DISTINCTIVE FEATURES OF THE LARVÆ OF AEDES ALLENI TURNER (DIPTERA: CULICIDÆ)[1, 3]

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INTRODUCTION

The adult of the mosquito, *Aedes alleni* Turner was described in 1924 from insects reared from larvæ collected in a rot cavity of a willow tree at Mission, Texas (Turner 1924). The larva was described during the same year from specimens taken at the same locality (Dyar 1924). Since the original description, the collection of the species has been reported several times in the literature, but it has not been collected in large numbers, and has been considered relatively rare. The mosquito is now known to occur in Texas, Oklahoma and Kansas (Jenkins and Carpenter 1946). According to Jenkins and Carpenter (1946), willow is the only kind of tree from which larvæ had been collected at the time their paper was published, although these authors state that larvæ have been found in artificial containers.

In reported collections, *A. alleni* larvæ have usually been associated with *Aedes triseriatus* (Say), another tree hole breeding form. The adults of these two species are relatively easy to distinguish, one of the outstanding differences being the white banded tarsi of *A. alleni* as opposed to the dark tarsi of *A. triseriatus*. The larvæ of the two species, however, have been considered to be almost identical, although various structures have been reported to distinguish them. Within the past few years it has become increasingly evident that at least some previously used criteria cannot be relied upon for the separation of the two species.

During the past several years the writer and his associates have made a large number of collections of tree hole breeding mos-

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[2] The writer greatly appreciates the assistance of Mr. Orin Wilkins, who helped with the collections of the larvæ discussed in this paper, and of Mrs. Roland Schmitt who made the drawings.

[3] Considered by some to be a *Synonym* of *Aedes zoosophus* Dyar & Knab.

quitoes from central Texas. *Aedes alleni* occurs in fair numbers in this area, but it is considerably outnumbered by *A. triseriatus*. Numerous larvæ of both species have been studied with the objective of finding constant distinguishing features between the two species. In the writer's collections *Aedes alleni* has usually been associated with *A. triseriatus*, and it is conceivable that this almost invariable association has been one reason for the confusion now existing regarding distinguishing features of the two forms. Workers may have studied a mixed population, believing that it consisted of only a single species.

Larvæ of *A. alleni* have been collected from tree holes in several species of trees including live oak (*Quercus virginiana*), post oak (*Quercus stellata*), blackjack oak (*Quercus marilandica*) and elm (*Ulmus crassifolia*). The writer has not collected the mosquito from artificial containers.

METHODS

Larvæ of *Aedes alleni* and *A. triseriatus* were collected and brought into the laboratory for rearing. They were placed in individual staining dishes and reared at laboratory temperature in tree hole water which was replenished by water from an artificial pond as it evaporated. Some of the water was so dark that the larvæ could not be seen, and in such cases clear water was added until the insects could be distinguished. When the adults emerged, the fourth larval skins were checked for distinguishing features. As soon as such structures were discovered, living larvæ were then isolated on the basis of these features, and the distinctions confirmed by rearing the larvæ to adults.

The conclusions to be presented are based upon a study of a large number of living larvæ, freshly killed specimens, mounted and preserved larvæ and larval skins from which known adults have been reared. More than 50 larvæ and larval skins of each species from several localities have been studied in detail, and certain structures have been checked on many more specimens. Larvæ of *A. alleni* have been studied from many collections near Austin, Texas, and the conclusions confirmed by reared specimens from Round Rock, Stephenville, Bartlett and Fredericksburg, Texas. Larvæ of *A. triseriatus* have been examined from

Austin, Luling, Round Rock, Stephenville, Bartlett and Marquez, Texas. Since numerous specimens from several localities have been examined, it is believed that the most important variations in the populations of this general area have been noted. Additional collections from distant localities may reveal other variations.

LARVAL FEATURES STUDIED

The following larval features were studied with the results indicated below.

HEAD HAIRS: According to Dyar (1928) the larvæ of *A. triseriatus* have two branches in the lower head hairs while those of *A. alleni* have four. However, there is considerable variation in both upper and lower head hairs. In the majority of both species, the upper head hairs are single, but in some cases the upper head hairs are double, and in a few specimens one hair is single while the other is double. Double upper head hairs occur more often in *A. alleni* than in *A. triseriatus*. Lower head hairs vary from two to four in both species, and the number may be different on opposite sides of the head. Two larvæ of *A. triseriatus* were seen that had only one branch in one lower head hair and two in the other, while a single larva of the same species was examined in which both lower head hairs were single.

SUBVENTRAL TUFT (*Siphonal Tuft*): The majority of both species in this area have a subventral tuft of two branches with an occasional specimen having three. Two larvæ of *A. triseriatus* were examined with a single hair, but no single-haired *A. alleni* were discovered.

COMB SCALES: Matheson (1944) distinguishes the two species on the basis of shape of comb scales. There is some average variation in the number, arrangement and shape of the comb scales, but the differences are slight and overlapping occurs. In both species the comb scales may be different on the two sides. In *A. triseriatus* the number of comb scales vary from 6 to 14 on one side, and they form a partial double row in most cases. In a few specimens with a low number of comb scales, the structures occur in a single row. The individual scale of *A. triseriatus* is usually somewhat more slender and thorn-like than in *A. alleni*, but these differences are not invariable. The larvæ of *A. alleni* have from

6 to 12 comb scales, sometimes arranged in a partial double row, and in other cases forming a single essentially straight row. More larvæ of *A. alleni* than *A. triseriatus* have been examined in which the comb scales are arranged in a single row.

LATERAL HAIR ABDOMINAL SEGMENT: Dyar (1928) indicates that 4 branches occur in this hair in *A. alleni* while larvæ of *A. triseriatus* have 7. The number of branches in the writer's specimens varies from 2 to 8 in *A. triseriatus,* and from 3 to 7 in *A. alleni.* The number of branches is frequently different on the two sides. As will be indicated more in detail later, the position of attachment of this hair to the dorsal plate differs somewhat in the two species.

DORSAL BRUSH: Matheson (1944) states that larvæ of *A. alleni* have a dorsal brush consisting of 1 long hair plus 6 shorter hairs on each side, as opposed to 1 long hair and 7 shorter hairs in *A. triseriatus.* Jenkins and Carpenter (1946) report specimens of *A. alleni* with 7 or 8 short hairs in addition to the long one. In this area, larvæ of *A. alleni* that were studied have a dorsal brush that varies from 4 to 8 short hairs plus the long hair. More specimens have 5 short hairs than any other number. *A. triseriatus* varies from 4 to 8 short hairs with 6 being the most common number. The number of short hairs may be different on opposite sides in both species.

SIPHON: As a rule, the siphon of *A. alleni* is somewhat stouter than that of *A. triseriatus,* but the distinction is slight and overlapping occurs so that the feature is of doubtful value in separating the two species.

COLOR: All larvæ of *A. alleni* that have been seen are almost white in color, the head, siphon, dorsal plate of the abdominal segment and comb scales usually being the only dark parts. The thorax is occasionally of a light brown color, but the abdomen is frequently semi-transparent so that tracheæ, parts of the digestive tract and other structures can be seen through the body wall. The dorsal posterior margins of the abdominal segments are usually obscure, and no specimens have been noted in which the abdomen contained dark pigment.

Most larvæ of *A. triseriatus* are dark or black in color, but some appear almost as light as *A. alleni* when they are examined

with the unaided eye. Under the binocular microscope, however, even these light specimens usually exhibit some dark pigment near the dorsal posterior edges of the abdominal segments so that the margins can be easily distinguished. So far as could be determined, pigmentation differences are not influenced by the color of the water in which the larvæ are developing. Both light and dark specimens may occur together in clear as well as in very dark tree hole water.

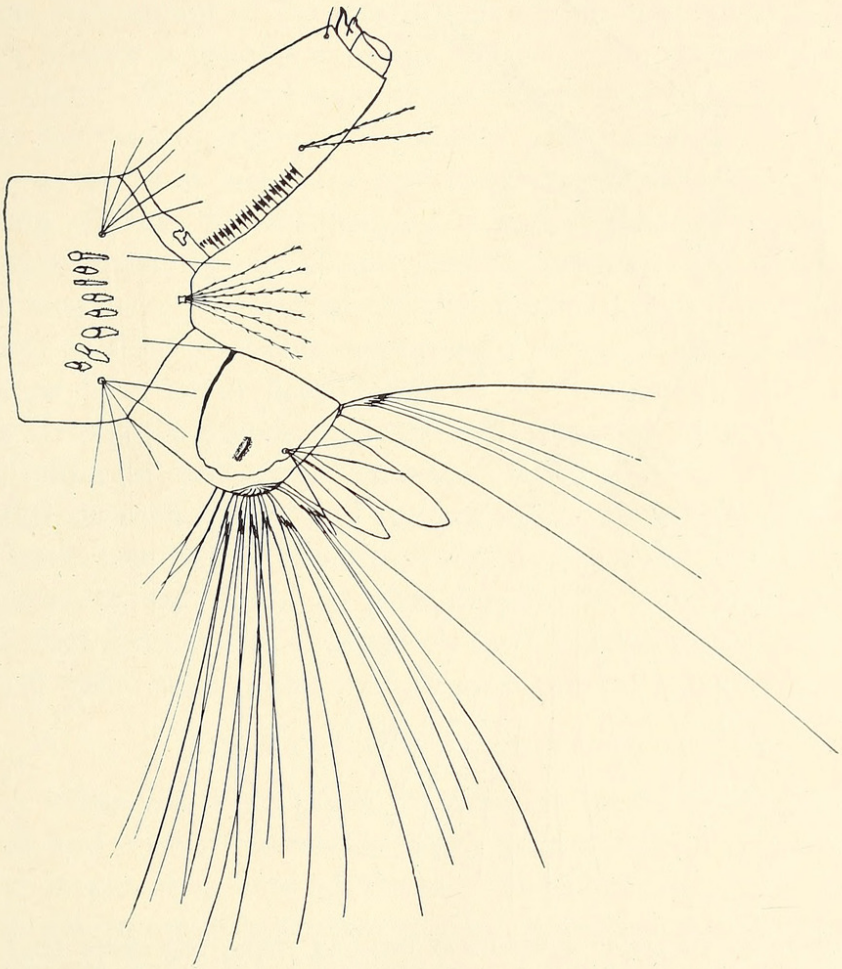

Figure 1. Posterior segments of larva of *Aedes alleni* Turner.

It is thus frequently possible to separate tentatively living larvæ on the basis of color, but this feature is not as reliable as structural differences to be noted later. Pigmentation differences are frequently not of value in distinguishing preserved or mounted specimens.

DORSAL PLATE ANAL SEGMENT: This plate is the only structure in which invariable differences between the two species of larvæ have been found. The larvæ of *A. alleni* have a definite depression in this plate on each side near the ventral margin (Fig. 1). The appearance of these depressions varies considerably. In some specimens it is large, almost round, and under

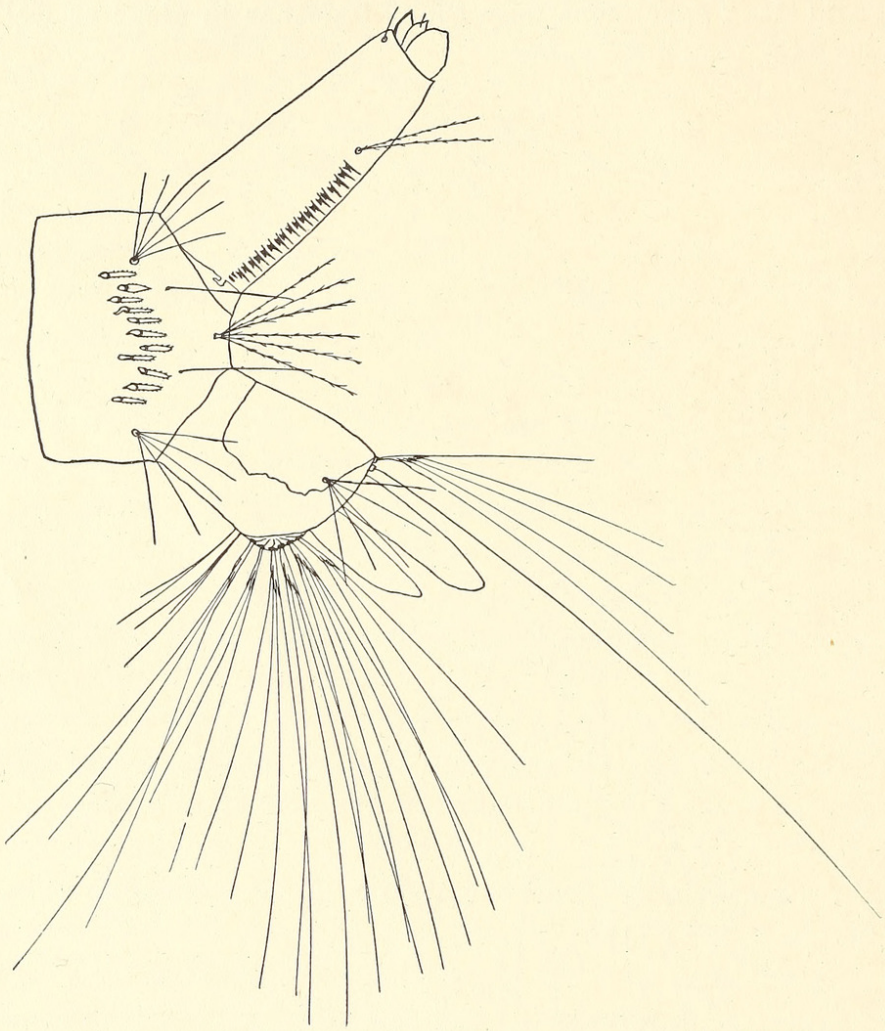

Figure 2. Posterior segments of larva of *Aedes triseriatus* (Say.)

the low power of a dissecting microscope the area is so transparent that it appears to be a hole. In other larvæ of *A. alleni*, the depressions are not obviously thinner than the surrounding areas of the plate. A dark margin about each depression causes it to be noticeable. Details of structure of these depressions are difficult to distinguish. If the dorsal plate is removed from the anal

segment, a thin membrane, very difficult to dissect away, adheres closely to the under surface of the plate. It appears, however, that in some instances the depressions completely penetrate the plate, but not the membrane, while in other cases true depressions rather than holes are formed.

These depressions do not occur in *A. triseriatus* (Fig. 2), although the lower margin of the plate may be irregular or notched. The dorsal plate frequently extends farther ventral in *A. alleni*, and the attachment of the lateral hair of the abdominal segment in this species is usually near the center of the posterior border of the plate. The attachment of the lateral hair in *A. triseriatus* is near the ventral edge of the plate in most cases.

The writer does not have any suggestions as to the possible function of these depressions, but it appears that the structures may have arisen by one of two possible methods. A single mutation may have resulted in the depressions appearing fully developed, or they may have arisen by a series of steps. The depressions have never been found in *A. triseriatus*, although a notch frequently occurs near the center or the ventral margin of the plate on each side. A mutation causing an extension of the plate on each side of and ventral to the notch, could conceivably have resulted in the condition now present in *A. alleni*. This later theory would be more tenable if it could be demontrated that notches and depressions in the dorsal plate have more survival value than plates with smooth ventral margins.

SUMMARY AND CONCLUSIONS

1. A study has been made of series of larvæ of *Aedes alleni* Turner and *Aedes triseriatus* (Say) collected from tree holes at several localities in central Texas. The objective of this study was to determine if there are distinct morphological differences of practical value for distinguishing between the larvæ of the two species. Distinctive features were discovered by rearing the larvæ individually and by studying the fourth instar larval skins of known adults.

2. It was found that criteria used in the past are of doubtful value in distinguishing the species, since in a large series overlapping occurs; or the differences are so slight that their use is impractical for one unfamiliar with the two species. Previous

records of *A. alleni* based only upon larval determinations are thus open to question. Records of *A. triseriatus* from larval determinations are not as doubtful, since *A. triseriatus* is much more common than *A. alleni,* and in most instances, collections of *A. alleni* have also yielded *A. triseriatus* larvæ.

3. All larvæ of *A. alleni* that have been examined are light in color, while most of *A. triseriatus* are dark to black. The two species may thus be tentatively distinguished on the basis of color, but this feature alone is not as reliable as certain structural differences. Some larvæ of *A. triseriatus* are almost as light as those of *A. alleni,* and pigmentation differences are not as evident in preserved or mounted specimens.

4. The structure of the dorsal plate of the anal segment has been found to be different in all larvæ of the two species that have been examined. In *A. alleni* there is a definite depression near the ventral margin of the plate on each side. Larvæ of *A. triseriatus* do not have these depressions, although the ventral margins of the plate are frequently notched or irregular. The lateral hair of the abdominal segment is usually attached near the center of the posterior edge of the plate in *A. alleni,* while in *A. triseriatus* the attachment is most often farther ventral. The dorsal plate frequently extends farther ventral in *A. alleni* than in *A. triseriatus,* and in some instances the plate almost surrounds the segment in the former species.

5. This study emphasizes that a large series of larvæ may exhibit considerable individual variation, and that such structures as hairs and comb scales may be different on opposite sides of the same specimen.

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