

TYPE AND VENATION OF WINGS AS FACTORS IN SEPARATING CERTAIN DELTOCEPHALOID GENERA.

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A few of the *Deltocephaloid* genera of the *Cicadellidæ* such as *Deltocephalus*, *Lonatura* and *Aconura** (American forms) are so closely related that specialists working upon this group are puzzled frequently to know just how to separate the species concerned by constant generic characters. Although as in many other groups, the generic standing of certain species is quite easy to determine, other species exhibit characters more common to allied genera. While the writer was engaged in a monographic study of the species of *Deltocephalus*, the question was asked by several co-workers where the line should be drawn between these genera or what character should be used as a final criterion for separation. These genera were therefore given special study from a comparative standpoint and an examination was made of all available material in them. This study has revealed several characters, some of a detailed technical nature. The most conspicuous and outstanding one, however, has to do with wing characters or conditions. These types of wings seem to indicate on the one hand definite relationships among certain species and on the other hand exhibit structural differences between these genera which form a basis for their separation. These genera however, which in the writer's opinion should be considered as generic groups, at least in the making, have apparently not yet diverged sufficiently that hard and fast lines can be drawn to separate them. There is consequently some doubt regarding the generic standing of a few species.

Throughout these genera it is common for many or all species belonging to a genus to have a dimorphic condition in the first pair of wings or elytra. In *Deltocephalus* this condition is lacking in certain subgroups and only the normal wing condition is known; but it is found in all described species of certain

* The genus is considered here as given by Van Duzee in his catalogue of Homoptera, 1916. The true *Aconura* species probably do not occur in North America.

other groups. The short winged condition is usually spoken of as a brachypterous wing and the long winged, the macropterous form. All of these species feed upon grasses and the great majority of those containing short winged forms are plains and prairie species. The size of the wing in these species may be of very slight importance so far as their ability to survive is concerned, since very little or no extended locomotion may be necessary in such a habitat.

With reference to this dimorphic wing condition in *Deltocephalus*, one of the most interesting discoveries during this study was the capturing of a male of *D. mendosus* Ball on a prairie adjoining a Florida everglade. This specimen has a right elytron of the macropterous variety and the left wing is a brachypterous form. A photograph of this specimen is inserted in the accompanying plate. Perhaps this might be called a heteromorph. It can scarcely be termed a gynandromorph of the lateral type for all other structures except the wings are normal, especially the genital structures of the male which are typical and normal for that sex and species. It would certainly be necessary to have both sexual structures represented to classify it thus.

In this specimen each of the elytra is typical of the form it represents. That is, in an examination of several hundred specimens of *D. mendosus* and a comparison with this specimen in question, it is found that the right elytron is typical of macropterous individuals and the left elytron is typical of the brachypterous specimens. It is therefore merely this dimorphic wing condition exhibited in a single individual. This example is given as it illustrates the condition of the reduction of the wing in the brachypterous individuals, as this condition occurs throughout the genus *Deltocephalus*. In some species of this genus the elytra are shortened more proportionately, but in all cases each part of the elytron seems to be shortened in proportion to every other part and the cells are merely reduced in size leaving the venation relatively the same.

The greatest reduction probably occurs in the apical portion but in all the material examined consisting of practically all the species of *Deltocephalus* and hundreds of specimens, when reduction occurs there is still a group of apical cells in the brachypterous wing although small in some cases. In an extreme condition of a short winged example of *D. collinus* the outer anteapical and apical cells are combined but this is not typical of

a large series of short winged forms of this species. Even in this extreme case the apical cells are all present with one exception.

In some species of the genus the wing venation will vary in minor respects and is somewhat irregular even in elytra of the same form—brachypterous or macropterous. Especially is this the case where it may be a question of the number of cross veins or the division of certain cells. Even in these instances there is no marked change in the plan or pattern of venation when reduction occurs. A comparison of the right and left elytra in the photograph of *D. mendosus* (Figure 1) will show that the venation in the two elytra is practically the same, except for size, vein for vein and cell for cell. This is the type of wing reduction which is characteristic and almost constant for the species of *Deltocephalus*. Another example shown in Figures 5 and 6 illustrates the long and short winged forms of *D. caperatus* Ball.

In both *Lonatura* and *Aconura* there is also a dimorphic condition of the elytra. As compared with *Deltocephalus* the type of venation in the short winged condition is somewhat different. As a rule the wings of brachypterous specimens of these genera are much shorter than corresponding wings of specimens of *Deltocephalus*. When thus shortened they cover only the basal two or three segments of the abdomen. From the generic standpoint the character of the wing is probably more important than relative size, although in many specific instances in dealing with these species the length alone has apparently been considered. In both of these genera the short winged condition is produced by an entire loss of the apical portion, or abrupt "cutting off" of the elytron in such a way that the venation of only the anterior portion of the wing occurs in brachypterous forms. There seems to be only a slight tendency, if any, for a comparative shortening of the whole elytron when reduced which would cause the cross veins to appear to be pushed forward and cells in the apical portion of the macropterous wings to be shortened.

In *Lonatura* the condition is somewhat intermediate between the other two, but here it is apparently only the reduction of the wing at approximately the apex of the clavus so that more cells are included in the brachypterous wing as compared with *Aconura* and slightly less of the posterior portion is omitted.

As a rule in *Lonatura* no apical cells are found when reduction occurs and frequently all or part of the anteapical cells are missing. In a few cases like *nebulosa* and *megalopa* formerly

designated as species of *Lonatura* small apical portions are found inside the wing margin. These species however have been placed with their close relatives in the genus *Deltocephalus* and show only a slight remnant of the apical cells.

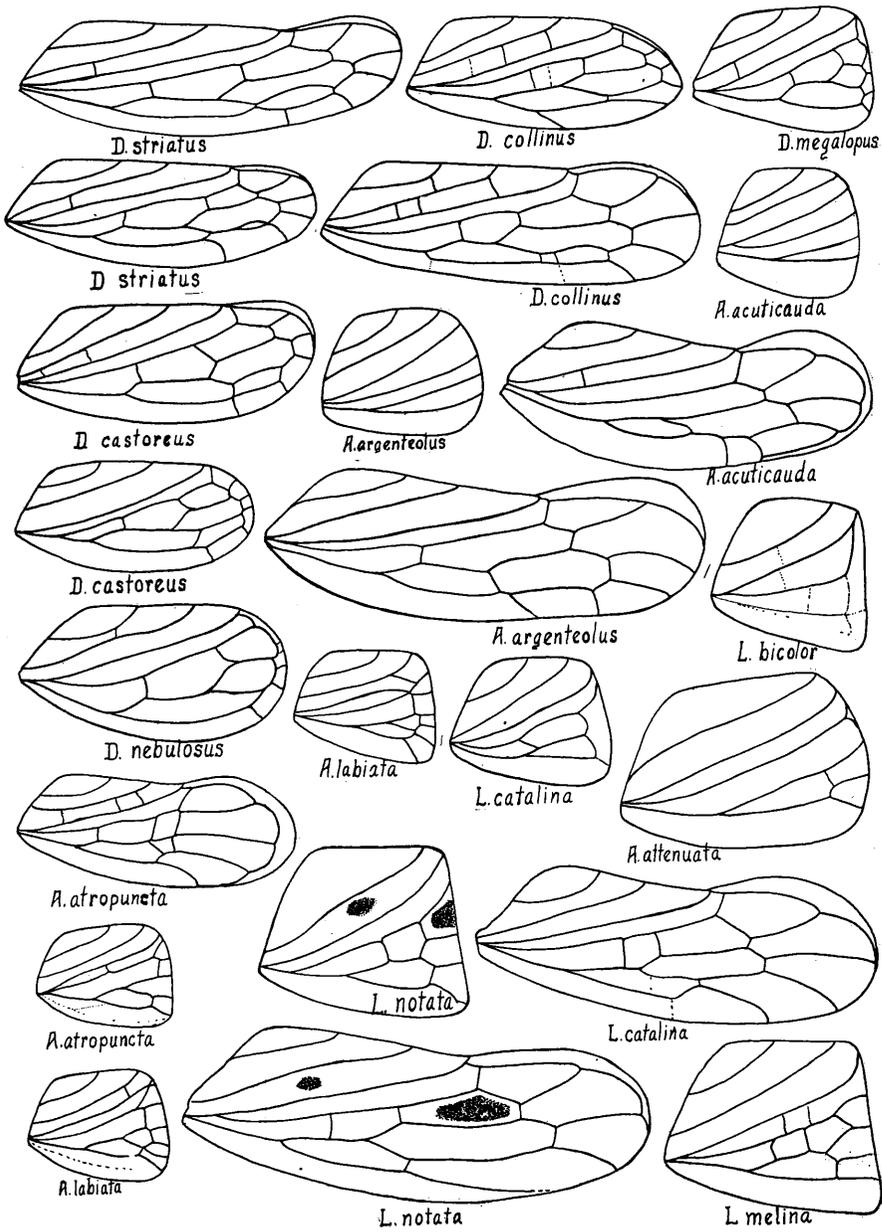
In *Aconura* the wing reduction is even greater and so pronounced in the majority of brachypterous wings that not even a cross vein occurs to separate the elytron into cells. Also the elytron is unusually shortened, the apical margin occurring anterior to the original terminal point of the claval vein. Large numbers of specimens and all the species of *Aconura* have been examined and in no case do apical cells occur in the brachypterous wings. In species like *atropuncta* and *labiata* a few small cells comparable to anteapicals occur at the posterior margin of the wing. But these are so distinct in many respects that they probably should not be placed in the same genus with those designated here as *Aconura*. These brachypterous wings illustrate a somewhat different condition in the wing reduction than do others previously mentioned.

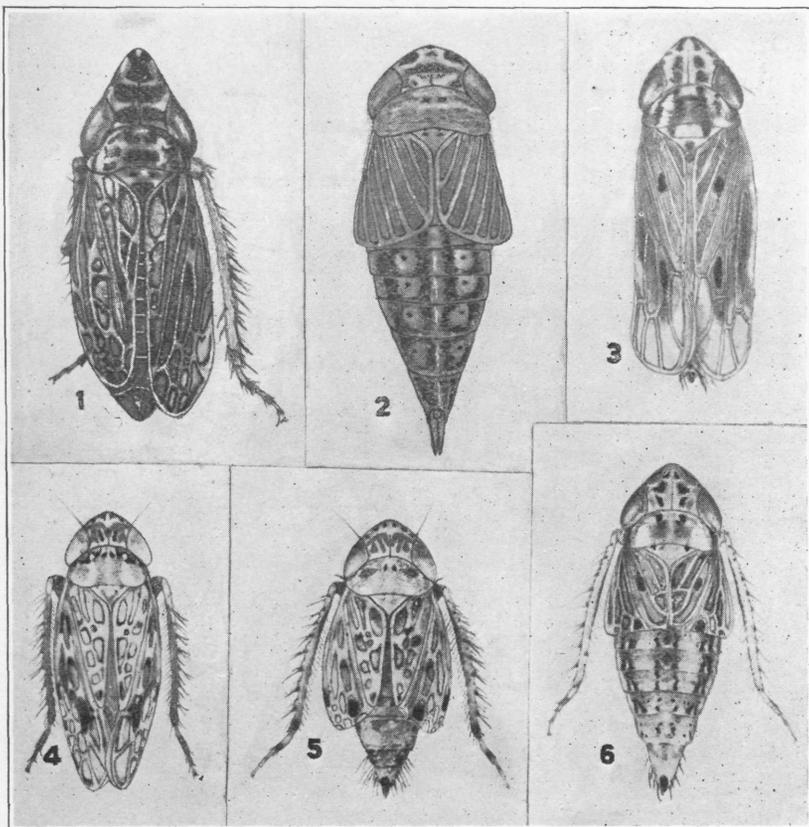
The macropterous form is not known except in a few species of *Aconura*, and certain species of *Lonatura* like *bicolor* are not known to possess long winged forms, although several hundred specimens of a single species have been examined.

In regard to venation proper, the normal and apparently constant condition in the *Deltocephalus* wing is a series of three anteapical cells, with a costal cell beyond the outer anteapical cell. In *Lonatura* there are only two anteapical cells in the long winged forms (*notata*, Plate I) and what is comparable to an outer anteapical extends to the posterior portion of the costal wing margin so that the anteapical and apical cells are combined and the costal cell is apparently wanting. In the genus *Aconura* there seem to be only two anteapicals with the costal cell the same as in *Deltocephalus*. Four apicals are thus formed as in *Deltocephalus* while only three are usually present in *Lonatura*. A few species of *Aconura* as for example *atropuncta* have macropterous wings in which a marginal vein extends from the posterior costal portion to the apex of the clavus. This is comparable to an appendix in other forms but is unique and, combined with other characters, probably represents a distinct genus as previously mentioned.

The wing condition in *Lonatura* and *Aconura* may be only another step in advance of *Deltocephalus* in the process of wing reduction, but as shown in the previous discussion and figures

both the venation and the type of reduction in the elytra indicate generic affinities. This should not be used as an absolute character for determining the generic standing of a species but probably should be emphasized as an important and primary generic character. Investigators who have made a study of the species in these groups have found that the type of genitalia is a very helpful character in attempting to place doubtful species. Many small groups are found whose species are closely related and whose genital structures are very similar. In a few cases these structures are undoubtedly the best to show relationships. Thus the type of wing serves as probably the best although not the final or only criterion for the separation of these genera.





1. *Deltocephalus mendosus* Ball (heteromorph).
2. *Aconeura acuticauda* Baker (brachypterous form).
3. *Lonatura notata* Osborn (macropterous form).
4. *Deltocephalus caperatus* Ball (macropterous form).
5. *Deltocephalus caperatus* Ball (brachypterous form).
6. *Lonatura notata* Osborn (brachypterous form).

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