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IRRITABILITY OF ADULT ANOPHELES IN THE PRESENCE OF DDT

by

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The irritability of adult Anopheles in the presence of insecticides was assessed in accordance with the method described by J. de Zulueta¹ and demonstrated by himself in August 1958 when he visited Romania.

The method consists of introducing batches of five mosquitos into conical chambers made of plastic material (WHO model) applied to filter paper impregnated with solutions of DDT in Risella oil at different concentrations and to control papers impregnated with Risella oil.² De Zulueta (1958) used papers impregnated with 2% and 4% solutions of DDT. Note was taken of the number of take-offs by mosquitos from the impregnated filter paper during a period of 15 minutes. After exposure, the mosquitos were transferred into cages and mortality was read after 24 hours. Irritability was measured by calculating the average number of take-offs per mosquito.

In the tests carried out we employed Anopheles as follows: (a) laboratory-reared, engorged, and (b) mosquitos captured in various villages, engorged in summer, or (most of them) non-engorged in autumn. The tests were made between 9 a.m. and 3 p.m. in incident lateral daylight (40-50 candle power). In October

¹ de Zulueta, J. (1959) Insecticide resistance in Anopheles sacharovi, Bull. Wld Hlth Org. 20, 797

² Filter papers contained in WHO kits for the determination of anopheline sensitivity to insecticides.

and November the light in the field was reduced; there were variations even from one test to another. After 15 minutes' exposure the Anopheles were transferred to cylindrical cages of perforated paper¹ or to paper cups covered with muslin.

The results of the tests (see table and graph) indicate greater irritability in Anopheles placed in contact with the insecticide as compared with the controls but, as a general rule - as demonstrated by de Zulueta - the degree of irritability is not proportionate to the insecticide concentration.

Tests repeated in the same locality showed that results are variable. The details given in the overall Table No. 1, also the results obtained by de Zulueta with A. sacharovi at Enisala (9 August 1958) and with reared A. atroparvus from Stefănești (16 August 1958) show that the reared strain of A. atroparvus-Stefănești gave practically the same degree of irritability to DDT in summer (18 August 1958) and in winter (30 December 1958). This strain was less irritable than the other species studied (A. sacharovi and A. messeae) which were captured in natural surroundings; this strain (Stefănești) is from an untreated locality.

In summer, an average of 15 "take-offs" was obtained per mosquito for 2% DDT and 16.8 for 4% DDT, with A. sacharovi captured in Enisala (treated from 1949 to 1951 and from 1953 to 1954) - values about twice as high as those obtained with laboratory-reared A. atroparvus-Stefănești. The Anopheles in Enisala were much less irritable in the presence of DDT in September and October, the average take-offs per mosquito being respectively 9.3 and 8.2 for 2% DDT and 9.7 and 12.1 for 4% DDT. Most of the Anopheles captured at Enisala in October and November were engorged and showed a lipid content. The results obtained elsewhere in October - the number of take-offs per control mosquito (8.1) being practically the same as that obtained with 2% DDT (8.2) - showed that real irritability produced by DDT was nil with the 2% concentration and fairly low with the 4%.

¹ Ungureanu, E. et al. (1958) Stud. Cercet. stiint. Ser. II, Sec. Med. 8, Fasc. 1

Similarly, at Caraibil (locality treated 1950-1954), A. messeae showed marked irritability in summer (1 September 1958) followed by a definite drop to about half in November (with 2% DDT: 14.1 to 7.1, and with 4% DDT: 14.7 to 6.8). At the end of September and in November, the flights per mosquito were slightly fewer for the 4% DDT than for the 2%; these two tests were made with non-engorged Anopheles with lipid content, that is, captured in November in a state of complete hibernation.

It is noteworthy that this seasonal drop in irritability to DDT was correlated in those mosquitos with a marked autumnal rise in their DDT-tolerance (measured by the LC_{50} 's determined by the WHO method), and an even more pronounced rise in their tolerance to dieldrin. These findings will be published elsewhere.

At Murighiol (treated from 1948 to 1958), lower rates were obtained with A. messeae captured in non-treated animal sheds (10.2 take-offs per mosquito for 2% DDT and 10.4 for 4% DDT and, only two days later at Caraibil, 14.1 and 14.7 respectively). Was it at Murighiol a case of decreasing irritability in Anopheles subjected to insecticide for 11 years? If we deduct the values obtained for the respective controls from the averages obtained with 2% and 4% DDT, the results for the two localities are approximately the same. It might be concluded that the apparent differences are due to a variation of natural irritability in these two localities, and that the use of insecticides in these cases (11 years at Murighiol and only five years at Caraibil) does not appear to have caused any change in the irritability of adult Anopheles in the presence of insecticides. Furthermore, in the sensitivity tests carried out in 1957¹ and 1958, the data concerning anopheline density and the absence of cases of malaria would seem to indicate the persistence of sensitivity of anopheline vectors and the absence of any changes in behaviour arising from irritability.

Anopheline mortality, read 24 hours after exposure, was generally lower by as much as one-third or more as compared with that obtained in the susceptibility tests where the period of exposure is one hour.

¹ Duport, M., Săndulesco, M. (1958) WHO unpublished document EUR.107.3/WPG

Conclusions

DDT was an irritant for the local anopheline species subjected to the tests. In general, irritability was greater with the stronger concentrations, but the increase was not proportionate.

Laboratory-reared A. atroparvus from Stefănești (an untreated locality) showed least irritability.

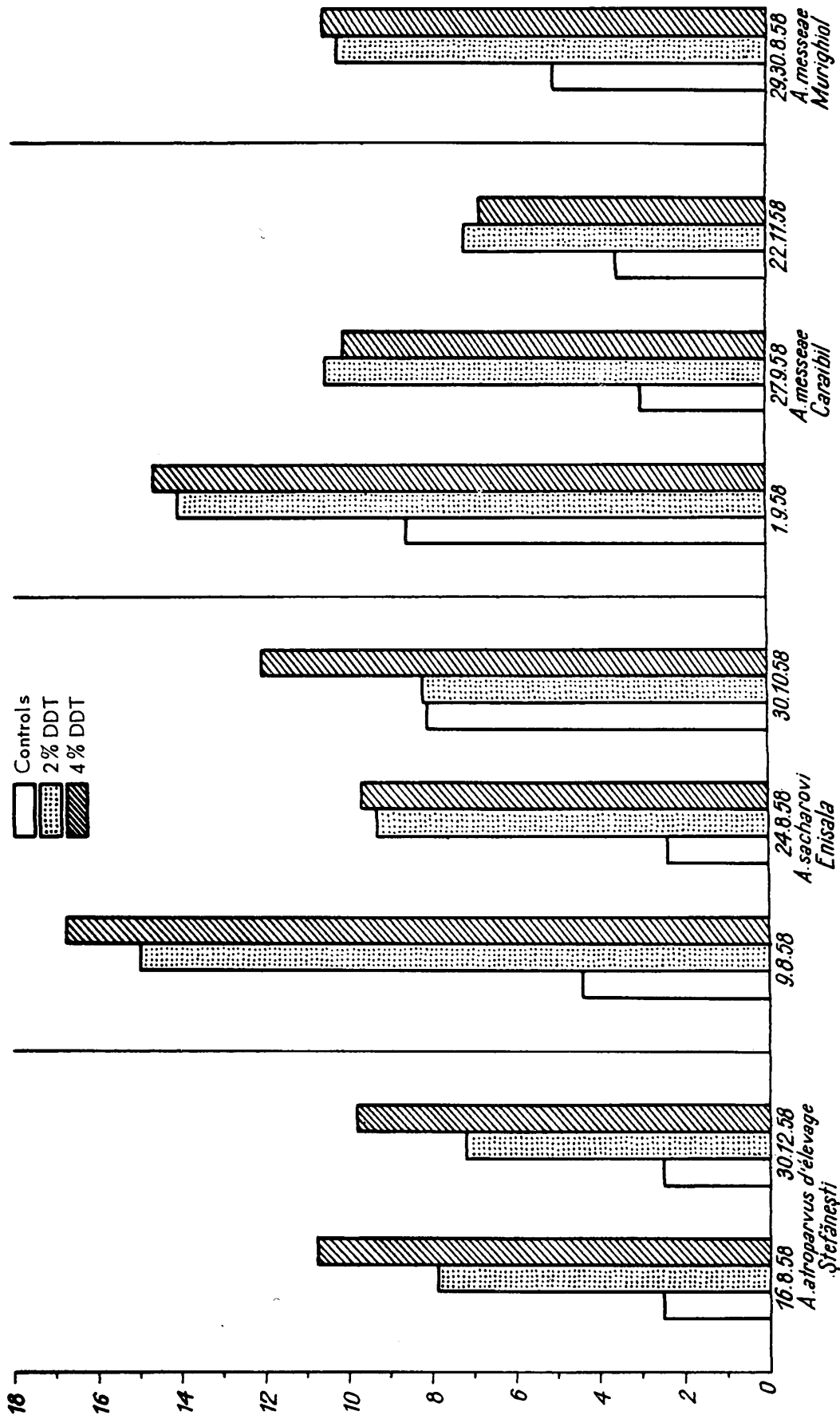
The irritability of A. sacharovi and A. messeae from localities which had been treated for different numbers of years was approximately the same.

In autumn and at the beginning of winter a marked drop in irritability was noted, which might have been due to the physiological condition of the Anopheles or to the different temperature and light in that period.

Laboratory-reared A. atroparvus showed the same irritability whatever the season.

IRRITABILITY TESTS

Number of take-offs per anopheles



IRRITABILITY TEST
 Overall Table No. 1

Locality	Species	Date of test	Temperature during exposure	Engorged or non-engorged anopheles	DDT 2%		DDT 4%		Controls	
					No. anoph. eles tested	No. of take-offs Per anoph. tested	No. anoph. eles tested	No. of take-offs Per anoph. tested	No. anoph. eles tested	No. of take-offs Per anoph. tested
Stefănești	<u>A. atroparvus</u> ♂*	16.8.58	27°C	engorged	59	465 7.8	60	643 10.7	60	151 2.5
	<u>A. atroparvus</u> ♂	30.12.58	25°C	engorged	30	212 7.1	30	295 9.8	30	76 2.5
Enisala	<u>A. sacharovi</u> *	9.8.58	26°C	engorged	50	750 15.0	60	1005 16.8	80	384 4.4
	<u>A. sacharovi</u>	24.9.58	21°C	engorged	50	466 9.3	50	486 9.7	50	123 2.4
	<u>A. sacharovi</u>	30.10.58	14°C-15°C	3/4 engorged	25	206 8.2	25	303 12.1	25	205 8.1
Caraibil	<u>A. messeae</u>	1.9.58	21°C	engorged	60	845 14.1	60	881 14.7	60	509 8.4
	<u>A. messeae</u>	27.9.58	20°C	non-engorged	30	317 10.5	30	304 10.1	29	144 4.9
	<u>A. messeae</u>	22.11.58	12°C-14°C	non-engorged	30	214 7.1	30	206 6.8	30	165 5.5
Marighiol	<u>A. messeae</u>	29.8.58-30.8.58	23°C-24°C	engorged	60	612 10.2	59	612 10.4	60	301 5.0

* Tests made by J. de Zulueta.

♂ Laboratory colony