

TABLE 1.—Activity of some insecticides against a susceptible laboratory strain and a DDT resistant field strain of *Culex pipiens quinquefasciatus* (from Coachella Valley).

Compound	Susceptible		Resistant		Fold tolerance <sup>1</sup>	
	LC <sub>50</sub>	LC <sub>90</sub>	LC <sub>50</sub>	LC <sub>90</sub>	LC <sub>50</sub>	LC <sub>90</sub>
Methyl parathion	0.003	0.0054	0.003	0.0047	1.0	1.0
Baytex	0.0046	0.0074	0.0068	0.0094	1.4	1.3
Parathion	0.0043	0.008	0.0082	0.015	2.0	2.0
Dieldrin	0.005	0.009	0.037	0.05	7.4	5.5
Sumithion	0.0062	0.0094	0.0092	0.015	1.5	1.7
AC-5727	0.01	0.026	0.023	0.038	2.3	1.5
Ortho 5353	0.021	0.038	0.05	0.1	2.4	3.0
DDT	0.028	0.045	0.32	1.2	11.0	27.0
Ortho 5305	0.038	0.07	0.046	0.082	1.2	1.2
Malathion	0.06	0.09	0.12	0.25	2.0	3.0

<sup>1</sup> Tolerance level of 1.0 indicates similar susceptibility.

species from other parts of the country (Hedeen 1963).

It should be pointed out that some reversal in tolerance may have occurred during the rearing of this Coachella Valley strain before actual evaluation studies in the laboratory. But the degree of such a reversal (if any) is considered to be rather small. Studies on the susceptibility pattern of laboratory colonies selected with organochlorine insecticides will bear this out. The period required for appreciable reversal is generally long.

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## PARASITIC HYDRACARINA OBSERVED ON MOSQUITOES AT THE WICHITA MOUNTAINS WILDLIFE REFUGE

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While studying the activities of mosquitoes at the Refuge during the summer of 1958 and 1959, a number of adult mosquitoes and a few larvae were observed to be parasitized by Hydracarina. The regular occurrence of this phenomenon at the headquarters area collecting station led to further study and the recording of Hydracarina on other species of mosquitoes. The results of these observations are presented below.

The Refuge is a tract of 59,020 acres, embracing the major portion of the Wichita Mountains in southwestern Oklahoma, and lies entirely within Comanche County.

**MATERIALS AND METHODS.** Larval and adult mosquitoes were examined routinely for parasites with a stereoscopic microscope under 60X magnification. A few larvae, with parasitic water mites attached, were observed for several days in isolation vials

in the laboratory. Data were recorded on the rate of infection of water mites on *Anopheles quadrimaculatus*, by examining all adults of this species for mites and recording the results.

RESULTS. Parasitic water mites were recorded from females of *A. quadrimaculatus* and *Aedes zoosophus*. Water mites were also recorded on the larvae of *Anopheles punctipennis* and *A. quadrimaculatus* during the summer of 1958. The water mites parasitic on the adult anopheline species were *Arrenurus* sp. During 1958, when precipitation was some 10 inches below normal, water mites of the genus *Arrenurus* were observed a number of times on resting females of *A. quadrimaculatus* near an impounded stream in the headquarters area. It is interesting to note that during the summer of 1959, when precipitation was much greater, the mite population became much smaller.

The data relative to the rate of infestation of the water mite *Arrenurus* sp. on the adults of *A. quadrimaculatus* are presented in Table 1. A total of 7.8 percent

TABLE 1.—Infestation rate of *Arrenurus* sp. (water mites) on adults of *Anopheles quadrimaculatus*.

Number of parasites per host	Number of host examined	Percentage of parasitism
50-59	1	0.14
40-49	1	0.14
30-39	1	0.14
20-29	5	0.74
10-19	6	0.88
1-9	39	5.77
0	622	92.1

of 622 *A. quadrimaculatus* adults collected were parasitized by these mites.

The water mite *Thyas stollii* Koenike 1895, was recorded from several adult females of *Aedes zoosophus* in July, 1959. Members of the genus *Thyas* are in general dipteran parasites (Mitchell, 1957).

During this study *Thyas stollii* was observed only on the adults of *A. zoosophus*, but never on the larvae. As far as can be

determined this is the first record of *Thyas stollii* on *A. zoosophus*.

Mosquito larvae were apparently not parasitized by these mites as often as the adults.

DISCUSSION. Mosquito parasites have been discussed at length by Steinhaus (1946), and Horsfall (1955). It is a generally accepted fact that mosquitoes are parasitized by a variety of fungi, bacteria, protozoans, nematodes, trematodes, and hydrachnid mites.

According to Mitchell (1957) the typical life cycle of the members of the superfamily Arrenurinae begins with the hatching of the eggs, after which the larvae swim swiftly through the water in an erratic and undirected path. If a mosquito pupa is encountered, the larvae attach. It appears that the larvae are not directed or attracted to the host from any great distance. When the host imago emerges, the larvae again become active and crawl onto the adult host and attach themselves, often at a specific location. Later, engorgement follows and distention of the integument occurs posteriorly and lateroposteriorly to the third coxae. It is believed that these mites, at the emergence of the adult mosquitoes, seek the soft parts of the adult hosts, to which they cling (Uchida and Miyazaki, 1935). Laboratory observations made during this study suggest that the attachment of these mites to emerging adult mosquitoes is perhaps a matter of chance since none of the adult mosquitoes which were isolated and reared from parasitized larvae had mites attached upon their emergence.

According to Mitchell, larvae of the genus *Thyas* swim actively upon the surface of the water. Later the larvae locate the host pupae and attach themselves near the breathing horns of the pupae. When the imago emerges, the larval mites climb on to the adult host and dig in their mouthparts before the cuticle is fully hardened. Engorgement follows, and the distention of the body anteriorly and posteriorly to coxae III.

*Thyas stollii* was recorded from adults of *Aedes vexans* by Dr. R. M. Crowell (per-

sonal communication) in Wayne County, Ohio during June and July, 1955. The Hydracarina discussed in this paper were identified by Dr. Crowell to whom the author is indeed grateful.

Uchida and Miyazaki (1935) have presented similar observations on water mites associated with species of the genus *Anopheles* in Japan; *Arrenurus madarski* Daday was reported with a 57 percent infestation rate when 219 *Anopheles* adults were examined.

In general the water mite belonging to the genus *Arrenurus* was quite host specific on species of *Anopheles*, even though larvae of *Culex erraticus* were often present in the same habitat. It is interesting to note that while *Culex* mosquitoes were often very abundant, these mites were never observed on *Culex* larvae or adults.

The reduction in mites during 1959, when precipitation was much greater, was probably attributable to the flushing of the stream during periods of heavy precipitation.

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## SCIENTIFIC NOTES

### A NEW DISTRIBUTION RECORD FOR *Culiseta* (*Culicella*) *minnesotae* BARR<sup>1</sup>

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On July 9, 1963, during the second year of a special survey of potential eastern encephalitis mosquito vectors in Plainville, Connecticut, 13 larvae were obtained from stagnant swampy water at Maiden Lane; of these, 10 were reared to adults and identified as *Culiseta* (*Culicella*) *minnesotae* Barr, while the 3 remaining (preserved) larvae were identified tentatively as the same species. On September 28, one more larva was obtained from stagnant water at Stremleau Avenue, reared to adult, and identified as the same species.

This represents a first report of this species in Connecticut.

Although an intensive mosquito survey of all possible breeding sites had also been carried out during the previous year by the author, no *C.*

*minnesotae* were found. This has led to the belief that recent findings in Plainville are the result of current infestation.

This species was reported and described by Barr, in 1957, from scattered localities in Minnesota. It was later reported from Utah by Nielsen and Rees (1959). Additional collections have been made from Idaho and Montana, in 1962 (Nielsen, *et al.*, 1963).

Two possibilities are thus open to speculation: that this species has recently been transported from western states to its present eastern site, or it has been present in Connecticut for some time without being detected. The second possibility points to a scarcity of this species in Connecticut although further investigation may reveal it in other localities.

Published reports indicate that the larvae would be expected to occur in semi-permanent marshes. However, the author has found larvae in permanent stagnant swampy water caused by inundations from slowly moving rivers at a typical bend heavily overgrown with weeds and brush. The sites were about two miles apart, in two separate rivers, the Pequabuck and the Quinnipiac.

In published reports on the biology of *C. minnesotae*, it is suggested that hibernation appears to be by adult females. Adults are attracted to lights, and they have been taken from April to June and from September to October. The

<sup>1</sup> This report is part of a research program conducted under the direction of Dr. William Stanziale, and submitted as a dissertation for the degree of Master of Arts, St. Joseph College, West Hartford, Connecticut.