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Classification of Hemiptera.

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Authors are by no means agreed as to the exact limits of the order *Hemiptera* or rather as to the number of groups to be included in this varied order. Neither are they agreed as to the natural affinities or the relative rank of the groups and sub-groups they place in it.

Mr. P. R. Uhler, our best American Hemipterist includes in the group only the *Heteroptera*, *Homoptera* and *Parasita*, excluding the *Mallophaga* and the *Thysanoptera*; these latter groups have been included by many authorities and Mr. Packard still maintains on embryological grounds that they should be included.

This being the condition, and as many more observations both embryological and morphological seem necessary to definitely settle the question at issue, we are forced to content ourselves with systems more or less artificial.

In undertaking to present a synoptical arrangement of the group therefore, I shall not consider it in place to discuss these doubtful matters, but simply endeavor to present in condensed form what seems to me the most natural grouping, and that which will afford students the most ready means of arranging their collections.

I have followed most nearly the arrangement given by Mr. Uhler in his chapter on Hemiptera in the "Standard Natural History" but am indebted also to the works of Westwood, Packard, and others. While I have verified all points possible, I have in many instances been obliged to rely upon various authorities, well aware that the discovery of new species must frequently modify the definition of the groups to which they naturally must be referred, and while finding occasion to introduce occasional characters in separating the families, based on observations of

the material in my own hands, it would of course be useless and out of place to attempt to designate such portions, since originality can not be claimed for any such work, though the author may rightly be held responsible for presenting the matter as a whole.

The arrangement given is in descending order, but it will be impossible to follow this in the order of giving the generic synopses.

Including the *Mallophaga* and the *Thysanoptera* (*Physapoda* of Packard) we have no comprehensive definition of the group. Excluding these, we may say the *Hemiptera* include those insects provided with a rostrum or beak formed from the labium and enclosing four extensile setæ which form a sucking tube, along with wings usually four in number which are either all membranous, or the fore ones partially or entirely coriaceous. (In *Coccidæ* there are two in the males only, and in some other groups they are absent or rudimentary in one or both sexes.)

This group which we may call *Hemiptera genuina* is clearly divided by the position of the head and the structure of the wings into two sub-orders, the *Heteroptera* and *Homoptera*.

A third sub-order, *Parasita*, includes the suctorial lice infesting mammals, these apparently having about equal affinities for the two other sub-orders, but combining with neither in being wingless and the beak not jointed.

The other groups are at present most conveniently grouped here, and may be ranked also as sub-orders though structurally there can be little question that they must bear a more distinct relation to the *Hemiptera* proper.

The *Thysanoptera* (or *Physapoda*) are minute insects usually less than 2 millimeters in length; with four very narrow delicately fringed wings which lie flat on the back, with free palpigerous mouth parts, and tarsi without claws; the terminal joint being vesicular.

The *Mallophaga* are wingless parasitic insects living on birds or mammals, with free biting mouth parts, antennæ of three to five joints and presenting some resemblance to the wingless Psocidæ, and by some authors grouped with the Pseudo-Neuroptera.

It is intended to include in these synopses only the North American genera, and the tables must not be considered as applicable in a larger range. The characters also, here mentioned are those of most importance as related to the groups to be here included.

Perhaps in no other order of insects is there such diversity of modification in the several structural elements, and this diversity is accompanied with extreme lack of constancy, so that the clear definition of groups is rendered difficult.

The *body* varies in form from the most elongated and thread like to short or circular, from the thickest to forms so flattened that they may live in the narrowest crevices They are convex above and below, or flattened or concave above and convex below.

The *head* serves by its position to separate the two leading suborders but aside from this it is subject to most extreme modification. It is cylindrical, often elongate in *Reduviidæ* and *Nabidæ*, decidedly flattened in *Coreidæ* and allied families. In the *Homoptera* the front is very often produced, the most extreme modification of this part occuring in the *Fulgoridæ*.

The *eyes* are usually prominent organs, standing out at the sides of the head; they serve rather as land marks—by which to locate the other organs of the head—than as distinctive in themselves.

The *ocelli* are commonly present and by their absence or by their relation to the eyes serve to define some minor groups.

The *antennæ* are never particularly elongated, usually composed of few joints and as a rule but slightly modified. They run from filiform in the lower *Homoptera* to setiform in *Cicada* and allies: and are mostly filiform, with the terminal joints either slender or else slightly enlarged in the *Heteroptera*. In a few cases the joint next the last is much flattened and broadened or otherwise modified. They are truly capitate only in the *Liotheidæ*.

The *labrum* is usually very small, but occasionally with the clypeus furnishes good characters for separation of genera and species. The setæ of the mouth vary greatly in length, but are of little value in determining the relation of groups.

The *labium* is an important structural element. It forms the sheath for the setæ, and is termed the beak or rostrum. It consists of three or four joints except in the *Pediculidae* where it is apparently devoid of articulation. By its origin at the front of the head indicating the horizontal position, or at the sternal border of the head indicating the vertical position, it serves to distinguish the *Heteroptera* and *Homoptera* and by its separation from or apparent union with the sternum it serves to divide the *Homoptera* into two minor groups. Furthermore the form of the basal joint and the comparative length of the joints are points of great value in determining relationships.

The *thorax* in its modifications corresponds in general with the habits of the groups, whether aquatic, terrestrial or aerial.

The *prothorax* is often minute and weak, again enormously developed and overshadowing all other parts as in *Membracidae*. It is transversely sutured in *Reduviidae*.

The *mesothorax* contains in the higher *Homoptera* and in nearly all *Heteroptera*, a well developed scutellum, situated between the bases of the fore wings. Its form and size assist in distinguishing some important groups. The metathorax is often reduced in size, forming a thin plate between mesothorox and abdomen. The *legs* vary in size and length and in the structure of the tarsi. A part or all of them are ciliated in most aquatic species: they are strong and spiny in most of the raptorial groups: pulvilli are in some groups present between the claws of the tarsi. The *wings* are quite characteristic. In *Homoptera* they are generally membranous and veined, or the fore ones as in *Cercopidæ* and allies uniformly coriaceous. In the latter case they do not overlap at the tips but unite on the median line as the elytra of Coleoptera. In *Heteroptera* the fore wings are divisible into three parts: a basal thick portion, the corium; a transparent apical portion, the membrane, which is veined; and a portion bordering the scutellum, the clavus. In some groups, notably the *Phytoconidae* there is a triangular part between the corium and membrane, the cuneus. They usually lie flat on the back, the membranous portions overlapping each other. The hind wings present less differences in structure, in both groups; but their venation is often important in distinguishing minor groups.

The *Parasita* and *Mallophaga* as well as one sex in many of the other groups, and occasionally both sexes are wingless or have these organs represented by mere rudiments. In *Thysanoptera* they are very delicate with a very broad and delicate fringe.

The *abdomen* presents many modifications of form, some of which are quite constant. It is quite commonly concave above for the reception of the wings, but seldom so concave as not to be filled by the flatly folding wings. The spiracles are, except in *Parasita*, situated below the margin. The margin is quite generally sharp and either horizontal or slightly elevated. The genital organs are in some groups external and furnish valuable characters for separating groups, but more commonly they are hidden in both sexes so as to furnish little aid without dissection and frequently the distinction of the sexes is impossible by external characters. In the higher *Homoptera* and in a few groups of the *Heteroptera* the ovipositor of the female is received into a slit on the underside of the abdomen and serves to readily distinguish the sexes and affords useful characters in systematic arrangement.

The following analytical tables will assist in placing the various subgroups, and also show the arrangement which seems to me at present most satisfactory.

In the synopses of families many groups are given that rank for

convenience, which by good authorities, and very properly I think, are given the rank of super-families. These groups will be discussed more particularly along with the characters of sub-family and generic importance in the synoptical tables of genera, which it is intended shall follow this paper.

SYNOPSIS OF SUB-ORDERS.

A.—Labium forming a beak and enclosing setæ.
B.—Labium jointed, spiracles inferior, wings usually present.
C.—Head horizontal, beak arising anteriorly, fore wings, coriaceous at base..... **Heteroptera.**
CC.—Head vertical, beak arising postero-inferiorly. Wings uniformly membranous or coriaceous ..... **Homoptera.**
BB.—Labium not jointed, spiracles superior. Wings always absent..... **Parasita.**
AA.—Labium not forming a beak, mouth parts free.
B.—Wings present, narrow, delicately fringed; tarsi vesicular (frequenting blossoms)..... **Thysanoptera.**
BB.—Wings never present; tarsi with claws. (Parasites on birds and mammals).... **Mallophaga.**

SYNOPSIS OF FAMILIES.

HETEROPTERA.

* ANTENNAE ALWAYS PROMINENT.

† *Legs ordinary, adapted to terrestrial life. Never inhabiting water or wet places.*

A.—Head usually flattened or triangular, closely joined to body, often immersed to the eyes, basal joint of the rostrum straight.
B.—Bodies usually rather thick and flattened or convex above, convex below.
C.—Ocelli usually conspicuous.
D.—Scutellum very large.
E.—Scutellum quite convex, covering nearly the whole abdomen..... **Scutelleridae.**
EE.—Scutellum nearly flat, attenuated posteriorly..... **Penlatomidae.**
DD.—Scutellum ordinary.
F.—Antennæ inserted above a line drawn from eyes to base of beak.... **Coreidae.**
FF.—Antennæ inserted on or below lateral margin of head and on a line drawn from eyes to base of beak..... **Lygaeidae.**
CC.—Ocelli absent or inconspicuous. Bodies rather soft.
G.—Terminal joint of antennæ not slender..... **Pyrrhocoridae.**
GG.— " " " " long and slender..... **Phytocoridae.**
BB.—Bodies decidedly flattened or else decidedly concave above, beak 3-jointed.
H.—Antennæ tapering. Body very flat..... **Cimicidae.**
HH.—Antennæ enlarging at tip or clubbed.
I.—Wings more than covering abdomen, gauze like..... **Tingitidae.**

II.—Wings not covering the abdomen.

J.—Margins of thorax and abdomen elevated, angular, head not flattened..... **Phymatidae.**

JJ.—Thorax and abdomen exceedingly depressed, (live under bark)..... **Aradidae.**

AA.—Head cylindrical, distinctly separate from body, base of rostrum curved. Antennæ usually tapering, prothorax with transverse suture.

K.—Rostrum long, slender..... **Nabidae.**

KK.—Rostrum short, stout ..... **Reduviidae.**

** ANTENNAE (EXCEPT IN GALGULIDAE) PROMINENT.

†† *Legs usually very long and slender, the tarsi variously modified for locomotion on surface of water or life in marshy places.*

A.—Antennæ very conspicuous.

B.—Antennæ slender. Bodies linear..... ..... **Hydrometridae.**

BB.—Antennæ short and thick or with basal joint stout and outer joints slender..... **Velliidae.**

BBB.—Antennæ long, conspicuous.

C.—Ocelli and scutellum apparently absent..... **Hydrobatidae.**

CC.—Ocelli present, size small ..... **Saldidae.**

AA.—Antennæ inconspicuous, ocelli present..... **Galgulidae.**

*** ANTENNAE ALWAYS CONCEALED IN CAVITIES OF THE HEAD.

††† *Legs often ciliated.* (*Aquatic forms.*)

A.—Head inserted in prothorax, fore tarsi normal.

B.—Bodies flat oval or ovate.

C.—Without caudal setæ .... **Naucoridae.**

CC.—With strap-like caudal appendage..... .. .. **Belostomidae.**

BB.—Bodies flat, oval, ovate or elongated, with long respiratory caudal setæ..... **Nepidae.**

BBB.—Bodies thick, usually soft, convex above..... **Notonectidae.**

AA.—Head overlapping the prothorax, fore tarsi flattened and ciliated.... **Corisidae.**

HOMOPTERA.

* BEAK DISTINCTLY SEPARATE FROM STERNUM.

Tarsi three-jointed. Antennæ minute, setiform.

A.—Wings more or less opaque, usually narrow, sometimes very broad.

B.—Prothorax well developed. Antennæ placed between the eyes. Scutellum triangular.

C.—Bodies usually rather slender, front little, if any, produced or carinated.

D.—Ocelli on vertex..... **Tettigonidae.**

DD.—Ocelli on front..... **Jassidae.**

CC.—Bodies usually stout, ocelli on vertex, front usually carinate.... **Cercopidae.**

BB.—Prothorax weak, often but slightly developed, antennæ and ocelli placed beneath the eyes, front often produced, scutellum inconspicuous.. **Fulgoridae.**

AA.—Wings entirely membranous, strongly veined.

D.—Prothorax normal, not covering wings. Wings broad, size large, males musical..... **Cicadidae.**

DD.—Prothorax greatly enlarged, covering the wings and often the entire body .... **Membracidae.**

** BEAK APPARENTLY ARISING FROM STERNUM.

Tarsi one- or two-jointed. All of small size. Antennæ prominent, usually filiform.

A.—Tarsi usually 2-jointed, wings, when present, four.

B.—Beak 3 or 4-jointed.

C.—Antennæ 10-jointed ..... **Psyllidae.**

CC.—Antennæ 3 to 7-jointed ..... **Aphididae.**

BB.—Beak 2-jointed ..... **Abyrodidae.**

AA.—Tarsi one-jointed. Males with two wings, females never winged. Enclosed in waxy scales closely adherent to bark or leaves, or clothed with cottony down. ..... **Coccidae.**

PARASITA.

The American species are contained in one family ..... **Pediculidae.**

MALLOPHAGA.

A.—Antennæ filiform. Maxillary palpi absent, tarsi short ..... **Philopteridae.**

AA.—Antennæ capitate. Maxillary palpi conspicuous, tarsi long ..... **Liotheidae.**

THYSANOPTERA.

These are conveniently grouped in one family ..... **Thripidae.**

An abnormal Lucanus cervus.*

At the January meeting of the Society Mr. L. C. Schenk exhibited a ♂ specimen of *Lucanus cervus* with apparently somewhat aborted mandibles. It seemed at first as if here was only a case of accidental injury in an early stage; but more careful study has developed a very interesting malformation. In size the specimen rather exceeds the average ♂ of *cervus*, and up to the head, is normal. The right side of the head to the mandible, is normal, the antenna complete. The mandible is distorted, lacking the teeth, and the point bent inwardly and joining the front under the labrum. It is perfectly immobile, and forms an irregular loop. The left side of the head is shorter than the right; but retains the normal sculpture to the front. The antenna is aborted, the basal joint much shorter than that of the opposite side, the remaining joints irregular, the club wanting. The eye is irregular in shape, and somewhat flattened. The front is oblique, the clypeus twisted sideways by the right mandible. The left mandible is wanting, its place occupied by an imperfect female head, with two perfect though immobile mandibles. The palpi and labrum are aborted and form a queer intergrade between ♂ and ♀ and appear partly to belong to the ♂ and partly to the ♀ head. The palpi are hardly half the length of those of a normal ♂. Altogether this is the most remarkable abnormity it has been my fortune to see. J.B.S.

* Read before the Brookl. Ent. Soc. March 1885.