Proceedings of the Iowa Academy of Science

Volume 63 | Annual Issue Article 79

1956

# Wing Venation in the Adephaga and its Contribution to Phylogeny

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It has been assumed for some time that the adephagous beetles, with the possible exception of the Rhysodidae, constitute a relatively homogeneous group. This assumption is not challenged here; the purpose of the present preliminary study is to examine certain evidence drawn from the wing venation of the most generalized (venationally) available species in an attempt to ascertain possible trends in venation among the various families. The scope of the material examined, as well as the species ultimately selected as being the most generalized in their respective families, are tabulated below.

**Table 1.**

Material Studied

| Family | Number of Genera Examined | Name of Species Used |
|---|---|---|
| Carabidae | 7 | *Calosoma sycophanta* L. |
| Omophronidae | 1 | *Omophron tessalatum* Say |
| Cicindelidae | 3 | *Cicindela respanda* Dej. |
| Gyrinidae | 2 | *Dineutes vittatus* (Germ.) |
| Dytiscidae | 16 | *Dytiscus parvulus* Mann. |
| Rhysodidae | 1 | *Rhysodes* sp. |
| Haliplidae | 1 | *Cnemidotus muticus* (Lec.) |

It is freely acknowledged that the final word on the phylogeny of a group must await the integrated study of many characteristics, but it is felt nevertheless that single structures, as long as their limitations are recognized, should be permitted to make thier separate contributions.

Drawings of the wings of the species mentioned in Table 1, together with a hypothetical adephagous type, are shown in Plate 1. Venational nomenclature is after Forbes (1922).

Figure 1 represents a hypothetical type from which the venation of all the families under consideration could have been derived. From such an ancestral form two lines of specialization seem to have occurred. The first contains the families Haliplidae and Rhysodidae, represented by *Cnemidotus* and *Rhysodes,* respectively. The relatively complete radial field of *Cnemidotus* points to an early origin of the Haliplidae; other noteworthy features of this genus are the retention of a terminal spur of Cu, and the reten-

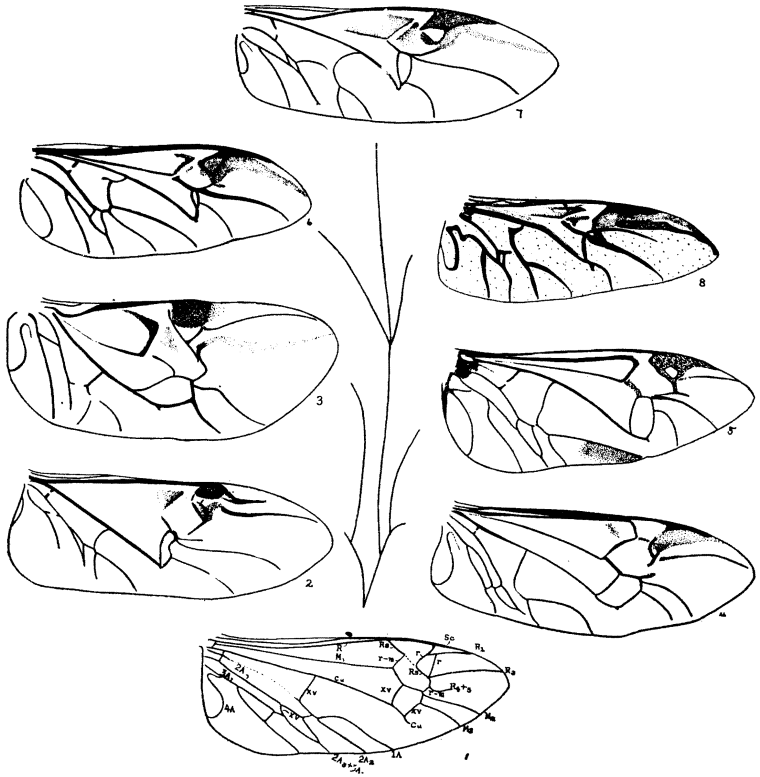

FIGURE CAPTIONS—PLATE I

Fig. 1. Hypothetical ancestral wing of the Adephaga. *A,* anal veins and their branches; *Cu,* Cubitus; *M,* Media and its branches; *R,* Radius and its branches; *Rs,* Radial Sector *Sc,* Subcosta; *r,* radial crossveins; *r-m,* radio-medial crossveins; *xv,* crossveins.

Fig. 2. *Rhysodes* sp. Fig. 3. *Cnemidotus muticus.* Fig. 4. *Dineutes vittatus.* Fig. 5. *Dytiscus parvulus.* Fig. 6. *Calosoma sycophanta.* Fig. 7. *Omophron tessalatum.* Fig. 8. *Cicindela repanda.*

tion of the apical part of the medial stem. It has lost the wedge cell. *Rhysodes* is placed with *Cnemidotus* mainly because of two features common to the two wings: the position of the short free portion of 3d $A_1$ and presence of well-developed veins just posterior to the stigma.

The second line of specialization contains the other families under discussion here. It is characterized by the progressive narrowing and shortening of the oblong cell (formed originally by two *m-cu* crossveins) and the long stem of Media in the more generalized types.

*Dytiscus* and *Dineutes* have much in common. Both have an elongate wedge cell, both have a nearly complete medial stem, a well-defined radial sector base and first *r-m* crossvein. *Dytiscus*

retains a stub of the base of 1st A, and *Dineutes vittatus* has a crossvein between the two branches of 3rd A. Clearly neither was derived from the other, but both could have diverged at nearly the same time from a common ancestor.

The Carabidae and Cicindelidae appear to be allied by the configuration of their wedge cell and the retention of a backward spur of 1st A from the *cu-a* crossvein. *Cicindela* retains a strong branch of Radius ($R_{4+5}$?) *Calosoma* shows a long, well-defined Media. *Cicindela* and *Tetracha* have lost or fused one vein of the oblong cell, but since both veins are present in the genus *Pogonostoma* (*vide* Forbes) this specialization is apparently not a feature of the family as a whole.

The venation of the Omophronidae has features of both the Carabids and Cicindelids. On the one hand, it shares with *Cicindela* a well-developed $R_{4+5}$ and several negative characters—i. e. the loss of (1) the medial stem, (2) the basal part of the radial sector, (3) the connection between the wedge cell and the 1st A-2nd $A_2$ fork, and (4) the 1st *r-m* crossvein. On the other hand, it shares with *Calosoma* the retention of the apical part of Rs. And it differs from both in the loss of the projecting spur of Cu. It is therefore placed here as having a common origin with the Carabid-Cicindelid line, without attempting a more specific association.

The foregoing account assumes certain parallelisms, mostly concerned with the loss or simplification of veins. The base of Media atrophies at least twice, once in the *Rhysodes-Cnemidotus* line and again in the ancestor of *Cicindela* and *Omophron*. The 1st *r-m* crossvein disappears in *Cicindela, Omophron,* and *Rhysodes*. The vein here called $R_3$ tends to be replaced by a band of pigment in *Cnemidotus, Omophron, Calosoma,* and *Cicindela.*

I am indebted for certain equipment and student assistance in this investigation to a research grant received under the auspices of the Iowa Academy of Science.

**Reference**

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