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THE SULPHUR CONTENT OF THE LARVAE OF THE DDT-SUSCEPTIBLE AND RESISTANT STRAINS OF *ANOPHELES FLUVIATILIS*.

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Comparative biochemical studies on the DDT-susceptible and resistant strains of mosquitoes have revealed the occurrence of DDT-dehydrochlorinase system in the resistant ones in *Aedes aegypti* and *Anopheles sundaicus* (Kearns 1955, Brown 1956, Brown and Perry 1956). Matsumura and Brown (1961) noted that the larvae of malathion-resistant strain of *Culex tarsalis* had a carboxyesterase that was active against the carboxy group of malathion.

In a recent study, Vasudevan et al. (1980) recorded interesting differences in the nature of the bound amino acids of the cuticle in the adults of the DDT-susceptible and resistant strains of *Anopheles fluviatilis;* in the former the cuticle proteins contain both the acidic and basic amino acids while the same in the resistant strain lack the basic amino acids completely. Further studies on the same species have revealed the occurrence of marked variations in the sulphur contents of the whole body of the larvae of the two strains and these results are given in the present paper.

The susceptible and the resistant strains used in the investigation were obtained from the same source, i.e. the field station of the National Institute of Communicable Diseases at Mettupalayam, India. The LC_{50} of the susceptible strain is at 0.004 ppm DDT at 21 to 24°C for 24 hr and that of resistant strain is at 0.04 ppm DDT.

The larvae were pressed gently in between filter papers to remove the adhering water and then weighed. Such materials were ground in a microhomogenizer and then used for estimation of sulphur according to Carius method (Clarke 1975). In this the organic sulphur is converted to acid sulphate by oxidation with fuming nitric acid in the presence of an alkali metal salt such as sodium chloride. The sodium hydrogen sulphate is converted to sodium sulphate and the sulphate determined by titration with 0.01 m barium chloride solution using a tetrahydroxyquinone indicator or gravimetrically as barium sulphate.

The results are presented in the accompanying table. In the susceptible strain the 1st instar larvae had 12.4±3.6 mg/g of sulphur. The larvae in the 2nd instar had a lower sulphur content, i.e. 9.3±2.4 mg/g. During the 3rd and 4th larval instars the values increased a little, viz. 11.8±2.9 and 10.6±3.8 mg/g, respectively.

Table showing the sulphur content of the larvae of the DDT-susceptible and resistant strains of *Anopheles fluviatilis*.

Sl. No.	Larval instar number	Quantity of Sulphur in mg/g: Susceptible strain	Quantity of Sulphur in mg/g: Resistant strain
1.	First	12.4±3.6	52.7±12.4
2.	Second	9.3±2.4	43.0± 5.6
3.	Third	11.8±2.9	41.5± 7.3
4.	Fourth	10.6±3.8	46.6± 9.8

In the resistant strain the larvae had an extremely higher quantity of sulphur in all the instars. The 1st instar larvae had 52.7±12.4 mg/g. The value came down to 43.0±5.6 mg/g in the 2nd instar and lowered further 41.5±7.3 mg/g in the 3rd instar. The larvae in the 4th instar had 46.6±9.8 mg/g of sulphur.

There is no previous literature pertaining to this kind of information. This precludes any discussion on the results recorded in the present investigation. It is not evident if this difference is related to the resistance of the mosquitoes to DDT.

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THE FIRST RECORD OF *AEDES TOGOI* (THEO.) IN THE UNITED STATES—ABORIGINAL OR FERRY PASSENGER?

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Aedes togoi (Theobald) is probably a native of the temperate Pacific east coast of Asia, where its larvae breed in rock pools at the high tide line. In Japan and the south coast of Siberia it has adapted to live in artificial containers. Interest in the species stems from its present distribution in rock pools around the Pacific rim from 2 to 50°N latitude and from the fact that it is a natural vector of Japanese B encephalitis virus and several filarial nematodes in Asia.

The first North American specimen of *Ae. togoi* appears to be an adult female in the Canadian National Collection, identified in 1974 (D.M. Wood personal communication). It was collected at Horseshoe Bay, 5 km northwest of Vancouver, B.C., by C.D. Garrett and is undated. It could have been taken as early as the mid 1940's when this dipterist moved to the coast and certainly predates the first larva, collected from Cordova Bay, 5 km north of Victoria, southern Vancouver Island, and identified by A. Stone in 1970 (Sollers-Riedel 1971).

Wood et al. (1979) give Vancouver and Victoria as the only localities for *Ae. togoi* but in 1977 and 1978, Dr. R. M. Trimble and I found it fairly widely distributed in Canada on suitable rocky shores, up to 55 km from these sites (Trimble & Wellington 1979).

Since 1978, I have searched for this species on the northern coastline of Washington State. There appear to be few suitable rocky outcrops on the coast of the mainland for some 35 km south of the border. Rock pools found just south of Bellingham were in porous sandstone, and the only mosquitoes breeding in them were *Culiseta incidens* (Thomson). Many of the islands in the San Juan group appear to have suitable rocky shores, but the only area searched, around the marine station at Friday Harbor, San Juan, did not yield mosquitoes.

In 1980 the search was continued south to Fidalgo Island and the area around the ferry terminal for Sidney, B.C., and the San Juan Islands, at Anacortes (Fig.1). All larval instars and pupae of *Ae. togoi* were found in a small rock pool by my son, Owen, on Aug. 22. The site was Rosario Beach on the west coast, some 6 km south of Anacortes. The pool was above recent high tide levels and many of the larvae and pupae were concealed under a mat of green alga (*Enteromorpha* sp.). Some chironomid larvae were present under detritus and many copepods were swimming with the mosquito larvae. From its chloride concentration, measured coulometrically, the pool contained 70% seawater.

Larvae and adults reared from the pupae, correspond closely to the descriptions given by La Casse & Yamaguti (1950) and Wood et al. (1979).

This species has now been found in an area extending 120 × 60 km, and it seems unlikely that it was introduced as recently as the 1940's. In Canada, *Ae. togoi* is seldom found more than a few hundred meters from the coastline and, without human assistance, one would expect it to spread along the shore from one rocky outcrop to the next. Several of its breeding sites, however, are separated from other rock pools by many kilometres of sand or gravel beach and one site, on South Pender Island, is separated from the closest known site by about 27 km of open sea.

The site on Fidalgo Island is 43 km, as the gull flies, from Cordova Bay but well over 150 km following the coastline south from Vancouver.