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Resistance Spectrum of Alkylating and Non-Alkylating Compounds in *Musca domestica nebulo* Fabr. Musharraf A. Ansari (Department of Zoology, Aligarh Muslim University, Aligarh, India.) Received April 13, 1973. *Botyu-Kagaku*, 38, 143, 1973.

21. イエバエのアルキル化および非アルキル化不妊剤に対する抵抗性スペクトラム

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イエバエの apholate 抵抗株, tepa 抵抗株, metepa 抵抗株, hempa 抵抗株, hemel 抵抗株について, 交差抵抗性の発現について研究を行なった. Apholate 抵抗株は, hemel に対する許容量が, 実験室で飼育している非抵抗株の 2.6 倍もあるが, tepa, metepa および hempa には感受性であった. Tepa 抵抗株は metepa, hempa および hemel に対し許容量の増加を示し, metepa 抵抗株は tepa には3.6倍, hempa には3.4倍, hemel には6.5倍の抵抗性を示した. Hempa 抵抗株は tepa, metepa および hemel にそれぞれ 3.3, 2.5, 9.1 倍の許容量の増加がみられた. Hemel 抵抗株は tepa, metepa および hempa にそれぞれ 4.6, 2.4, 8.7 倍の許容量の増加があることがわかった.

The development of tolerance to chemosterilants other than the one to which a strain has been selected, has raised a number of problems for the control personnel. A species resistant to an chemosterilant may be expected to show cross tolerance to other chemicals having similar structure and manner of detoxification in the insect body but a serious threat is posed when it becomes resistant to a chemical having an entirely different structure. Such cross tolerance have already been reported by Absa and Hansens (1969) in *M. d. domestica* who found that houseflies resistant to apholate were not only tolerant to this chemical but also showed increased tolerance to metepa. Similar results were obtained by Patterson and his associates (1967) in the yellow fever mosquito, *Aedes aegypti* that had been selected with apholate for 30 generations developed cross resistance to tepa and 3 to 4 fold increase in tolerance to metepa.

No effort has, however, been made to investigate the cross tolerance to chemosterilants in Indian forms of housefly, *Musca domestica nebulo*. Hence, tests were performed to observe if strains resistant to apholate, tepa, metepa, hempa and hemel developed any tolerance other than the one to which a strain has been selected.

Materials and Methods

During the present studies five strains of *M. d. nebulo* namely the AR strain, resistant to apholate, the TR strain, resistant to tepa, the MR strain, resistant to metepa, the HR strain, resistant to hempa or the PR strain resistant to hemel were tested for their susceptibility to other compounds by incorporating the candidate chemosterilant in the food of freshly emerged adults for four days and determining the hatch rate of the eggs in random samples of 100 eggs each. They were initially developed by selecting the adults at an Sc level of 90.0 percent or above with each of the chemicals in successive generations of laboratory rearing at a temperature of 28±1°C and 60 to 70 percent relative humidity and the larvae were reared on cotton pads soaked in diluted milk.

The percentage sterility obtained in the tests was converted into probit and plotted against log-concentration on a graph paper. Regression lines were drawn by calculating the maximum and minimum values of probit.

Results

The Sc50 values (Tables 1-6 and Figures 1-5) clearly indicate that the AR strain was as susceptible to tepa, metepa, and hempa as the normal laboratory strain but developed 2.6 times tolerance to hemel. The tepa resistant strain, however, showed considerable tolerance to metepa, hempa and hemel. Similarly the MR strain showed 3.6, 3.4 and 6.5 times tolerance to tepa,

Table 1. Sensitivity of apholate resistant strain (AR) of *M. d. nebulo* to apholate, tepa, metepa, hempa and hemel.

Chemosterilant	Percent net sterility at different concentrations											
	0.00195	0.0039	0.0078	0.0156	0.03125	0.0625	0.125	0.25	0.5	1.0	2.0	4.0
Apholate	—	—	—	7.6	19.9	35.8	76.5	100.0	**	—	—	—
Tepa	6.01	42.7	65.1	90.1	100.0	**	—	—	—	—	—	—
Metepa	—	—	8.5	48.5	70.9	93.4	100.0	**	—	—	—	—
Hempa	—	—	—	—	12.9	39.08	67.7	86.4	100.0	100.0	**	—
Hemel	—	—	—	—	—	—	—	11.3	39.5	69.3	91.8	100.0

** The females did not oviposit.

Table 2. Sensitivity of tepa resistant strain (TR) of *M. d. nebulo* to apholate, tepa, metepa, hempa and hemel.

Chemosterilant	Percent net sterility at different concentration										
	0.0039	0.0078	0.0156	0.03125	0.0625	0.125	0.25	0.5	1.0	2.0	4.0
Apholate	—	18.6	54.8	83.2	96.6	**	—	—	—	—	—
Tepa	6.01	15.1	28.2	54.5	93.8	100.0	**	—	—	—	—
Metepa	—	—	—	2.6	25.7	58.5	98.7	100.0	**	—	—
Hempa	—	—	—	—	—	—	4.9	27.5	64.02	95.6	100.0
Hemel	—	—	—	—	—	—	—	—	14.7	32.6	79.7

** The females did not oviposit.

Table 3. Sensitivity of metepa resistant strain (MR) of *M. d. nebulo* to apholate, tepa, metepa, hempa and hemel.

Chemosterilant	Percent net sterility at different concentrations										
	0.0039	0.0078	0.0156	0.03125	0.0625	0.125	0.25	0.5	1.0	2.0	4.0
Apholate	—	22.9	63.6	85.9	98.2	**	—	—	—	—	—
Tepa	7.5	35.08	59.02	83.8	100.0	**	—	—	—	—	—
Metepa	—	—	7.4	11.6	23.4	57.5	75.7	100.0	**	—	—
Hempa	—	—	—	—	—	6.2	37.5	76.5	92.7	100.0	**
Hemel	—	—	—	—	—	—	—	6.6	22.2	58.3	94.2

** The females did not oviposit.

Table 4. Sensitivity of hempa resistant strain (HR) of *M. d. nebulo* to apholate, tepa, metepa, hempa and hemel.

Chemosterilant	Percent net sterility at different concentrations										
	0.0039	0.0078	0.0156	0.03125	0.0625	0.125	0.25	0.5	1.0	2.0	4.0
Apholate	—	31.6	59.9	85.9	99.4	**	—	—	—	—	—
Tepa	11.9	37.9	61.4	93.2	100.0	**	—	—	—	—	—
Metepa	—	—	8.7	29.9	63.5	97.9	100.0	**	—	—	—
Hempa	—	—	—	—	—	—	9.7	24.8	37.1	86.5	**
Hemel	—	—	—	—	—	—	—	—	9.9	45.4	86.9

** The females did not oviposit

Table 5. Sensitivity of hemel resistant strain (PR) of *M. d. nebulo* to apholate, tepa, metepa, hempa and hemel.

Chemosterilant	Percent net sterility at different concentrations									
	0.0078	0.0156	0.03125	0.0625	0.125	0.25	0.5	1.0	2.0	4.0
Apholate	10.2	33.2	72.08	89.5	100.0	**	—	—	—	—
Tepa	9.4	43.5	81.4	99.7	**	—	—	—	—	—
Metepa	—	8.9	40.9	73.1	98.2	100.0	**	—	—	—
Hempa	—	—	—	—	—	8.1	28.8	59.5	96.9	**
Hemel	—	—	—	—	—	—	—	9.7	29.9	49.4

** The females did not oviposit.

Table 6. Sc50 values of normal and resistant strains of *M. d. nebulo*.

Strain	Apholate	Tepa	Metepa	Hempa	Hemel
N	0.01148	0.0036308	0.017378	0.091201	0.23442
AR	0.070795	0.0054954	0.023988	0.091201	0.60256
TR	0.015136	0.025704	0.079433	0.70795	2.5119
MR	0.016596	0.011220	0.17783	0.31623	1.5136
HR	0.010471	0.010233	0.043652	0.93325	2.1380
PR	0.025119	0.014791	0.041687	0.79433	4.6774

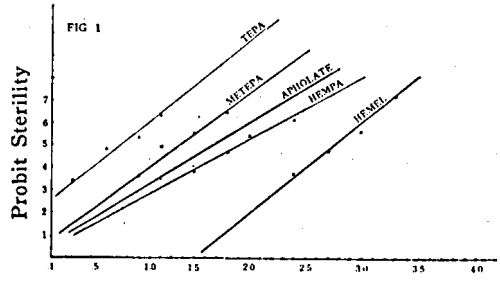

Fig. 1. Dosage sterility lines for apholate, tepa, metepa, hempa and hemel shown by apholate resistant strain of *M. d. nebulo*.

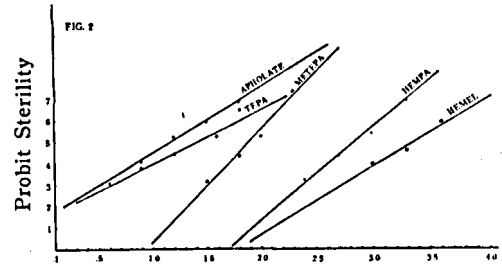

Fig. 2. Dosage sterility lines for apholate, tepa, metepa, hempa and hemel shown by tepa resistant strain of *M. d. nebulo*.

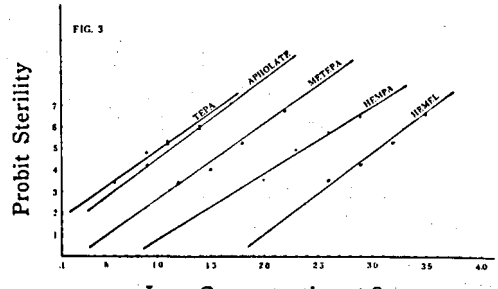

Fig. 3. Dosage sterility lines for apholate, tepa, metepa, hempa and hemel shown by metepa resistant strain of *M. d. nebulo*.

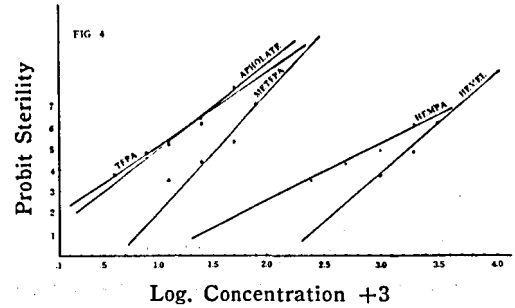

Fig. 4. Dosage sterility lines for apholate, tepa, metepa, hempa and hemel shown by hempa resistant strain of *M. d. nebulo*.

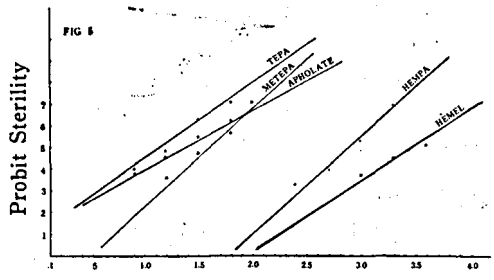

Fig. 5. Dosage sterility lines for apholate, tepa, metepa, hempa and hemel shown by hemel resistant strain of *M. d. nebulo*.

hempa and hemel respectively but was more or less as susceptile to apholate as the normal laboratory strain. The HR strain did not show any significant tolerance to apholate but it was 3.3, 2.5 and 9.1 times resistant to tepa, metepa and hemel while the PR strain registered 4.6, 2.4 and 8.7 fold increase in resistance to tepa, metepa and hempa.

Since nothing is known about the mechanism of resistance to chemosterilants it is very difficult with the present data to explain such results and can conclude by saying that it may be possible that a selected strain selects individuals for other sterilant also.

Summary

The cross resistance characteristics was studied in apholate, tepa, metepa, hempa and hemel resistant strains of *Musca domestica nebulo* by incorporating the candidate chemosterilant in the food of adults. The apholate resistant strain showed 2.6 times tolerance to hemel but was as susceptible to tepa, metepa and hempa as the laboratory strain. Another strain resistant to tepa developed considerable tolerance to metepa, hempa and hemel but remained susceptible to apholate. Similarly metepa resistant strain acquired 3.6, 3.4 and 6.5 times tolerance to tepa, hempa and hemel but none to apholate. The strain resistant to hempa developed 3.3, 2.5 and 9.1 times tolerance to tepa, metepa and hemel respectively but remained susceptible to apholate. Hemel resistant strain was 4.6, 2.4 and 8.7 times tolerant to tepa, metepa and hempa respectively and also showed some tolerance to apholate.

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書　　評

生態系と農薬

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急速な発達をとげた農薬の発達過程とそのむじゅん，生物相におよぼす農薬の影響，具体例としての有機塩素系殺虫剤や有機水銀剤の作物における残留や環境汚染，野生動物さらには人類への農薬の影響について研究分野のそれぞれ異なる著者等のチームワークによりわかりやすくまとめられている．この本は現在広く問題になっている農薬の残留，環境汚染について単なる総合抄録をしたものではない．外国におけるこれらの研究成果をとらえながらわが国における具体例を反映させ，これらの問題を一層身近かなものとして画かれていること，それぞれの項目について明快な論議や鋭い批判が適所にみられることは著者等のチームワークと努力がうかがえる．

最終項のこれからの問題についてもう少し頁をさいて著者等の具体的意見を述べてほしいところであるが選書版としての制限もあり致し方なかろう．植物防疫に関する人はぜひ一読しておくべき著書であり，専門外の人でも理解し得る良き啓もう書でもある．

（斎藤哲夫）