971a) succeeded in a laboratory test to disclose that the herbicidal thiolcarbamate EPTC² (Eptam® 6-E=S-ethyl-dipropylthiolcarbamate) has a selective female sterilant activity against *S. littoralis* when fed to last instar larvae at a dose of 250 µg active ingredient per larva. The herbicide prevented, almost exclusively, egg laying in emerging females.

For practical significance, it seemed necessary to develop a field method of application that can be used in a programme of control or eradication.

The present study was undertaken to evaluate the possible use of EPTC to sterilize *S. littoralis* when cotton plants were treated with it and subsequently infested with larvae. In addition, some agronomic data were recorded to reveal whether the herbicide would bear hard on treated plants.

MATERIALS AND METHODS

Test animals. Newly-ecdysed 6th (=last) instar larvae of *S. littoralis* were obtained from a homogeneous insecticide-free laboratory culture

that was maintained according to EL-IBRASHY and CHENOUDA (1970).

Field treatment: Cotton seeds, *Gossypium barbadense* L. (Egyptian variety, Giza 70) were shown in rows 70 cm apart and 25 cm between successive holes. On germination, plants were thinned to two plants per hole. Fertilizer was applied uniformly at the feddan (=1.038 acres) rate of 150 kg ammonium sulphate (15.5% N), 150 kg super phosphate (15.5% P₂O₅), and 50 kg potassium sulphate (48% K). The fertilizer was applied side dressing one week later to thinning. The experimental design was of complete randomized block system with three replications and four treatments (0.0, 400, 800, 1600 ppm EPTC active ingredient in water solution). The plants were sprayed with a small pressure pump at a rate of 20 ml per plant. Only one spray was applied on June 30, 1971 when plants were three months old.

Larval infestation was made on 0, 1, 2, 3, 5 and 7 days after spray. A group of 10 larvae was captured in a perforated plastic cage (20 × 30 cm) tightly enclosing a branch. 1000 larvae were used for each replicate. At 24 hr of captivity the larvae were transferred to the laboratory for completion of development. They were kept singly in cups furnished with daily-renewed castor-oil leaves, *Ricinus communis* L. that were maintained at 30 ± 0.1°C and uncontrolled relative humidity.

Reproductive capacity: All test crosses were made with 5 pairs of emerging moths with only one sex treated. Tests including untreated checks were replicated three times at least. Egg laying and hatch were followed up in a manner quite similar to that described by EL-IBRASHY (1971b). EPTC, in the present study, appeared to affect not only the viability of eggs but fecundity as well. Therefore, it was thought plausible to consider both criteria altogether and the following formula was adopted:

% decrease in reproductive capacity =

$$100 - \left[\frac{h \times l}{H \times L} \times 100 \right]$$

where, *h* and *l* = mean eggs hatched and mean eggs laid per treated female, respectively. *H* and *L* = mean eggs hatched and mean eggs laid per un-

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2 Eptam®: 75.5% active ingredient, a product of Stauffer Chemical Co., 380 Madison Ave., New York 17 (N.Y., USA).

Table 1. DECREASE OF REPRODUCTIVE CAPACITY (%) OF *S. littoralis* MOTHS RESULTING FROM LAST INSTAR LARVAE CAPTURED FOR 24 HR TO COTTON PLANTS SPRAYED WITH EPTC AT DIFFERENT CONCENTRATIONS

Time after spraying Concentration, ppm	Immediately			1 day			2 days		
	400	800	1600	400	800	1600	400	800	1600
Treated ♀ ♀	4.7	55.2	53.4	16.6	60.0	74.4	3.8	61.1	77.5
Treated ♂ ♂	0.0	39.8	49.0	10.0	46.4	45.1	0.0	40.8	46.2

Time after spraying Concentration, ppm	3 days			5 days			7 days		
	400	800	1600	400	800	1600	400	800	1600
Treated ♀ ♀	0.3	51.4	83.3	0.5	36.3	42.9	0.2	21.8	34.9
Treated ♂ ♂	1.8	30.6	43.0	2.1	25.8	37.4	1.0	20.5	28.5

Table 2. SOME AGRONOMIC CHARACTERISTICS OF COTTON PLANTS *G. barbadense* SPRAYED FOR ONCE WITH EPTC AT DIFFERENT CONCENTRATIONS

Characteristics	Concentration (ppm)			LSD	
	400	800	1600	0.0(check)	(0.05%)
<i>At initiation of flowering</i>					
Plant height(cm)	32.9	32.6	30.7	32.7	NS
Leaves weight(g) per plant	13.6	15.1	14.1	15.8	NS
Stem weight(g)	7.9	7.4	7.4	8.3	NS
Root weight(g)	1.6	1.7	1.6	1.5	NS
<i>At fruit setting</i>					
Plant height(cm)	42.9	43.9	42.8	45.6	NS
Leaves weight(g) per plant	31.4	36.4	36.5	26.9	NS
Stem weight(g)	15.1	18.6	18.4	14.5	NS
Root weight(g)	4.7	5.2	5.1	4.9	NS
No. bolls/plant	8.8	9.9	9.5	9.2	NS
Bolls weight(g) per plant	41.0	41.8	41.0	32.5	NS
<i>At harvest</i>					
Yield(lint+seeds) (g) per plant	11.1	11.1	11.2	9.2	NS

treated female, respectively.

Agronomic characteristics: Each sample consisted of six plants with three replications. The following measurements were obtained on all test plants at two cuts; one at initiation of flowering on July 9, and the other at fruit setting on August 8: (a) plant heights by measuring each plant from the ground surface to the tip of the terminal bud, (b) leaves fresh weight per plant, including petioles, (c) stem fresh weight, (d) root fresh weight, (e) number of bolls (includes bolls one-half inch in diameter and larger), (f) bolls fresh weight, (g) total yield (lint+seeds) harvested on October 17.

RESULTS

Effect of EPTC upon reproductive capacity of S. littoralis. The results, summarized in Table 1, show that EPTC sprayed only for once on cotton plants at 1600 ppm was able on the third day after spray to reduce reproductive capacity of resulting females by as much as 83%, respective to only 53% at the moment of spray when these were compared with untreated checks. Untreated females mated to males ensuing from larvae that were captured for 24 hr to sprayed plants with the same concentration showed comparatively a less reduction which was unrelated

to the time of infestation (43%–49%). In general, the detrimental effect of EPTC upon reproductive capacity of either sex began to be abated apparently next to the earliest three days after spray. For example, on the 7th day after spray, the percentages decrease in reproductive capacity were estimated at only 35% for females and 28% for males resulting from larvae captured upon plants sprayed with 1600 ppm EPTC in water solution.

Effect of EPTC upon some agronomic characteristics of cotton plants: Table 2 shows that EPTC did not affect significantly the vegetative growth of cotton plants that were sprayed for once with even the highest concentration used (1600 ppm active ingredient in water solution). This was evident either at the initiation of flowering or at the time of fruit setting whereupon investigations were made. At harvest, the yield (expressed as weight of lint contaminated with seeds) per plant was also not affected significantly.

DISCUSSION

Although no complete sterility was obtained in these field studies compared to that reported under laboratory conditions where larvae of *littoralis* were fed 250 µg active ingredient of *S. EPTC* per larva (EL-IBRASHY, 1971a), the use of this compound and the method of sterilization described herein are promising as a means of controlling this pest. The herbicide has proved to be an effective sterilant specifically for females. It was, generally, more effective in females than in males. Untreated females mated to males from larvae fed the compound produced less number of viable eggs than females in untreated checks.

Partial sterility obtained in females treated with even the highest concentration used (1600 ppm) may be explained if the larvae failed to consume enough of the chemical to induce complete sterility in resulting adults. Indeed, the captured larvae were [noticed sluggish enough to crawl and feed properly. Although experi-

mental cages were perforated, humidity inside them was generally high to reach saturation. This can be recognized by the high mortalities encountered among larvae, either treated or checks, 24 hr after captivity due apparently to a polyhedral infection. Moreover, the percent decrease in reproductive capacity among replicates at similar treatment levels was quite variable. Therefore, refinement of the assessment might prove useful and in experiments now underway these errors are avoided. Measurements of vegetative growth and yield of cotton plants showed the quite safety of using the compound as larval chemosterilant by direct spray method.

Thus, the use of the herbicide EPTC by spraying cotton plants to sterilize normal populations of *S. littoralis* in the field appears to hold considerable promise.

REFERENCES

- ABOUL-NASR, A. E., M. T. EL-IBRASHY and N. F. SHEHATA (1971). *Appl. Ent. Zool.* **6** : 210–212.
 BOŘKOVEC, A. B. (1966) *Advan. Pest Contr. Res.* **7** : 1–140.
 EL-IBRASHY, M. T. (1971a) *Experientia* **27** : 808–809.
 EL-IBRASHY, M. T. (1971b) *Z. angew. Ent.* (In press).
 EL-IBRASHY, M. T. and M. S. CHENOUDA (1970) *Z. angew. Ent.* **65** : 146–156.
 MAHER, A. A., R. H. BISHARA, M. S. EL-SAWY, M. HUSSEIN, M. M. ABDEL KADER, F. A. ABDEL SALAM and I. IZAK (1962) *Agric. Res. Rev., Cairo* **40** : 51–70.
 TOPPOZADA, A., S. ABDALLAH and M. E. ELDEFRAWI (1966) *J. econ. Ent.* **59** : 1125–1128.

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