

NOTES ON THE TAXONOMIC SEPARATION OF ADULT FEMALES OF *CULEX PIFIENS* L. AND *CULEX QUINQUEFASCIATUS* SAY¹

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INTRODUCTION. In most keys the appearance of the basal white bands on the third and fourth abdominal tergites has been used to separate adult female *Culex pipiens* L. and *Culex quinquefasciatus* Say. The pale basal bands in *C. pipiens* are generally broadly joined to the lateral white scale patches; in *C. quinquefasciatus* the pale basal bands are disconnected or only narrowly joined to the lateral patches (Carpenter & LaCasse, 1955). In this preliminary study an analysis was made to test the reliability of the abdominal banding characters presently used and particular emphasis was placed on the possibility of using wing characteristics to distinguish the two species or to supplement existing characters. Bekku (1956) in northern Japan had attempted to use wing characters: length of cell R_2 (second marginal cell) divided by the length of vein R_{2+3} (vein 3) to distinguish adults of the *pipiens* group. Bekku's results were inconclusive and Kamura (1958) found that these particular wing measurements varied with the temperature of the environment. However, Nielsen and Rees (1961) reported that the most reliable method of separating females of *C. pipiens* and *C. quinquefasciatus* in Utah was by a wing measurement value obtained by dividing the length of the second marginal cell by the length of the petiole of vein 2. These authors reported this value to be about 5 for *C. pipiens* and 3 or less for *C. quinquefasciatus*.

It was, therefore, considered desirable to evaluate further the use of this wing character. A total of 153 females of *C.*

pipiens and *C. quinquefasciatus* were carefully examined. Most of the female were from reared series with associated males. Male terminalia from each series were mounted and examined to ensure as far as possible the accuracy of the identifications. Measurements of the wing character reported by Nielsen and Rees were made and the constancy of the abdominal banding characters was studied.

RESULTS AND DISCUSSION. The results of this study are presented in Figure 1. For *C. pipiens* a total of 95 specimens was examined, 86 of which were from the United States; 9 specimens were examined from outside of the United States, 4 from Korea and 5 from England. The average wing ratio was 5.24 with a range of 3.01 to 9.11. The lowest average wing ratio was 4.22 from Missouri. The highest average wing ratio was 5.95 from England material. A representative *C. pipiens* wing is shown in Figure 2B.

The abdominal bands of the *C. pipiens* material were remarkably constant; 91 of 95 specimens had unbroken basal pale bands on abdominal tergites III and IV. Two specimens from Idaho, one from Utah, and one from Missouri had the pale bands narrowed or broken. These specimens had wing ratios of 4.24, 5.31, 4.50 and 4.40 respectively; all ratios were characteristic of *C. pipiens*, although they were within the extremes of the *C. quinquefasciatus* range. The possibility that these specimens might actually have been the latter species cannot be precluded.

The greatest variation in wing ratio was found in the *C. pipiens* specimen from Idaho and Utah. However, all of the specimens from these two states possessed typical *C. pipiens* abdominal markings. Of the 95 specimens of *C. pipien*

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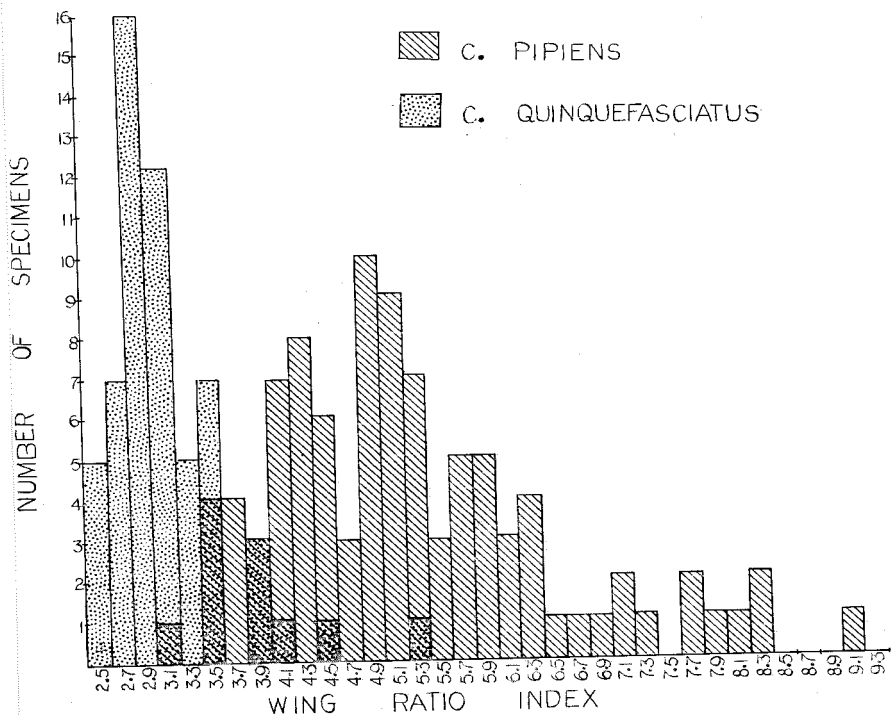


FIG. 1.—Summary of wing measurements of 95 females of *Culex pipiens* L. and 58 females of *Culex quinquefasciatus* Say. Wing ratio index obtained by dividing length of 2nd marginal cell by the length of the petiole of vein 2.

examined, only one specimen from Utah with a wing ratio of 3.09 fell below the average ratio of *C. quinquefasciatus*, 3.19. This specimen had complete abdominal bands and was one of a reared series of eleven which had an average wing ratio of 5.57.

A total of 58 specimens of *C. quinquefasciatus* was examined. Forty-five of these were from the United States, 12 were from Luzon, and 1 was from Puerto Rico. The average wing ratio was 3.19, with a range of 2.43 to 5.33. Seven specimens from Georgia gave the highest average wing ratio of 3.94. The ratios of these Georgia specimens were 5.33, 4.12, 4.10, .96, 3.92, 3.55, and 2.60. All had broken

bands on abdominal tergites III and IV. A representative *C. quinquefasciatus* wing is shown in Figure 2A.

Fifty-six of 58 specimens of *C. quinquefasciatus* examined had broken or narrowed bands on abdominal tergites III and IV. One specimen from Arizona and 1 from Texas had complete bands. The wing ratios of these two specimens were 3.52 and 2.92 respectively. In this respect they were more typical of *C. quinquefasciatus*. It seems unlikely that these two specimens were *C. pipiens* as this species is not known to occur in either of these two southwestern states.

Carpenter and LaCasse (*op. cit.*) have given full species status to both *Culex*

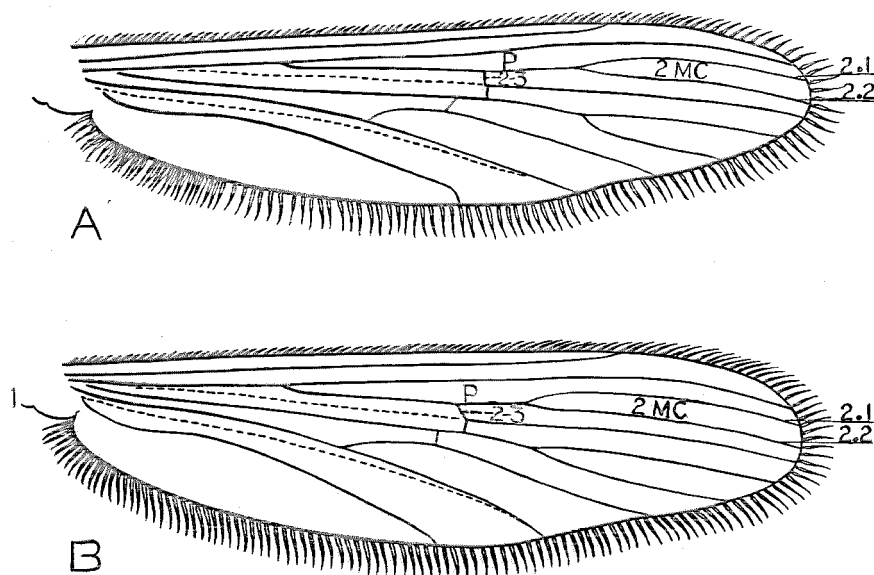


FIG. 2. A.—Wing of *Culex quinquefasciatus* Say. B.—Wing of *Culex pipiens* L. P, petiole of vein 2-3, cross vein; 2MC, 2nd marginal cell; 2.1, anterior branch of vein 2; 2.2, posterior branch of vein 2.

pipiens and *Culex quinquefasciatus*. Barr (1957, 1960), Stone (1959), and others have treated *C. quinquefasciatus* as a subspecies of *C. pipiens*. For the purposes of this paper the authors have treated them as distinct species. However, it is well known that fertile hybrids can be produced in the laboratory and that intergrades do occur in nature in some parts of the United States (Sundararaman, 1949; Barr, 1957). On the basis of results of Barr (1951, 1957) with the male genitalia, one might suspect the wing of hybrids of *pipiens* x *quinquefasciatus* crosses to be intermediate between the parent species. Five specimens of F₁ hybrids in the University of Utah mosquito collection were measured for the wing character noted above and were found to have an average ratio of 2.77. Ratios ranged from 2.40 to 3.10, thus falling into the range of *C. quinquefasciatus*. The abdominal bands of these hybrids also are broken as in *C. quinquefasciatus*.

Additional measurements were made of the total wing width, ratio of second vein to second marginal cell, ratio of petiole of vein 4 to length of second posterior cell and width of second marginal cell. These measurements indicate that *C. pipiens* usually has a wider wing and a wider second marginal cell than *C. quinquefasciatus*, but considerable variation occurs and these differences do not appear to be as reliable as the wing ratio index.

Males of *C. pipiens* could not be distinguished from males of *C. quinquefasciatus* by use of any of the wing characters measured in this study.

CONCLUSIONS. On the basis of the material examined in this study the pale banding on the third and fourth tergite appears to be a reliable and consistent character to distinguish *C. pipiens* from *C. quinquefasciatus*. The complete abdominal banding on these tergites held true for 95.7 percent of the *C. pipiens* females examined and the broken abdom-

nal bands were characteristic of 96.5 percent of the females of *C. quinquefasciatus* studied.

The wing ratio character showed much greater variability. A statistical analysis of the data indicates that this character is not reliable for distinguishing individuals, but significant average differences are evident. The variability of this character in *C. quinquefasciatus* was much less than in *C. pipiens*. The mean in *C. quinquefasciatus* was 3.19 with all specimens within a range of only 2.9 (2.43 to 5.33). The mean in *C. pipiens* was 5.24. The specimens, however, covered a range of 5.02 (3.09 to 9.11), more than twice that of *C. quinquefasciatus*. It is interesting to note that 81 percent, or more than three-fourths, of the *quinquefasciatus* specimens had a wing ratio between 2.6 and 3.6, a difference of only 1.0, and 90 percent of all the specimens fell below 3.6. In contrast almost 95 percent of all the *pipiens* specimens had wing ratios in excess of 3.6. The authors are convinced that the wing ratio character is a valuable supplemental character which will be particularly helpful in the identification of a series of specimens of *C. pipiens* or *C. quinquefasciatus*. It may also be a very useful aid in identifying specimens which are badly rubbed or have the abdomen missing, such as is often the case with light trap material.

The reason for the considerable variation in the wing ratio index, particularly in *C. pipiens* is not known. The work of Kamura (*op. cit.*) points to the possibility of an environmental factor, temperature, influencing this trait. A great many more specimens need to be examined to arrive at a solution to this problem. The authors

intend to proceed further by examining populations of both species from northern and southern extremes of their ranges and from intergrading areas as well as populations within a given area over an entire season. It is hoped that other workers will investigate this character. It may help to shed further light on the taxonomic problems in the *pipiens* complex.

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