Cross-resistance Characteristics of *Musca domestica nebulo* Resistant Strains. Jamil A. Ansari (Department of Zoology, Aligarh Muslim University, Aligarh, India.) Received February 12, 1976. *Botyu-Kagaku*, 41, 87, 1976.

18. 各種殺虫剤に抵抗性イエバエ *Musca domestica nebulo* の交差抵抗性

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研究室でイエバエ *Musca domestica nebulo* を DDT, BHC, Dieldrin, DDT と Dieldrin の交互，による処理でそれぞれ抵抗性系統を選抜した．そしてそれぞれの抵抗性系統のこれら殺虫剤に対する交差抵抗性を検討した．その結果，DDT 抵抗性は BHC および Dieldrin に対し，交差抵抗性を示さず，Dieldrin 抵抗性は BHC に対して交差抵抗性を示した．BHC 抵抗性および Dieldrin 抵抗性は DDT に対し，抵抗力が強まる傾向を示した．

BHC 抵抗性は DDT に対し，DDT 抵抗性が BHC に対するよりも，明らかに強い抵抗力を示した．

DDT と Dieldrin の交互処理で選抜された系統は，Dieldrin だけで選抜された Dieldrin 抵抗性系統に比較して，BHC に対する交差抵抗性の程度がそれほど違っていなかった．

Introduction

Generally houseflies resistant to one insecticide show increased tolerance also to other related compounds[1]. Quite different report was presented by Kearns[2] who examined 40 different strains of *Musca domestica domestica* for their cross-resistance to different chemicals and observed that flies initially resistant to DDT and analogues remained susceptible to BHC, Dieldrin and related compounds; while those resistant to BHC, Dieldrin and analogues did not reveal any resistance to DDT or its analogues. However, Brown[3] expressed his opinion that if the flies were made resistant by successive use of the first and second group of insecticides, these may develop tolerance to any of the chlorinated hydrocarbon group of chemicals.

These conflicting reports have introduced a serious problem for the house fly control in India, and since no attempt has so far been made to investigate such aspects in the predominant Indian form of the house fly, the situation has become all the more worse. Owing to this fact evaluation on the cross-resistance of four resistant strains of *Musca domestica nebulo* was under taken in this laboratory. It is hoped that the present study would prove to be of vital intrest and immense utility in the control operation.

Materials and Methods

The house fly *Musca domestica nebulo* used as the test insect was collected from the field and reared in the laboratory. The stock culture of the susceptible house flies has never been exposed to any insecticide. Various resistant strains listed below were developed from the parent susceptible stock by insecticidal selection pressure.

1. DR-Strain: DDT resistant strain developed by selection pressure of DDT.
2. OR-Strain: BHC resistant strain developed by selection pressure of BHC.
3. UR-Strain: Dieldrin resistant strain developed by selection pressure of Dieldrin.
4. XR-Strain: Multiple resistant strain developed by alternating DDT and Dieldrin selection pressure in successive generation.

Susceptibility levels of the flies were determined by topical application of acetone solutions of the insecticides[4]. The size of the drop applied was kept constant but the concentration varied. The LC_{50} values for DDT, BHC and Dieldrin were derived from dosage-mortality regression lines fitted by eye. The slope of the regression lines was expressed as the change in probits per 10-fold change in dosage.

Results and Discussion

The LC_{50} values of the resistant strains were compared with simillar values of the normal strain and the resistance ratio thus calculated are given in Table 1:

Table 1. The LC_{50} values of the resistant and the normal strains.

Strain	DDT			BHC			Dieldrin		
	LC_{50}	Slope	Ratio	LC_{50}	Slope	Ratio	LC_{50}	Ratio	Slope
DR	32.0	1.25	51.6	0.3	2.46	6.8	0.31	2.53	2.4
OR	3.2	1.54	5.3	1.8	1.6	40.9	0.5	1.7	4.0
UR	4.2	2.08	6.7	0.44	2.29	10.0	1.05	1.8	8.4
XR	33.0	0.99	53.2	0.32	1.53	7.2	1.9	1.72	15.2
Normal	0.62	1.55	—	0.04	2.43	—	0.125	2.47	—

The above results show that the DDT tolerance of the DR-strain increased 51.6 times to that of the normal in 40 generations of selection. The dosage-mortality regression line (Fig. 1) shifted to the right and marked by defnite decrease in its slope which proved that the strain has

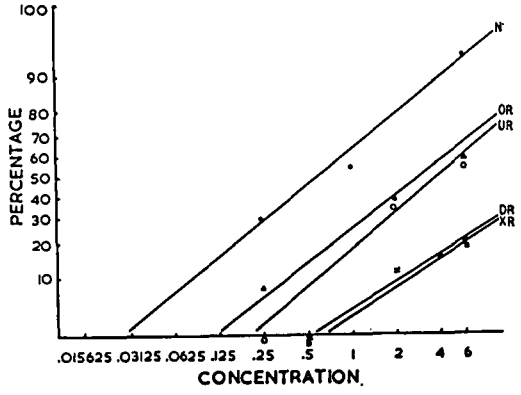

Fig. 1. Dosage-mortality response of susceptible and resistant strains against DDT.

developed a true resistance to DDT. Further, the resistance was specific to DDT as indicated by the fact that the slopes of the regression lines of the DR-strain for BHC and Dieldrin (Figs. 2 & 3) when compared to those of the normal strain were slightly higher inspite of somewhat increased tolerance of the strain to these chemicals. The slight resistance of 3 to 7 times which DR-strain show to Dieldrin and BHC has been attributed to incresed vigour of the strain resulting from intensive selection ; an opinion which Hoskin and Gordon[5] have expressed earlier.

The OR-strain developed a BHC tolerance of 40.9 times to that of normal in 40 generations of selection with BHC showed slight cross-

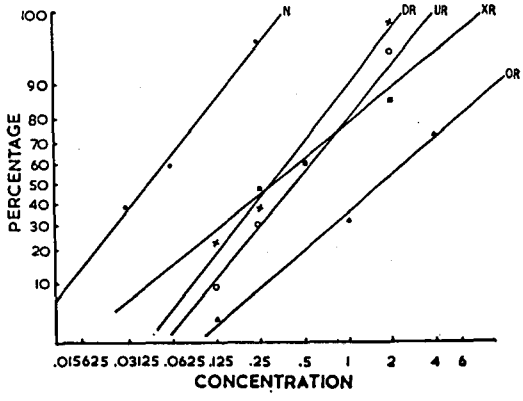

Fig. 2. Dosage-mortality response of susceptible and resistant strains against BHC.

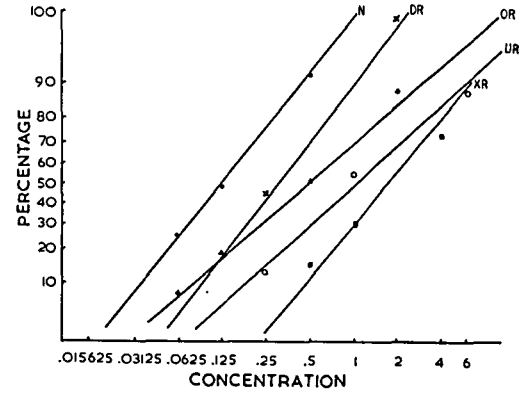

Fig. 3. Dosage-mortality response of susceptible and resistant strains against Dieldrin.

resistance to Dieldrin. Its DDT tolerance was, however, much more than the BHC-tolerance of the DR-strain. This indicated that while considerable cross-resistance to DDT may be acquired by a strain developed by selection pressure from BHC, no cross-resistance to BHC developed in strains made DDT-resistant by DDT pressure

alone.

Application of Dieldrin pressure on field collected flies for 40 successive generations developed UR-strain that showed a tolerance of only 8.4 times the normal for Dieldrin. It exhibited considerable resistance to BHC indicating thereby that selection with Dieldrin does confer cross-resistance to BHC (Fig. 2). The increased tolerance of this strain to DDT may be correlated to the accumulation of vigour tolerance as a result of selection pressure[3]. This is clear from the Figure 1 which shows an increase in the slope of the ld-p line inspite of the strain acquiring a DDT tolerance greater than that of the normal strain.

The XR-strain which in the 15th generation increased its tolerance 82.2 and 15.2 times the normal for DDT and Dieldrin respectively. This was more than the DDT tolerance of DR-strain and the Dieldrin tolerance of UR-strain which indicated that resistance developed at a faster rate in flies selected with different insecticides alternating in successive generations.

The BHC-resistance of the XR-strain (Fig. 2) is intermediate between that of the DR and UR strains. This may be due to the fact that the two insecticides used during selection pressure belonged to different groups and therefore acted in a rather antagonistic manner. So the strain could neither become as resistant to BHC as the UR-strain nor as susceptible as the DR-strain.

Summary

Cross-resistant test of four resistant strains of *Musca domestica nebulo* developed under laboratory conditions was carried out. DR-strain after DDT selection pressure did not show any cross-resistance to BHC and Dieldrin as against the UR-strain developed through selection pressure of Dieldrin which indicated marked cross-resistance to BHC. The increased toletance of BHC and Dieldrin resistant strains viz., OR-strain and UR-strain to DDT was due to the accumulation of vigour tolerance as a result of selection pressure. The regression line became steeper inspite of the strains acquiring a DDT tolerance greater than that of the normal strain.

The OR-strain porduced from selection pressure of BHC was significantly more tolerant to DDT than the DR-strain to BHC. Cross-resistance to BHC of another strain, XR-strain, initially resistant to DDT and Dieldrin was not so pronounced as that of the strain developed from Dieldrin selection pressure alone.

Acknowledgement: The author is thankful to Prof. S.M. Alam, Head, Department of Zoology, Aligarh Muslim University, for encouragement and provision of laboratory facilities in the department.

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