

原 著

The Effect of HEMPA on the Sterility and Longevity of *Dysdercus cingulatus* Fabr. Islam AHMAD (Dept. of Zoology, M. M. College, Modinagar (U. P) India.) Received February 12, 1976. *Botyu-Kagaku*, 41, 83, 1976.

17. アカホシカメムシ *Dysdercus cingulatus* Fabr. の不妊化および生存期間におよぼす hempa の影響 Islam AHMAD (Dept. of Zoology, M. M. College, Modinagar (U. P) India.) 51.

2. 12 受理

羽化したばかりのアカホシカメムシ雄成虫を 0.4425, 0.885 mg/in² hempa で処理したシャーレに接触させ、正常の雌と交配させた。Hempa は雄の不妊化に効果があり、接触時間が長いほど、不妊率が高くなった。また雌の産卵数は接触時間の長いほうが少なくなった。しかし、多量の薬剤で処理された雄と交配した雌は産卵がなかった。

また hempa は成虫の産卵前期間、産卵期間、および産卵後期間にも影響を与え、接触時間が長くなるにしたがって、これらの期間が短くなった。Hempa は濃度が高くなると、成虫にも毒性を現わす。

In applying the sterility technique to the control of harmful insects it is particularly important to develop methods for sterilizing the males of the species. Initially only some alkylating agents mostly the aziridine derivatives were known to be active but the nonalkylating agents such as melamines, phosphoramides etc. were discovered after 1964. These chemicals also showed a promising male sterilizing activity. Chang, *et al.*¹⁾ found that nonalkylating agent, hempa could produce sterility in *Musca domestica* while similar results were obtained by La Brecque, *et al.*²⁾ when the same chemical was applied to pupae and adults of housefly. The sterilizing effect of alkylating agent metepa and nonalkylating agent hempa was similar on both sexes of Azuki bean weevils, *Callosobruchus chinensis* when they were dipped in solutions of metepa, hempa and a 1:19 mixture of metepa and hempa³⁾. Hafez, *et al.*⁴⁾ observed that hempa induced complete sterility in *Anopheles pharoensis* when applied to adult diet at concentrations between 0.5 and 0.005% and females did not oviposit at 1% concentration of the chemical. Hempa was also found to induce complete sterility in both sexes of *Culex pipiens* when the larvae were reared in water containing 500ppm. of chemosterilant⁵⁾. Hafez, *et al.*⁶⁾ also achieved the complete sterility in males and inhibition of oviposition in females of *Musca sorbens* by exposing them on the residual deposits

of 50 mg/0.09m² of hempa for 2 or 4 hours. Chang, *et al.*⁶⁾ circulated the vapours of several chemosterilants such as tepa, thiotepa, hempa and thiohempa in a fumigation chamber to sterilize male houseflies, *Musca domestica* and found all of them to be more effective.

Several workers performed experiments to find out the effect of chemosterilants on the longevity of insects. Murvosh, *et al.*⁷⁾ investigated the effects of metepa and apholate on the longevity of houseflies and found that these chemicals substantially shortened the life span of the fly. Ladd⁸⁾ observed a reduction in the longevity of *Popillia japonica* when treated with apholate. A considerable reduction in the life span of both sexes of housefly, *Musca domestica* *nebulosa* was also discovered by Raghuwanshi, *et al.*⁹⁾ when treated with apholate either in the larval stage or as adults. Hafez, *et al.*¹⁰⁾ found a gradual reduction in the longevity of *Musca sorbens* with the increase in concentration of hempa given in the food of fly.

Practically no effort has been made to find out the effectiveness of nonalkylating agent hempa against *Dysdercus cingulatus*. An attempt was, therefore, made to evaluate the efficiency of this chemical as the chemosterilant for *D. cingulatus*. An effort was also made to find out the effect of this chemical on the preoviposition, oviposition, post oviposition periods and longevity of adults.

Materials and Methods

The bugs during the present studies were obtained from a normal strain of *D. cingulatus* which is being maintained in Laboratory since 1974. They were kept at a temperature of $27^{\circ} \pm 1^{\circ}\text{C}$. and were reared on water soaked cotton seeds.

The nonalkylating agent, hempa was procured through the courtesy of Dr. A. B. Borkovec, in charge, chemosterilant investigations, USDA, Maryland.

Experimental procedure: 0.0625 % and 0.125 % solutions of hempa were prepared in acetone and 5cc of the desired solution was sprayed on each petridish, 3 inches in diameter. The dish was continuously rotated on the surface until dry so as to obtain an even film of the chemical. Freshly emerged males were released in between the two treated petridishes for the desired time period and were then transferred to clean glass jars. Single pair crosses were made between treated males and normal females. Ten pairs of each type were observed for the rate of oviposition, fertility of eggs and longevity of adults. Percent sterility and percent net sterility was calculated by the following formula:-

$$\begin{aligned} & \frac{\text{Total number of unhatched eggs}}{\text{Total number of eggs laid}} \times 100 = \% \text{ Sterility} \\ & \frac{\% \text{ sterility in test} - \% \text{ sterility in normal}}{100 - \% \text{ sterility in normal}} \times 100 = \% \text{ net sterility} \end{aligned}$$

Results

The results obtained (Table 1) show that hempa could produce sterility in males of *D. cingulatus*. The males when exposed to petridishes treated at the rate of 0.4425 mg/sq. inch of hempa for 30 minutes and crossed with normal virgin females induced 35.7% net sterility. The rate of sterility increased to 42.1% when males were exposed for one hour and allowed to mate with normal females. However, a maximum net sterility of 81.1% was obtained when males after having been exposed for two hours on the same concentration of the chemosterilant were allowed to mate with normal females. The normal females when allowed to mate with males exposed to

petridishes treated at the rate of 0.885 mg/sq. inch of hempa did not oviposit irrespective of the time of exposure.

The exposure period showed a marked effect on the average number of eggs laid by females. During the present studies the oviposition is gradually reduced when the exposure period of males which treated with normal females on a surface containing 0.4425 mg/sq. inch of hempa is increased from 0.5 hours to 2 hours. Mustafa and Naidu¹¹ also observed a considerable reduction in oviposition when the females of *D. cingulatus* were exposed to a surface containing 0.7 mg. apholate/sq. inch for 18 hours. A reduction in the number of eggs laid by chemosterilized females of *M. domestica* had been observed by Morgan and La Brecque¹².

The observation (Table 2) clearly show that the preoviposition, oviposition and post oviposition periods gradually decrease with the increase of exposure period when the males were exposed on the petridishes treated with hempa at the rate of 0.4425 mg/sq. inch and allowed to mate with normal females. The longevity of both sexes is also reduced with the increase of exposure period at the same concentration. A similar reduction in the longevity of male and female houseflies, *M. D. nebulosus* treated with hempa was also observed by Ansari and Khan¹³ which was inversely proportional to the concentration tested. The males, however, failed to survive when exposed on the surface treated with 0.885 mg/sq. inch hempa irrespective of exposure period.

It is evident by the above observations that the longevity of both sexes is increased upto a certain extent when males were treated with hempa at the concentration of 0.4425 mg/sq. inch and exposed for 30 minutes and one hour which is an advantage for sterile male release technique in controlling insect pests. Keeping in view the previous findings the chemosterilized males are as competitive as normal male¹⁴ it seems reasonable to believe the sterile males would have an opportunity to mate with most of the females of normal population.

Summary

The effect of nonalkylating agent, hempa has

Table 1. Effect of Hempa on the fecundity and fertility of *D. cingulatus*.

Concentration mg/sq. inch	Exposure period in hours.	No. of Eggs laid			% Hatch	% Net sterility
		Average	Extremes			
0.4425	0.5	92.7	38	156	61.6	35.7
0.4425	1.0	86.0	65	101	54.4	42.1
0.4425	2.0	55.5	50	61	18.01	81.1
0.885	0.5	No	Oviposition			
0.885	1.0	No	Oviposition			
0.885	2.0	No	Oviposition			
Control	—	220.0	152	327	96.0	

 Table 2. Effects of Hempa on the Oviposition and Longevity of *D. cingulatus*.

Concentration mg/sq. inch	Exposure Period in hours	Preoviposition period in days			Oviposition period in days			Post oviposition period in days			Longevity of adults					
											Males		Females			
		Average	Extremes		Average	Extremes		Average	Extremes		Average	Extremes	Average	Extremes		
0.4425	0.5	9.0	4	12	12.2	7	24	19.1	10	34	52.8	32	61	40.3	20	54
0.4425	1.0	7.2	6	9	9.2	7	13	4.0	3	6	29.5	12	47	20.4	19	23
0.4425	2.0	5.5	5	6	3.5	3	4	1.5	1	2	16.5	16	17	10.5	10	11
0.885	0.5	Females did not oviposit.														
0.885	1.0	"														
0.885	2.0	"														
Normal	—	7.3	6	8	5.6	5	6	1.3	1	2	14.2	10	18	14.2	12	16

been studied on the males of *Dysdercus cingulatus*. The freshly emerged males were exposed in between petridishes treated with 0.4425 and 0.885 mg/sq. inch of the chemical. The single pair crosses were made between treated males and normal females. Hempa proved to be a successful chemosterilant on the males of this species. The rate of sterility increased with an increase of exposure period. The average number of eggs laid by the females decreased with the increase of exposure period. The females, however, did not oviposit in case they were allowed to mate with males exposed on higher concentration of the chemical.

Hempa not only produced sterility but also affected the preoviposition, oviposition, post oviposition periods and longevity of adults. A gradual reduction of these durations and longevity of adults was noticed with the increase of exposure periods at the same concentration. The higher concentration of hempa, however, proved toxic to adults.

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