INSECT PREDATORS OF MOSQUITO LARVAE AND PUPAE IN ALASKA [1]

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Numerous instances of insects attacking and feeding on mosquito larvae and pupae came to the attention of the authors during the summer of 1948 as they engaged in a study of the biology of Alaskan mosquitoes. Many studies concerning predators of the immature stages of mosquitoes have been conducted in other parts of the world; however, the only information based on observations in Alaska is that given by Jenkins (1948). He noted that predaceous Chaoborinae were locally abundant and that other types of predaceous insects were common in the latter part of the breeding season.

The results of the observations made by the authors during 1948 are discussed below.

DYTISCIDAE (COLEOPTERA). Laboratory observations at Fairbanks demonstrated both larvae and adults of the genus *Agabus* to be effective mosquito predators. One larva was kept in the laboratory for 20 days before it died. During this time it destroyed 80 mosquito larvae and 10 pupae. This and one other *Agabus* larva molted twice during captivity; one larva molted 3 days after being brought into the laboratory and again 4 days later. During the period between molts one larva destroyed 10 second- and third-stage *Aedes* larvae, and the other disposed of 11. No *Agabus* larvae pupated, but th cause of their death is not known. On *Agabus* adult consumed 63 *Aedes* larva in 13 days.

Many other adult and larval dytiscic were observed to feed on mosquito larva In the field dytiscid larvae were fr quently captured still holding wigglers i their mandibles. Larvae were numerou and widely distributed, particularly i semipermanent water (pools that becam dry sometime during the season). Excep for chaoborines, the dytiscids seemed t be the only predators that were associate to any extent with larvae of the early maturing, black-legged *Aedes*.

CORIXIDAE (HEMIPTERA). Since 190 several authors have reported variou species of Corixidae to be predaceous o mosquito larvae (Hinman 1934, Hal 1922, Poisson 1935), and in 1947 Jenkin (unpublished report) listed corixids a incidental predators in Alaska. Despit these observations the view has persiste among most entomologists that the preda ceous habit is incidental and that mos corixids feed primarily on diatomaceou ooze, flocculent organic matter, and algae A possible exception is the genus *Cymatia* which appears to be structurally adapte for predaceous habits.

It was therefore something of a surpris when on May 1 a mating pair of *Calli corixa audeni* Hungerford was observe to feed on *Aedes* larvae to the exclusion o other food. The corixids were brough into the laboratory in a pint jar containing some pond vegetation, some bottom ooze and 25 larvae of *Aedes communis* (De

[1] These observations are based on material and data collected by the authors while they were members of the Alaska Insect Project in 1948. This project was conducted by the U. S. Bureau of Entomology and Plant Quarantine under a transfer of funds from the Department of Defense to the Bureau.

Geer). Both the corixids and the wigglers seemed contented; however, the jar was not watched closely during the next 5 days. By May 6 all the wigglers had disappeared, leaving remains that looked like cast skins, and the corixids were attempting to escape from the jar.

The corixids were then placed in a 1-ounce jar with three wigglers, and they again appeared satisfied. The following morning no wigglers were present in the jar, and three more were added with similar results. On May 8 three more wigglers were added and the jar was placed under close observation. Within 5 minutes the female corixid had seized a wiggler (fourth-instar *A. communis*). The wiggler was held by the forelegs and clasped tightly against the lower face. The stylets could be seen as they probed through the cuticle of the wiggler. The wiggler's struggles caused the corixid no difficulty and it was soon subdued. The corixid made the usual trips to the surface for air carrying the larva with it.

The male soon proceeded to feed at one end of the wiggler held by the female, which fed at the other end. Occasionally they would break apart, the female retaining the wiggler. After 20 minutes the wiggler was reduced to a collapsed skin, with even the head capsule caved in. Only the contents of the alimentary tract remained inside the wiggler. Shortly after the first wiggler was discarded, the male captured another and the procedure was repeated but at a much slower speed. The female joined in feeding on the wiggler only once for a period of 3 minutes. The male continued to feed for 55 minutes. At the end of this time the wiggler was reduced to an empty skin.

Later observations supported the conclusion that *Callicorixa audeni* and *alaskaensis* Hungerford are both predaceous on mosquito larvae. It is significant that the adult corixids were quite content to stay in jars as long as mosquito larvae were present, but were repeatedly observed trying to escape within 24 hours after larvae were no longer available. The presence of small crustaceans, plant life, or bottom ooze did not remove their obvious dissatisfaction. These observations indicate that mosquito larvae are favored prey, and suggest that the adult *Callicorixa* may migrate from pools in which the mosquito population is exhausted.

Both species of *Callicorixa* were collected within an area extending from Anchorage and Valdez north to Circle City and east to the Yukon border. Both were frequently found in the same pools; however, *audeni* was more common in both number of individuals and number of collections.

Adults and nymphs were found in semipermanent pools that normally produce *Aedes excrucians* (Walker), *A. fitchii* (Felt and Young), *Anopheles earlei* Vargas, *Culiseta alaskaensis* (Ludlow), *C. impatiens* (Walker), and *Culex territans* (Walker). There seems little reason to doubt that these corixids are an important factor in limiting the abundance of these species of mosquitoes.

CHAOBORINAE (DIPTERA: CULICIDAE).[2] The predaceous larvae of this culicid subfamily were frequently encountered. The genus *Corethra* was more common than *Chaoborus* near Fairbanks, and larvae were often taken from pools containing larvae of *Aedes punctor* (Kirby) and the later developing *Aedes* species. *Corethra* larvae were also numerous in pools where *Culiseta* wigglers were found. *Corethra* larvae were also common near Anchorage, but seldom was more than one larva per selected dip found even in favorable locations.

At Anchorage two permanent ponds containing much emergent vegetation were observed to contain four to six larvae of *Chaoborus flavicans* (Meigen) per dip as early as April 19. Virtually no *Aedes* or *Culiseta* mosquitoes were produced in these ponds. *C. flavicans* larvae pupated about May 1 and adults emerged between May 5 and 7. Second and third instars were again common in the same pools after the middle of August.

[2] Laboratory observations were made by Kathryn M. Sommerman.

The importance of *C. flavicans* as a predator on mosquito larvae was further confirmed by laboratory observations. On April 23 eight fourth-stage *flavicans* larvae were brought into the laboratory and placed in a jar with several first-stage *Aedes* larvae. The mosquito larvae disappeared and the supply was replenished at intervals. On April 28 one *flavicans* larva was isolated and placed under close observation. The isolation was made in the forenoon, and 10 first-stage *Aedes* larvae were placed in the rearing tube with the *flavicans* larvae. One wiggler was eaten immediately, tail first, and eight more were consumed during the day. Twenty-three more wigglers were eaten before the *flavicans* larva pupated on May 1. Five of the *flavicans* larvae in the general culture pupated on the same day. Records of the specimens in the general culture are incomplete; however, two adults emerged on May 5 and another on May 6. The isolated specimen emerged as an adult on May 7. Both in the general culture and in the case of the isolated specimen there was evidence that the *flavicans* larvae seized and killed many mosquito wigglers without eating them.

ODONATA. Damselfly and dragonfly naiads were abundant along marshy lake shores and in permanent ponds containing floating vegetation. These locations are particularly favorable for the development of *A. earlei* and *C. territans*. Early instars of these species as well as of the *Culiseta* species were frequently found in abundance. However, if one naiad per two or three dips could be found in the same water, no *Culiseta* and few *Anopheles* or *Culex* were observed to survive to the pupal stage.

DISCUSSION. No accurate assessment of the importance of the insect predators in controlling mosquitoes in Alaska is possible from these limited observations. Obviously their presence does not prevent pest populations from developing in central and northern Alaska. However, it is quite possible that they restrict the period of time that annoying mosquito populations are present in an area and that they greatly reduce such populations locally during years when a generally distributed pest population is not produced.

This assumption is based on evidence that the generally distributed pest species develop in temporary snow-melt pools which are not suitable for the immature stages of most of the predator species. On the other hand, the predators thrive in the semipermanent and permanent pools where the less important species of *Aedes*, *Culiseta*, *Anopheles*, and *Culex* develop. The *Aedes* species originating in these pools emerge later than do the species of greatest pest importance and in local areas prolong the season of annoyance, where the *Culiseta* species live through the winter as adults and are capable of creating serious nuisance several weeks in advance of the first *Aedes* emergence. If the natural check provided by the predators were removed, there is little doubt that the season of mosquito annoyance would be lengthened and that the pests would be much more numerous in localities adjacent to ponds and marshes.

Literature Cited

HALE, H. M. 1922. Studies in Australian aquatic Hemiptera, No. 1 Corixidae. Rec. S. Austral. Mus. 2(2):309–330.

HINMAN, E. H. 1934. Predators of the Culicidae (mosquitoes). I. The predators of larvae and pupae exclusive of fish. Jour. Trop. Med. and Hyg. 37(9):129–134.

JENKINS, D. W. 1948. Ecological observations on the mosquitoes of central Alaska. Mosquito News 8(4):140–147.

POISSON, R. 1935. Les hémiptères aquatiques (Sandaliorrhyncha) de la faune française. Arch. de Zool. et Gén. 77:455–563.