Acknowledgement : The author is deeply indebted to late Prof. M. A. Basir Khan for permitting to work in the department and for providing necessary facilities. Special thanks are due to Prof. S. M. Alam, Head of the Department for persistant encouragement and Prof. Nawab H. Khan for his kind help and valuable guidance during the tenure of research.

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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

Islam Ahmad (Department of Zoology, Aligarh Muslim University, Aligarh, India) 49. 2. 28 受理

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.

* Present address : Zoology Department, M. M. Post Graduate College, Modi Nagar (Meerut), U. P., INDIA.

Materials and Methods

Test insect and Chemical

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 fed on water soaked cotton seeds.

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

of the selected ones.

Results

The results obtained (Table 1) show that the species is not likely to develop any tolerance to apholate. There was no increase in the hatch rate of eggs obtained from the females belonging to the 5th selected generation. Instead a slight increase was observed in sterility. This may be due to accumulation of genetic defects or deleterious factors in the chromosomes as suggested by George and Brown (1967) in the case of *A. aegypti*.

Table 1. Selection of *D. cingulatus* with apholate

Generation	No. of eggs laid			% hatch		
	Average	Extremes		Average	Extremes	
P	158.2	125	192	20.8	0.0	56.6
F1	139.0	56	212	16.3	0.0	42.2
F2	122.2	79	201	10.7	5.7	16.4
F3	77.6	72	82	14.5	9.7	18.9
F4	77.2	32	103	11.6	4.4	15.6
F5	111.0	55	190	12.8	8.2	19.6

Summary

The selection of adults with apholate for five generations did not induce any tolerance to the chemical and no significant difference could be observed in the sterility of the parental and the selected generations.

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抄　　録

カンタリジン：昆虫に対する強力な摂食阻害物質
Cantharidin: Potent feeding deterrent to insects. J. E. Carrel, T. Eisner, *Science*, 183, 755 (1974).

ツチハンミョウ科の甲虫は触れると反射的に肢の腿節と脛節の関節部分からカンタリジンを含む体液を浸出する．アリ *Pogonomyrmex occidentalis* の巣のそばにツチハンミョウの1種 *Epicauta brunnea* を放すとアリの攻撃を受ける．しかし肢から浸出した体液がアリの体につくと，アリはすばやく走り去り，体液を除こうとする．またオサムシ *Calosoma prominens* もこのツチハンミョウを食べなかった．無理に咬ませたり，体液を口器につけて砂の上に放すと，口器を砂の中に突込み掃除しようとした．

別のアリ *Formica exsectoides* にカンタリジンを0.1M グルコースに混入して摂取させると，最少濃度の0.77×10^{-6}M でもコントロールの0.1M グルコースに比べて有意に摂取量が減少した．上記のオサムシに種々の濃度のカンタリジン溶液をブラシにつけて咬ませて，砂の中に口器を突込み掃除する行動を観察した．その結果，最少濃度の0.66×10^{-6}M でもコントロール溶液よりも有意に多くの個体がこの行動をとった．以上の結果から浸出体液中のカンタリジンに摂食阻害作用のあることがわかる．

11種のツチハンミョウからそれぞれ毛細管で一定量の浸出体液を採取し，既知濃度の純粋なカンタリジンを標準物質として，カンタリジン含量を GLC で定量した．どの種類の体液にもカンタリジンが含まれており，検出量は *Formica* や *Calosoma* に対する最少摂食阻害濃度の100倍あるいはそれ以上であった．

カンタリジンは比較的安定な不揮発性化合物で，昆虫の最も低い味覚閾値に匹敵する濃度で昆虫に対して摂食阻害作用を発揮する．カンタリジン類縁化合物は昆虫に対してカンタリジンに匹敵する摂食阻害効果をもつ可能性があるので，農薬として有効な，カンタリジンよりも低毒性の類縁化合物を探索する必要がある．

（市川俊英）