Permanency of Sterility Effects of Apholate, Tepa and Metepa in Males and Females of *Dysdercus cingulatus* Fabr. Islam AHMAD* (Department of Zoology, Aligarh Muslim University, Aligarh, India) Received Feb. 28, 1974. *Botyu-Kagaku*, 39, 66, 1974.

12. アカホシカメムシ *Dysdercus cingulatus* Fabr. の雌雄における apholate, tepa, metepa の不妊効果の持続性

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アカホシカメムシの新らしく羽化した雌雄に，apholate, tepa, metepa をそれぞれ施用し，不妊性の持続を調べた．雄に施用した場合，次々に3匹の無処理雌と交尾させた結果，3回ともほぼ同じ不妊率を示した．雌に施用した場合も，3回の卵塊の孵化率を調べたが，不妊率の低下は認められず，不妊性は持続していた．

Morgan and la Brecque (1962, 1964) observed a degeneration of oocytes in the ovarian chambers of chemosterilized houseflies and in 1961 Weidhaas and his associates observed a much high sterility in the eggs of *Aedes aegypti* when the females were fed on chemosterilant treated diet throughout the observation period. Dame and Ford (1964) found a gradual recovery of fertility in the males of *Aedes aegypti* when allowed to mate more than once. The loss of sterility was higher in apholate treated males than in those treated with tepa. Raghuwanshi (1968) found that sterilized males and females of *Culex fatigans* lose their sterility effect gradually.

So far no effort has been made to investigate the permanency of apholate, tepa and metepa against *D. cingulatus*. Therefore, the present experiments were conducted to evaluate the permanency of sterility effects of these chemicals against both sexes of *D. cingulatus*.

Materials and Methods

Test insect and chemicals

The insects during the present studies were obtained from a normal strain of *D. cingulatus* that is being maintained in the laboratory since 1964. They were kept at a temperature of 29± 1°C and were reared on water soaked cotton seeds.

The alkylating agents, apholate, tepa and metepa were obtained through the courtesy of Dr. A. B. Borkovec, in charge, chemosterilant investigations, USDA, Beltsville, Maryland.

Experimental procedure

The present author exposed freshly emerged males of *D. cingulatus* to apholate, tepa and metepa, residues on petri dishes. The chemicals were applied at the rate of 3.54 mg/sq. inch and the males after having been exposed for two hours were allowed to mate with normal virgin females of the same age by making individual crosses in rearing jars and were fed on water soaked cotton seeds. After a male had copulated once, it was removed to another tube for a second mating with another normal virgin female. In this way each male was allowed to mate three times with a normal virgin female of the same age. Tests were also made to assess the permanency effect of the three chemosterilants in the females by releasing newly emerged females in petri dishes that had previously been treated with the desired concentrations of the chemosterilants. Each female was then kept with an untreated male of the same age in a rearing tube. The number of eggs in each batch was counted and the percentage hatching of eggs in each of the three batches laid by a female was determined.

Results

The results obtained (Table 1) show that the initial sterility of the males remained more or less permanent and no significant loss could be observed in successive matings. Apholate treated males which induced 88.6% sterility in their first mating with normal females were almost equally

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Table 1. Permanency of sterility effects of Apholate, tepa and metepa in males of *D. cingulatus*

Chemosterilant	Mating Series	No. of Eggs per female			% Hatch			Percentage Sterility
		Average	Extremes		Average	Extremes		
APHOLATE	I	178.2	91	264	11.3	6.7	15.5	88.6
	II	122.2	72	182	16.2	13.4	19.7	83.7
	III	152.5	101	195	15.1	10.3	21.0	84.9
TEPA	I	152.0	105	236	35.3	27.9	43.6	64.6
	II	121.6	69	156	47.1	37.6	51.4	52.8
	III	182.3	86	271	42.2	36.4	48.4	57.7
METEPA	I	145.0	81	205	47.5	33.3	55.7	52.4
	II	153.3	121	180	47.7	43.8	53.7	52.2
	III	153.0	56	213	51.4	45.7	66.1	48.5

potent in inducing 84.9% sterility in their third mating. Similarly no recovery of fertility was observed in the case of males treated with tepa and metepa. These observations are in agreement with those of Dame and Ford (1964) who found that *A. aegypti* when exposed to tepa residues developed a sterility which could not be lost even in four series of matings with normal females. The sterility developed in such cases may probably be due to direct effect of the chemosterilant on the sperms so that the destruction of genetic material by chemosterilant may leave the males permanently sterile (Smith, *et al.*, 1964)

As in males, the chemosterilants induced permanent sterility in females also and no appreciable recovery of fertility could be observed (Table 2). A slight increase in the hatch rate of eggs belonging to the second and the third batch was evident in cases when the females were treated with tepa or metepa at the rate of 3.54 mg/Sq. inch but such a recovery was not observed in the females treated with lower concentrations of these chemosterilants. The partial loss of sterility observed in the second batch eggs laid by apholate treated females was considerably restored in the subsequent batch of eggs laid by them. It is very difficult to explain such results except to say that probably all the ovarioles of an ovary are not equally effected by the chemosterilant so that the hatch rate may differ in the successive batches of eggs laid by them.

Summary

The permanency of sterility effects of apholate, tepa and metepa were observed in both sexes of *D. cingulatus*. It was found that the sterilized males when allowed to mate with the normal females retained their sterility during successive matings. The chemosterilants also induced a permanent sterility in females and in cases where the treated females were mated with normal males, the hatch rate of the eggs belonging to the 2nd and 3rd batches was almost the same as that of 1st batch.

Table 2. Permanency of sterility effects of Apholate, tepa and metepa in females of *D. cingulatus*

Conc. (mg/sq. inch)		Serial Number of the egg batches								
		Apholate			Tepa			Metepa		
		I	II	III	I	II	III	I	II	III
1.77	Eggs per batch	133.6	59.6	38.0	104.0	70.0	28.2	103.6	60.2	36.0
	% hatch	60.1	80.6	70.4	69.4	75.2	61.1	67.9	70.5	65.6
3.54	Eggs per batch	114.8	68.6	36.4	94.8	59.0	18.0	112.6	69.6	12.4
	% hatch	41.7	69.3	40.8	56.2	66.7	77.0	63.8	69.3	70.9

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Development of Resistance to Apholate in *Dysdercus cingulatus* Fabr. Islam Ahmad* (Department of Zoology, Aligarh Muslim University, Aligarh, India) Received Feb. 28, 1974. *Botyu Kagaku*, 39, 68, 1974.

13. アカホシカメムシ *Dysdercus cingulatus* の apholate に対する抵抗性の発達

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アカホシカメムシの成虫を apholate で5世代淘汰し，各世代毎に産卵数，孵化率を調べた．その結果 apholate に対する抵抗性の発達は認められなかった．

The development of insecticide resistance in insects of agricultural importance has led the entomologists to find out other safer methods of control. One such method consists in the use of chemosterilants and has already shown promise for the eradication of insect populations. In 1964, however, Hazard and his associates reported resistance to apholate in *Aedes aegypti* and in 1966, Klassen and Matsumara observed metepa tolerance in the same species. Resistance to metepa has also been indicated in housefly, *Musca domestica* (Sacca and Scirochhi, 1966) and Patterson, *et al.* (1967) observed a 20 times resistance to apholate in a colony of *A. aegypti* developed by larval selection.

There seems to be no study relating to the development of increased tolerance to chemosterilants in pests of agricultural importance and hence an attempt was made to find out if *D. cingulatus* can develop resistance to apholate under laboratory conditions.

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Materials and Methods

Test insect and Chemical

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The alkylating agent, apholate was obtained through the courtesy of Dr. A. B. Borkovec, in charge, chemosterilant investigations, USDA, Beltsville, Maryland.

Experimental procedure

The inner surfaces of petri dishes were treated with apholate at the rate of 3.54 mg/sq. inch and freshly emerged adults were confined between them for 60 minutes. They were then removed to rearing jars and were fed on water soaked cotton seeds. The eggs obtained were counted and reared to produce the next generation, the adults of which were again exposed in a similar manner. In this way selection was continued for five generations and the % sterility of the parent generation was compared with that