

On the Classification of the Fulgoroidea. By F. MUIR,
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WORKERS in systematic entomology have two ideals from which to choose. One is purely a system of convenience, by means of which they can give a name to a specimen before they place it in their collection; to such workers the most easily recognized characters are preferable, and if such characters bring together forms not closely related, or sever those which are, it is a matter of minor importance. The other ideal is towards a "natural" system, which will eventually show the supposed relationship of the genera and species, and those characters, however obscure or difficult of access, which the worker considers give this result are chosen, the matter of convenience being considered of minor importance. It is illogical to complain that the striver after one ideal has not attained the other. That the natural system is the one to be held in view is the opinion of the writer, but he also recognizes that it is necessary to combine it with a workable and convenient system, and he has endeavoured to do so.

The foundations of the classification of the Fulgoroidea, as well as most other Homoptera, were laid by Stål, Fieber, and others some sixty to seventy years ago. How well this was done is seen by the fact that the fourth volume of Stål's 'Hemiptera Africana' (1866) is still the chief source of information and inspiration for homopterists. While great numbers of genera and species have been described since then, our knowledge of morphology of the group has not advanced in a corresponding manner, and until lately we worked with the same characters as the older workers. With those characters I believe but little further advance can be made, and we must look for others for confirmation or alteration of our present system.

Most writers since Stål have followed him or adapted his system to limited faunistic work. Kirkaldy made some suggestions, but never worked them out. In 1923 the writer published a paper on the subject*, using the male genitalia for the grouping of the families. This work was extended by Dr. Hem Singh-Pruthi in 1925 †, but some of his conclusions were based upon too little data, and do not hold good. In 1929 Herr H. Haupt‡ published a paper in

* Proc. Haw. Ent. Soc. v. (2) pp. 205-247 (1923).

† Trans. Ent. Soc. Lond. 1925, pts. i. & ii. pp. 127-268 (1925).

‡ Zoolog. Jahrbucher, Systematik etc., Band lviii. pp. 173-286. |

which he has made some radical alterations which are not justified on morphological grounds, mixing up some groups which are fundamentally different and separating others which are allied. If his tables were of world-wide application and purely for convenience, I should have nothing to criticize, except that he had not done what he did not intend to do; but his tables are not of wide-world application, and he claims for his work a contribution to phylogeny. For this reason I think it is necessary to give alternate tables, using characters which hitherto have been given little consideration, such as the hind tarsal joints, the genitalia, and the position of the coxæ. The results lead to a much more natural system, and if they are not entirely inclusive in their application, I believe they are more so than any tables so far presented to homopterists.

As it is not possible to repeat what I stated in 1923, and the figures given then cannot be reproduced here, it is necessary to refer workers to that paper for details and some general remarks, as this paper is only a supplement to it, with a table of families constructed on different characters.

The selection of the hind tarsi for taxonomic work was neither haphazard nor arbitrary; recognizing the affinity of the families to one another by a study of the genitalia and other morphological characters, the task was to find a combination of characters which would give an approximate representation of this, and at the same time be of practical value when expressed in tabular form. After considerable work in several directions I found that the condition of the hind tarsi gave fairly good results. That these results fit in with those based upon genitalia and other characters, or do not conflict with them, indicate that we are approaching a natural arrangement.

The chief alteration I have made is to separate the Nogodinidæ from the Ricaniidæ, and place them near to the Issidæ. To anyone who has studied these families such an arrangement will be recognized as an improvement; the Nogodinidæ and the Issidæ approach one another very closely, and are difficult to keep apart. That the Acanaulonidæ find a more fitting place near to the Issidæ than next the Flatidæ is attested to by several recent workers.

There is bound to be some opposition to the recognition of eighteen families in the Fulgoroidea. This group at present consists of about twelve hundred genera of very diverse form. Many workers have contended that they

form one family, or, very illogically, have separated off the Delphacidæ as one family, and considered the rest as another. If we take Stål's table in his 'Hemiptera Africana,' and consider the characters he used for their division, we would be justified in saying that they formed only one family; but if we compare the morphology of each group, and see the various differences, then we should come to a different conclusion. A table, especially an artificial one like Stål's, cannot give all the characters the families are founded on.

When we consider that Stål divided the small number of genera known to him into thirteen groups, and now, with the twelve hundred or so genera we know to-day, only eighteen groups are recognized, it shows the soundness of his work and the conservatism of his successors. The five families not recognized by him are:—Tettigometridæ, Achilixiidæ, Kinnaridæ, Meenoplidæ, and Nogodinidæ.

In the table I have used the position of the hind trochanter. This is dependent upon the arrangement of the coxa, which, again, is dependent upon the build of the insect. If we examine a form such as is found in the Flatidæ or Issidæ, in which the body is flattened laterally, the hind coxa, when viewed laterally, is diagonal and the trochanter is thrown forward, taking up a ventral position; this allows the hind legs to be thrown forward beneath the thorax, a position often assumed by specimens when dead. In forms in which the body is flattened horizontally, such as Achilidæ and Eurybrachidæ, the coxæ are perpendicular and the trochanter thrown backward; this does not allow the legs to be brought forward under the thorax, and specimens when dead generally have the legs directed backward. The presence of intermediate forms prevents the use of this character except in a limited manner, but it has its use.

The second segment of the hind tarsi has two distinct forms, one of which is again divided into two groups. In one form it is fairly long, the sides are subparallel or wider towards the apex, which is straight or somewhat excavate, and there is a row of spines across the apex; in the other the second segment is small or very small, the apex is bluntly or more acutely rounded, and there are either no spines at all or only one on each side. These conditions can be observed with a low-power lens, and should give no trouble to workers. While it is impossible to examine every genus of the Fulgoroidea, I have examined a large number, and have found these characters hold good. The length of a tarsal segment is measured from its base to the base of the succeeding segment.

It would be strange if out of over twelve hundred genera there were not a few whose position is difficult to decide. At present *Buca*, Walker, *Ivinga*, Distant, and *Padanda*, Distant, are enigmas; the first two I place in the Issidæ, and the third in the Dictyophoridae, and I have commented upon them under those families.

I would like to place on record my obligations to Mr. W. E. China, of the British Museum, for the constant help he is giving me in my work on Fulgoroidea.

Table of the Families of the Fulgoroidea.

- 1 (2). Antennal flagellum segmented. No mobile spine on hind tibia. Lateral ocelli not outside the lateral carinae of frons; loræ plainly visible in full view, forming a continuous curve with clypeus. Second hind tarsus small, apex slightly rounded with only a small spine at each corner TETTIGOMETRIDÆ.
- 2 (1). Antennal flagellum not segmented. Lateral ocelli outside the lateral carinae of frons, generally beneath the eyes; loræ not visible in full view or forming an angle with clypeus.
- 3 (20). Second tarsus of hind leg not very small, the apex with a row of small spines, truncate or emarginate. Without a costal area or with only a small one without cross-veins.
- 4 (5). One or both claval veins granulate and the apical joint of labium long (much longer than wide). The abdomen laterally compressed; the sixth, seventh, and eighth abdominal tergites bearing wax-secreting pores. Median ocellus generally present. Male genitalia of a distinct type, with an outer perianthrium; ovipositor absent or the processes greatly reduced. MEENOPLIDÆ.
- 5 (4). Claval veins not granulate, or, if so, then the apical segment of labium short (as wide as long).
- 6 (7). The sixth, seventh, and eighth abdominal tergites bearing wax-secreting pores. Ædeagus having an outer perianthrium; ovipositor reduced, incomplete KINNARIDÆ.
- 7 (6). The sixth, seventh, and eighth abdominal tergites not bearing wax-pores.
- 8 (9). Anal area of hind wings reticulate (many cross-veins); clypeus with lateral carinae; head often greatly prolonged. The membrane connecting inner penis and outer perianthrium capable of protrusion and expansion, often bearing armatures. FULGORIDÆ.

- 9 (8). Anal area of hind wing not reticulate.
- 10 (11). Apical segment of labium short* (about as wide as long). In the male the ninth abdominal tergite is fused with the anal segment and not with the lateral portions of pygofer; the basal plate and apodeme are absent. Ovipositor with the processes short or abortive DERBIDÆ.
- 11 (10). Apical segment of labium long (distinctly longer than wide).
- 12 (15). Claval vein entering the apex of clavus.
- 13 (14). Base of abdomen with one or two short appendages bearing three hemispherical depressions. Laterally compressed forms; tegmina tectiform, the membrane not overlapping ACHILIXIDÆ.
- 14 (13). Base of abdomen without such developments. Mostly horizontally flattened forms; the membranes beyond clavus overlapping ACHILIDÆ.
- 15 (12). Claval vein not reaching to the apex of clavus, entering commissure before apex.
- 16 (17). Hind tibia with a mobile spur at the apex. Ædeagus very similar to that of the Cixiidæ; ovipositor always complete. In most genera with a transverse carina on gena below the antenna DELPHACIDÆ.
- 17 (16). Hind tibia without a mobile spur.
- 18 (19). Head prolonged in front, sometimes greatly so, or if not, then frons with two or three carinae, or the tegulae absent and claval suture obscure. Always without median ocellus. The Ædeagus similar to that of the Fulgoridæ. Ovipositor incomplete, styles small, pygofer small DICTYOPHORIDÆ.
- 19 (18). Head not prolonged in front or only moderately so, the frons with only a median carina or none (excluding lateral margin). Tegulae present and claval suture distinct. The median ocellus often present. The Ædeagus consists of a single tube, generally with two segments. Ovipositor often complete, if not, then pygofer large and exposed CIXIIDÆ.
- 20 (3). Second hind tarsus small or very small, the apex without spines or with only one at each side; the apex generally rounded or pointed. Costal area absent or present.
- 21 (30). Second hind tarsus with a spine on each side, the apex rounded or bluntly pointed. Claval vein nearly always ending in apex of clavus.

* The genus *Vinata* an exception.

- 22 (23). The posterior angle of mesonotum restricted off by a groove or fine line. Cross-veined costal area absent or present. Hind basitarsus seldom with the ventral surface padded, generally long or moderately long. Aedeagus sometimes without a periandrium or a very short one; ovipositor styles fairly long, with serrated edge. Hind trochanter generally pointing backward TROPIDUCHIDÆ.
- 23 (22). Posterior angle of mesonotum not so restricted off. Hind basitarsus generally short or very short. Aedeagus always with periandrium and ovipositor seldom with a serrated edge, often very reduced in size. Hind trochanter pointing ventrad.
- 24 (25). With a cross-veined costal area, but without granules on clavus, and nearly always with lateral carinæ on clypeus NOGODINIDÆ.
- 25 (24). Without a cross-veined costal area, or, if with such, then the clavus granulate or the clypeus without lateral carinæ.
- 26 (27). With a cross-veined costal area and the clavus granulate or the base of costa strongly curved FLATIDÆ.
- 27 (26). Clavus not granulate and base of costa not strongly curved.
- 28 (29). Tegmina large, steeply tectiform; hind tibiæ without spines on the sides; no costal area ACANALONIIDÆ.
- 29 (28). Tegmina not so large and generally not so steeply tectiform; hind tibiæ generally with one or more spines on the side. Pronotum short, especially behind the eyes. Costal area generally absent or obscure ISSIDÆ.
- 30 (21). Second hind tarsus small, with the apex rounded or bluntly pointed, without any spines.
- 31 (32). Tegmina wide on apical margin, steeply tectiform, with a cross-veined costal area; clavus long. Head as wide, or nearly as wide, as the thorax. Hind trochanter pointing ventrad; hind basitarsus short or fairly short RICANIIDÆ.
- 32 (31). Tegmina not so wide on apical margin nor so steeply tectiform, or the head is distinctly narrower than thorax; clavus not so long. Hind trochanter pointing backward; hind basitarsus long or fairly long.
- 33 (34). Frons seldom so wide as long and often with the lateral margins not angular, nearly always with one to three longitudinal carinæ, and the clypeus generally having lateral carinæ LOPHOPIDÆ.

- 34 (33). Frons wider than long, sides angular; no lateral carinæ on clypeus and no longitudinal carinæ on frons or only a very obscure one EURYBRACHYDIDÆ.

1. Tettigometridæ.

This small family of some fourteen genera and subgenera is of interest, as it represents the most generalized of the Fulgoroidea, and possesses characters pertaining to the Cicadoidea. But the male genitalia, as well as the majority of other characters, plainly place it in the Fulgoroidea.

The genera and species are very uniform in appearance, and the arrangement of the genera difficult. Baker* was the last to give a tentative table of some of the genera, but the chief character he used—the proportional length and breadth of the vertex—is not natural. A more natural grouping may be found in the male genitalia, which appear to be of two types. In one type the genital styles are free and quite normal, with apodemes, or only joined together by a membrane (e. g., *Egropa*, *Tettigometra*), whereas in the other there are no distinct styles or apodemes, but a median membranous plate with a lobe on each side (e. g., *Nototettigometra*, *Euphyonartex*, *Hilda*). In the female the ovipositor is absent or only represented by a pair of minute processes.

This family has some closer affinities with the Tropicuchid group of families than with the Cixiid group.

2. Cixiidæ.

In 1925† I tabulated the genera of this family, including the Meenoplidæ and Kinnaridæ. The family contains between eighty and ninety genera. With the exception of the five genera of the Bothriocerini, distinguished by the presence of a subantennal process or the antenna sunk into a pit, it is difficult to divide this family into subfamilies. The ædeagus consists of a simple tube, often divided into two segments; the ovipositor is either complete or considerably reduced, in which case the pygofer is wide and exposed. The styles are never entirely absent or unrecognizable, and can always be recognized from all other families except Delphacidæ, which have the complete ovipositor.

Haupt has included Lameniinæ, Cixiinæ, and Achilinæ in his Cixiidæ, a very unnatural association. The Lameniinæ, which he defines very poorly, may be equal to my Cenchreini or Cenchreini and Otiocerini combined; they are

* Philippine Journ. Sci. 24, i. pp. 91-99 (1924).

† Pan-Pacific Entom. i. 3, pp. 97-163 (1925).

Derbidæ, and their genitalia, as well as other structures, exclude them from the Cixiidæ. There is little affinity between the Cixiidæ and Achilidæ, and they should never be placed in one family.

3. Delphacidæ.

- 1 (2). Posterior tibial spur subulate, the cross-section either circular or angular, apex acuminate, without teeth on the sides ASIRACINÆ.
- 2 (1). Posterior tibial spur cultrate, subcultrate, or thin, with or without teeth on the hind margin DELPHACINÆ.
- 3 (4). Tibial spur cultrate, solid, both sides convex, distinct teeth along the hind margin. Alohini.
- 4 (3). Tibial spur thin, or, if solid, then with the inner surface concave.
- 5 (6). Spur without teeth on the hind margin; generally solid, with the inner surface concave. Tropidocephalini.
- 6 (5). Spur with teeth on hind margin, generally thin, often tectiform. Delphacini.

This family consists of over a hundred genera; those that I have examined are divided as follows:—Asiracinæ 17, Alohini 17, Tropidocephalini 22, Delphacini 49. The genitalia in this family are allied to those of Cixiidæ, but the female always has a complete ovipositor. In the Asiracinæ the ædeagus is divided into two segments, whereas it consists of one in the Delphacinæ. Most of the genera, but not all, have a diagonal carina on gena below the antenna.

Haupt has divided this family into four subfamilies, viz., Asiracinæ, Tropidocephalinæ, Delphacinæ, and Megamelinæ. His characterizations are very far from inclusive, and the Alohini, which form a very distinct group, find no place in his system. The division between his Delphacinæ and Megamelinæ is very artificial, and does not have the same value as between Asiracinæ and Delphacinæ.

4. Derbidæ.

- 1 (4). Tegmina long and narrow. Wings very small or not more than half the length of the tegmina, narrow, the costal and posterior margins subparallel or converging to a pointed apex, the cubital and claval areas greatly reduced, with the claval veins missing or reduced, the posterior basal area large, corrugated, and used as a stridulating organ ZORAIDINÆ.
- 2 (3). Eyes in front not reaching to base of clypeus, subcostal cell long, sometimes very narrow Zoraidini.

- 3 (2). Eyes in front reaching to the base of clypeus; subcostal cell very short or absent; female genitalia abortive Sikaianini.
- 4 (1). Tegmina not long and narrow; wings nearly always more than half the length of tegmina, the anal area large and the cubital and anal veins normally formed DERBINÆ.
- 5 (10). Claval cell closed or only narrowly open for a short distance, the extended claval vein not joining cubitus and not forming part of a contiguous series of submarginal cross-veins; cubitus generally proceeding straight to hind margin.
- 6 (7). Cubitus apparently with four or more veins reaching to the hind margin Derbini.
- 7 (6). Cubitus with less than four veins reaching to the hind margin.
- 8 (9). Cubitus simple or furcate, reaching to the hind margin direct, not running into the basal median sector Cenchrini.
- 9 (8). Cubitus connected with the base of median sector, forming an angular or quadrate cell; sometimes with a cross-vein near the base of the basal median sector, forming a triangular cell; tegmina broad Rhotanini.
- 10 (5). Clavus open, the cubital veins bent and touching and, together with the extended claval, forming part of the submarginal row of apical cross-veins Otiocerini.

This family contains about one hundred genera. In spite of the fact that it shows greater variety in venation and general form than any other of the Fulgoroid families, it is exceedingly compact and quite distinct from all others. This can be seen in the male genitalia, where the ninth abdominal tergite is amalgamated to the anal segment, and not to the lateral portion of the pygofer, and there are no basal plate and apodeme. If Singh Pruthi is correct in saying that a rudimentary basal plate apodeme is present in some forms, then it shows that the family has arisen from the Cixiid stock; but, if this is entirely missing, then we may have to consider the possibility of an independent origin from the original stock. Even if this apodeme is not present I should rather consider the group as having had it originally and lost it, than that they had never possessed it.

Haupt has removed one part (Lameniinæ) to the Cixiinæ, and has included Kermesiinæ and Meenoplinæ. This is another very unfortunate combination, and cannot be accepted.

The fact that there is no basal plate apodeme and bridge makes necessary a very different arrangement of muscles, the study of which would be interesting and instructive, especially in the genus *Mysidia*.

5. Achilixiidæ.

Two genera are at present represented in this family, *Achilixia*, from the Malay Islands, and *Bebaiotes*, from Central and South America. While they have a Cixiid connection, yet the peculiarities of the male genitalia and the peculiar processes on the third and fourth abdominal segments justifies their separation. In the former genus there is a transverse bar across the middle of the pygofer to which the base of the ædeagus is attached; this latter is cultrate, the ventral margin being double and curved, the dorsal margin straight and single. In the latter it is more complex. In the female of *Bebaiotes* the fourth, fifth, and sixth abdominal sternites are divided down the middle.

6. Meenoplidæ.

The eight genera which I recognize as belonging to this family form a compact group quite distinct from any other in the suborder. The genitalia alone will distinguish them from the rest of the Fulgoroidea; the long apical segment of the labium and the median ocellus easily separate them from the Derbidae, and the venation and the granulation of the claval veins from the Cixiidæ; from the Achilidæ the steep tectiform tegmina and the arrangement of the claval veins and membrane beyond the clavus form distinguishing characteristics.

At the time of tabulating these genera in 1927* I had not examined *Meenoplus albosignatus*, Fieber; since then, thanks to the kindness of Dr. G. Horváth, I have examined this genotype, and also Dr. A. Roman, of Stockholm, has compared certain specimens with Stål's types, and informs me that *Inxwala bergrothi*, Muir, is the same as *Anigrus lugens* (Stål), and *Inxwala modesta*, Distant (genotype), is the same as *Anigrus sordidus*, Stål (genotype). The examination of material from *Formosa* convinces me that *Paranisia*, Matsumura, is the same as *Anigrus*, Stål. I therefore give an emended table:—

- 1 (14). Claval veins forking near apex of clavus; the first claval vein strongly granulate, second not granulate or only slightly. First claval generally curved, second subparallel to commissure NISIINÆ.
Phacomeura.
- 2 (3). Frons with a distinct median carina
- 3 (2). Frons without a median carina.
- 4 (7). No lateral carinæ on clypeus.

- 5 (6). Tegmen narrow; *M* arising at base of *Sc+R* *Cu* before fork, and the first claval vein only slightly curved *Nisia*.
- 6 (5). Tegmen broader; *M* arising more distad; *Cu* before the fork, and the first claval vein considerably curved *Kermesia*.
- 7 (4). Lateral carinæ of clypeus distinct.
- 8 (11). No break at clypeal suture between the lateral carinæ of frons and clypeus.
- 9 (10). Vertex longer than wide *Eponisia*.
- 10 (9). Vertex wider than long *Robigalia*.
- 11 (8). A break at clypeal suture between the lateral carinæ of frons and clypeus.
- 12 (13). Tegmina comparatively narrow, not greatly broadened at apex; generally seven apical cells *Suva*.
- 13 (12). Tegmina broad, greatly broadened at apex, generally eight or nine apical cells *Kermesia*.
- 14 (1). Claval veins forking nearer to middle of clavus; second claval vein granulate. First claval vein straight, suparallel to suture, second claval vein curved MEENOPLINÆ.
- 15 (16). Frons and vertex with a median carina, sometimes obscure on base of vertex and apex of frons. In some cases a fine carina, in others more of a median longitudinal swelling *Anigrus*.
- 16 (15). Frons without a median carina; in some cases a very fine median carina on vertex. *Meenoplus*.

The following synonymies and changes must be recorded:—*Anigrus*, Stål = *Inxwala*, Distant = *Paranisia*, Matsumura = *Paranigrus*, Bergroth. The following species are included in this genus:—

Anigrus sordidus, Stål = *Inxwala modesta*, Distant; *Delphælugens*, Stål = *Inxwala bergrothi*, Muir; *Anigrus fuscomaculatus*, Melichar (?); *Paranigrus muiri*, Bergroth; *Paranisia formosana*, Matsumura; *Paranisia nigricans*, Matsumura; *Paranisia frequens*, Matsumura.

Meenoplus will contain:—*M. albosignatus*, Fieber; *Anigrus fuscovenosus*, Jacobi; *Anigrus albinervosus*, Muir; *Anigrus stramineus*, Muir; *Anigrus turneri*, Muir.

Lallemand's two species, *Anigrus semihyalinus* and *Anigrus pallidus*, belong to *Kermesia*.

This confusion was due to the misunderstanding of the two oldest genera of the group, *Meenoplus* and *Anigrus*, and could only be cleared up by an examination of the types or genotype species.

The preceding four families have the ædeagus as a single tube; this and the following families have two layers (except in some Tropicuchidæ), an outer periandrium and an inner penis. This family is quite distinct and homogeneous, and

* Ann. & Mag. Nat. Hist. (9) xix. p. 197.

easily recognized. Haupt has placed it in the Derbidæ, with which it has no near affinity. The wax-secreting areas on the abdominal tergites found in this family and in the Kinnaridæ appear to be similar to those found in the young stages of some Cixiidæ (e. g., *Mnemosyne*).

7. Kinnaridæ.

This family contains at present seven genera, viz., *Kinnara*, *Eparmene*, *Paramicriza*, *Prosotropis*, *Atopocixius*, *Æchidius*, and *Paræchidius*. While they have affinity with Cixiidæ, the male genitalia are not of that type, and, along with the Meenoplidæ, the sixth, seventh, and eighth abdominal tergites bear wax-producing areas. *Haplaxius* has been placed in this family, but it belongs to the Cixiidæ.

8. Dictyophoridæ.

This family contains about one hundred genera. It is closely connected with the Fulgoridæ, both possessing a similar type of male genitalia which is found in no other families. There is an inner penis and outer periandrium, and the membrane connecting them can be protruded and inflated, and is complex, often bearing armatures.

Melichar divided it into five groups, but I doubt if they are natural.

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|---|------------------------|
| 1 (6). A distinct suture dividing clavus from corium; tegulæ and ocelli present | DICTYOPHARINÆ. |
| 2 (3). No cross-veins in the clavus | <i>Dictyopharini</i> . |
| 3 (2). Clavus with a cross-vein between first claval vein and suture. | |
| 4 (5). Tegmina with narrow costal area | <i>Dichopterini</i> . |
| 5 (4). Tegmina without costal area | <i>Cladyphini</i> . |
| 6 (1). No suture dividing the clavus from corium . . | ORGERINÆ. |
| 7 (8). Tegmina entirely or almost covering the abdomen | <i>Lyncini</i> . |
| 8 (7). Tegmina very short, not nearly covering the abdomen | <i>Orgeriini</i> . |

Haupt has followed Kirkaldy in altering the name of this family to Fulgoridæ, but I cannot agree to this. No good can come of this even if the law of priority or type fixation does demand it, and very considerable confusion and inconvenience will ensue. Equity is above law, and fairness to present and future workers should be considered.

Haupt has also included Tropicuchidæ and Lophopidæ in this family, thus making of it a strange compost which his characterization does not cover.

It is difficult to place the genus *Padanda*, Distant. By the build of the head and thorax one would place it in this

family, but the second hind tarsal joint, while having the apex truncate, has only a spine at each corner, and so should go into the Issid group of families, where it would be the only genus I know that has the apex truncate. The male genitalia are peculiar; the ædeagus is thin and flattened laterally, the opening of the periandrium being on the dorsal side at apex; there is a strong tube passing into the base of the periandrium, which appears to be connected with the periandrium by a large membrane which may be capable of protrusion and inflation as in all Dictyophoridæ. Whatever family we place it in it does some violence to the characterization, but it appears to do less to that of the Dictyophoridæ than to any other. This genus is stated to be identical with the same as *Cixiopsis*, Matsumura.

9. Fulgoridæ.

This family contains about one hundred and ten genera, and includes some of the largest and strangest of the superfamily. For this reason it has received considerable attention from collectors and taxonomists, and we find it divided into a number of subfamilies. Haupt characterizes seven, but they have not the same morphological significance as the subfamilies in some of the other families, i. e., Derbidæ and Delphacidæ.

I place this family next to Dictyophoridæ. The male genitalia are similar in the two families and quite distinct from all other Fulgoroids; they are also closely allied in other characters.

Kirkaldy contended that Sulzer fixed the type of *Fulgora* as *europæa* in 1776 (Abgek. Gesch. Ins. p. 85), but I cannot accept this as a type-fixation. In 1801 Lamarek selected *lateraria* as the representative of the genus, but this work has been ruled out by the Committee on Zoological Nomenclature so far as fixation of types is concerned. In 1810 Latreille quoted *europæa* as the type of *Fulgora*.

It is useless to discuss what is a type-fixation and what is not in this case, as no agreement could be reached. We must now consider what will be to the greatest advantage of entomology, to which nomenclature is but a handmaiden. There is no disadvantage whatever if we conserve this name for what it has stood for since 1767. The specific names used by Linneus were very often descriptive, and the combination of *Fulgora lateraria* and *Fulgora candelaria* indicate that he was considering those species which were considered to be luminous and which had been described and figured by several workers. For one hundred and sixty years this name

has stood for these insects, and has passed into common use and is found in numerous works.

If we take this name, which for many years has stood for this distinct group of insects, and use it as the name for a totally different group which has been known under a totally different name for a hundred years, we create confusion not only for the present but for all times. No good will be achieved by this, except one considers a pedantic conformity to a rule is such, irrespective of the harm it may cause. To do this in the name of stability of nomenclature is illogical in the extreme.

I, for one, shall retain the name in its 160-years-old sense, and trust that when the question is put before the Committee on Zoological Nomenclature they will do likewise.

The genus *Chalia*, Walker, is a Eurybrachydid.

10. Achilidæ.

This family consists of over seventy genera, and, as no attempt has been made to tabulate them since 1866, when Stål dealt with the thirteen genera known to him, work in the family at present is difficult. With the exception of *Apateson*, Fowler, which I place in this family, the genera are fairly uniform, and show no distinct morphological differences for the erection of subfamilies. Such may be revealed upon closer study. They are mostly horizontally flattened forms, the membrane beyond the clavus overlapping when at rest. The little we know of the ædeagus of the Achilidæ shows it to be distinct, and in some cases very complex and peculiar. There is an outer periandrium and a small inner penis; thus its structure does not resemble that in the Cixiid group of genera. The hind tarsal joints do not divide the families into the same groups as do the different genitalia.

Haupt has made this family a subfamily of the Cixiidæ. I cannot understand this; as there can be no confusion between the two and they differ in fundamental characters. Both the male and female genitalia are distinct, and the males belong to two types; the general build and the overlapping of the membrane beyond the clavus and the venation are very distinctive.

11. Tropiduchidæ.

This family contains about eighty genera; in 1914 Melichar monographed it, and then recognized sixty-nine. The suture or depression which restricts the posterior angle of the mesonotum appears to be constant in this family,

and, together with the characters given in the table, should characterize it from others. The condition of the second segment of the hind tarsus separates it from Dictyophoridaæ. The ædeagus is interesting, as in some genera there appears to be no periandrium, while in others there is a well-developed one, and intermediate conditions exist. Judging by the conditions found in this family, one would conclude that the periandrium is a secondary development due to an outgrowth of the membrane around the base of the penis, and not a withdrawal of the distal segment of the ædeagus into the basal segment. The possibility of this condition arising independently in two or more groups must be borne in mind when considering the phylogeny of the families. The tegmina of some of the genera of this family are somewhat like certain Permian fossils, such as *Prosbole*.

I follow Melichar in the following division of the family, but more morphological work is needed before their relationships can be understood:—

- | | |
|---|--------------------------|
| 1 (4). Costal area present with cross-veins | TROPIDUCHINÆ. |
| 2 (3). Antennæ very short, globose | <i>Tropiduchini</i> . |
| 3 (2). Antennæ longer, considerably longer than the width of an eye | <i>Catullini</i> . |
| 4 (1). Costal area absent or very small and without cross-veins | TAMBINIINÆ. |
| 5 (6). Costal area absent or only forming a small arc on the costal margin; subcosta with many branches, some furcate, reaching costal margin | <i>Alcestisini</i> . |
| 6 (5). Subcosta without furcate branches reaching to costal margin. | |
| 7 (12). Tegmina not leathery. | |
| 8 (9). Cross-veins (nodal line) absent | <i>Tripetimorphini</i> . |
| 9 (8). Cross-veins (nodal line) present. | |
| 10 (11). Cross-veins distad of the middle of tegmina. | <i>Tambiniini</i> . |
| 11 (10). Cross-veins basad of middle of tegmina, membrane longer than corium | <i>Paricaniini</i> . |
| 12 (7). Tegmina leathery, reaching but little beyond apex of abdomen | <i>Hiracini</i> . |

12. Nogodinidæ.

This group has hitherto been included as a subfamily, tribe, or a part of the Ricaniidæ. I have separated it as a distinct family, as the general facies as well as distinct morphological characters indicate. The two spines on the second hind tarsus, the frons longer than wide, and the lateral carinæ on the clypeus all distinguish it from the Ricaniidæ. As the family stands at present it contains about forty genera and has greater affinity to the Issidæ than to the Ricaniidæ.

13. Flatidæ.

This family contains more than one hundred and eighty genera divided into two groups which appear to be natural, and should, I think, be considered as two subfamilies:—

- 1 (2). Body considerably compressed laterally, the tegmina steeply tectiform, the apical margin and often the apical portion of the costal margin meeting together or approaching very closely when at rest. The base of the costal margin not considerably curved. FLATINÆ.
- 2 (1). Body not compressed laterally or only slightly so; tegmina horizontal or only slightly tectiform, the apical portion of the costal margins and apical margins not meeting together when at rest. The base of the costal margin considerably curved. FLATOIDINÆ.

Haupt separates the latter as a family under the name of Phalænomorphidæ, but he includes the Acanaloniidæ as a subfamily of Flatidæ. In this I consider he is not justified, as Flatinæ and Flatoidinæ are much more closely related to one another than either is to the Acanaloniidæ.

Melichar (1923) divided the Flatinæ into seven tribes, which are a convenience for systematic purposes but do not represent natural divisions. The family contains nearly one hundred and seventy genera at present. Forms like *Colproptera* cannot be placed in it, but must go into the Issidæ.

14. Acanaloniidæ.

According to Melichar's last work on this family (1923) it contains eleven genera. It may eventually be sunk into the Issidæ, unless other forms are segregated out of Issidæ (e. g., *Tonga*); but the difficulty at present is to find one or more characters which will characterize such a group. Stål recognized this as a distinct subfamily.

15. Issidæ.

The proper understanding of the relationship of this family to the three previous ones will not be evident till more detailed work on the morphology has been done. At present it contains nearly one hundred and fifty genera, and thus comes second in point of numbers, the Flatidæ coming first; it also contains some very diverse elements. *Augila*, Stål, has been placed in this family, but the absence of any spine on the apical margin of the second hind tarsal segment removes it from this family. For the present I place it in the Lophopidæ. The peculiar genus *Buca*, Walker,

which has been overlooked by Melichar, comes into this family under the Issinæ. *Augilina*, Melichar, I have not examined.

The following table is based upon Melichar:—

- 1 (2). Tegmina short and only reaching slightly beyond the base of abdomen, or exceedingly narrow, parchment-like, thick or opaque, seldom hyaline; wings absent or rudimentary. CALISCELINÆ.
- 2 (1). Tegmina entirely covering the abdomen or the greater portion of it.
- 3 (4). Clavus and corium not separated by a suture. Tegmina generally convex, thick, and the venation obscure. HEMISPHERINÆ.
- 4 (3). Clavus separated from corium by a suture. ISSINÆ.
- 5 (6). Wings absent or rudimentary, not folded. *Hysteropterini*.
- 6 (5). Wings present, entire.
- 7 (8). Wings with margins entire. *Issini*.
- 8 (7). Wings with a deep cleft in the apical margin, the anal area very large. *Thionini*.

The genus *Ivinga*, Distant, is interesting, and its position not very clear. The hind basitarsus is short, the apex has a large spine on each side and small ones between; the second tarsus has the apex round with a spine on each side. There is a small costal area along the base of costal margin without cross-veins; the costal cell is wide, *Sc* giving off veins towards the costal margin, whose apices coalesce and form an ambient vein. Ovipositor long, complete (?), a few teeth at apex. The two claval veins reach the apex of clavus without meeting. The male genitalia has been figured and described by Singh-Pruthi, and is peculiar. It is best placed in the Issidæ.

16. Ricaniidæ.

This family, divided from the Nogodinidæ, contains about forty genera. The genera were dealt with by Melichar in 1923. The Lophopidæ approach them in certain forms, but the characterization given will distinguish them from the only other two families having no spines on the second hind tarsus.

17. Lophopidæ.

This is a small family of some thirty-five genera; in 1915, when Melichar monographed it, he included twenty-seven, but two, *Ivinga* and *Padanda*, I do not include in it. In 1925 Baker remarked on Melichar's classification, and put forward some suggestions for a better arrangement. I believe a better arrangement than either Melichar's or Baker's

can be established upon the nature of the hind tibiae and tarsi:—

- A. Hind tibia with a simple apical row of spines; the basitarsus with a small pad of spines *Menosca, Pseudocorethrura, Buxtoniella, Makota, Jivatma, Aluma, Magia, Kasserota, Acarna, Apia.*
- B. Hind tibia with some of the apical spines joined together to form a plate; the basitarsus having a similar arrangement *Elasmoscelis.*
- C. Hind tibia having irregular spines at apex not confined to apex.
- C1. Basitarsus with a small pad of small spines. *Pitambara, Bisma, Menosca, Hesticus.*
- C2. Basitarsus with a small pad of small specialized hairs *Lacusa.*
- C3. Basitarsus long, the entire sole, or nearly the entire, covered with a pad of small specialized hairs *Serida, Corethrura, Sarebasa, Pyrilla, Lophops, Augilia.*

The remaining genera I have not been able to examine, but it is along these lines, I think, that we shall be able to make a more natural grouping and a more convenient one.

The nature of the specialized hairs composing the pads are of interest; many are small, slightly flattened, and have the tips bent at a right angle. A comparison of the habits and habitats of the genera having different pads would be of interest.

Haupt placed this family in his Fulgoridæ (= Dictyophoridæ) along with Tropiduchidæ, which, on almost every morphological consideration, must be condemned.

18. Eurybrachidæ.

This little family of some twenty-nine genera is very compact, the forms being easily recognized, although some depart considerably from the normal (i. e., *Thessitus*). There has been some confusion between this family and Fulgoridæ, but the absence of spines on the second hind tarsus, the absence of lateral carinæ on the clypeus, the broad angular frons without median carinæ, and, especially, the genitalia, show how widely divergent they are.

As it is necessary to have a linear sequence for the families, the one I have followed will express their affinity as well as such a sequence and our present knowledge will permit. A discussion of the phylogeny of this group and its relationship with the other groups of Homoptera cannot be entered into here. In fact, such a discussion is of very limited value until we have a much fuller knowledge of the Cicadoidea and of the relationship of the families composing that superfamily one to another.