TAXONOMIC VALUE OF ANTENNAL CHARACTERS IN THE AMBLYCERON MALLOPHAGA.

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INTRODUCTION

The classification of the *Amblyceron Mallophaga* has been in a chaos for a long time. The original genera *Menopon* Nitzsch and *Colpocephalum* Nitzsch contained an extremely large number of diverse forms, merely huddled together on trivial superficial resemblance, which later on turned out to be of family significance only. During recent years these unwieldy and complex assemblages have been split up into several groups and sub-groups, expressing Pseudo-relationships based on morphological resemblances and host. As has been pointed out in an extremely valuable article by Clay (1947), the classification where deduction of the relationships of hosts are made from those of the parasites, leads to erroneous conclusions. In *Amblyceron Mallophaga,* where adaptation to the host is less close than in *Ischnocera* and where genera have wider distribution, such classification tends to be misleading.

The need for detailed investigations of the internal and other external structures of various forms of *Mallophaga,* to establish natural phylogenitic relationship was suggested by all the previous workers. "It is impossible to lay down any hard and fast rules as to what should be considered generic characters, because what may be generic character. in one family may not be generic character in another." (Bedford, 1939). It is further stated, that some of the diagnostic characters so far used are merely of secondary importance, for instance *"Oesophageal sclerite"* and *"Gastric teeth"* are of no generic significance. Clay (1947) said "no one character can be treated as constant, but each must be considered in the context of the genus in question. Therefore, to settle the important question of the best combination of characters for the classification, the workers are required to take various anatomical characters into consideration." Eichler (1941) attempted to re-classify all the known genera of the *Phthiraptera* (*Mallophaga* and *Anoplura*) In the case of *Menoponidae,* at least, his classification seems to bear little relationship to the facts (Clay, 1947).

Clay (1947) did not make any attempt to re-classify the family. It was felt by her, that further material and more study including that of the internal anatomy are needed before it is possible to decide which characters show relationships between *Mallophaga* genera. Characters of recent adaptations are necessary to be known. These can be recognised where species on one host, although belonging to separate genera, have certain characters in common. Degree of development of the crop-teeth and pigmentation, thickness and surface texture of the sclerotised areas are important examples.

Now-a-days, it is fully realized that it is impossible to construct an adequate classification of *Mallophaga* unless every bit of information obtainable on internal or external anatomy is made use of. The morphological characters used for classification by Clay (1947) fall into the following three categories :—

I. *Relatively constant characters, most useful for generic establishment* :—

(1) Lateral areas of the head including the antennary fossae and

the latero-dorsal margin ; there may, however, be some variation in the form of the pre-ocular slit or notch.

(2) The form of the antennae, appear to be constant ; but one artefact should be noted, that is the inversion in some specimens of the distal end of the terminal segment to form a cup in which lie the terminal spines.

(3) The presence or absence of ventral sclerotised, recurrent spinous processes near the base of the palpi.

(4) The form of the gular and prosternal plates.

(5) The number of setae on prosternum (variable in some genera), and

(6) The presence or absence of femoral or sternal combs.

II. *Characters not constant throughout a genus.*

(1) The form and position of femoral and sternal brushes of setae are usually good generic characters, but in some specimens of a genus the brushes may be completely absent.

(2) The femoral combs, usually constant characters, are absent in some species.

III. *Characters rarely seen generically constant.*

(1) Shape of prothorax and its breadth in relation to those of the head.

(2) Degree of development of the hypopharyngial sclerite or lyriform organ (Bedford, 1939).

(3) Number and arrangement of the tergal setae.

(4) The presence or absence of internal thickening.

(5) Sexual dimorphism of the abdomen.

(6) Male genital armature may be so constant for a genus that they are not even of specific importance and may also be of same type in different genera or vary considerably within the genera (Bedford, 1939).

(7) Characters of the anus and genital region of the female may be similar in different genera. But in some genera seem to show good generic character, in other cases they are variable with the genus.

(8) Gastric teeth are probably always present but differ in degree of development (Ferris 1932).

Observations on the *Amblyceron Mallophaga* have revealed a diversity of structure with regard to antenna. The commonest form of the antenna is a clubbed or capitate mobile structure. Almost all the members of *Amblyceron Mallophaga* possess 4-segmented antenna. In those few, which have 5-segmented antenna, the ultimate article becomes divided into two. These appendages have been frequently used to clear up many of the disputed points in the classification of the *Amblyceron Mallophaga*. Mjoberg (1910), Clay (1947) made extensive studies of the antenna of the European forms. Clay (1947) used antennal characters, in combination with other anatomical characters for separating some (31 out of 50) of the important genera of *Menoponidae* viz., *Amyrsidea* Ewing, 1927; *Ardeiphilus* Bedford, 1939; *Bonomiella* Conci, 1942; *Bucerophagus* Bedford, 1929; *Chapinia* Ewing, 1927; *Ciconiphilus* Bedford, 1939; *Clayia* Hopkins, 1941; *Colpocephalum* Nitzsch, 1818;

Cuculiphilus Uchida, 1926; *Dicteisia* Keler, 1938; *Eucolpocephalum* Bedford, 1930; *Gruimenopon* C & M. 1941; *Heleonomus* Ferris, 1916; *Hoazinous* Guimaraes, 1940; *Hohorstiella* Eichler, 1940; *Kurodaia* Uchida, 1926; *Menacanthus* Neumann, 1912; *Menopon* Nitzsch, 1818; *Necmenopon* Bedford, 1920; *Nanidiola* Ewing, 1927; *Piagetiella* Neumann, 1906; *Plegadiphilus* Bedford, 1939; *Psittacomenopon* Bedford, 1930; *Somaphantus* Paine, 1914; *Trinoton* Nitzsch, 1818; *Turacoeca* Thompson, 1938 and New Genera A,C,D,E,F, Clay, 1947. She has given thirteen figures of antennae. The present paper is contribution to this knowledge.

Antennae of twelve genera of the Amblyceron Mallophaga in the author's collection (including seven genera not given in the above list) were studied in detail. Indian species in hand showed a considerable deviation with regard to form of antennal segments. In the light of these observations, it was endeavoured to make use of antennae alone for splitting up all the genera. A tentative table to be useful in recognising these genera is given. It is obvious that the classification of the family will need drastic revision, when based on the morphological characters of the adults including the structure of its antenna.

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The drawings included were prepared with the help of Camera lucida. It is the purpose here to show the characters of different antennal segments mentioned in the text the magnification and chaetotaxy have, therefore, been omitted without comments.

Description of Antennae.

In *Amblyceron Mallophaga* infesting birds, the antennae are short, clavate or capitate usually concealed in longitudinal, ventrally situated excavations, partially or completely covered by the lateral expansions of head; or slightly projecting outwards beyond the border of the head; or are situated in ventrally open capsules, which are sometimes bulbous and constitute conspicuous lateral swellings on the head. As a rule, the antennae are composed of four segments except in a few species, *e.g.*, *Bucerophagus* sp., *Colimenopon urocolius* (Bedford), *Cuculiphilus fasciatus* (Scopoli), *Eucolpocephalum robustum* Bedford, *Gruimenopon longum* (Giebel), *Menopon pallidum* Nitzsch *Meromenopon meropis* Clay and Meinertzhagen, *Odoriphilus phoeniculi* Clay and Meinertzhagan, in which they are five segmented. The first segment, *scape*, is usually simple in form and mostly subpyriform or subclavate throughout the group. Segment II, *pedicel*, is narrow basally and swollen apically, in some groups, however, it is produced on the outer margin to varying degrees. Segment III bell-shaped, narrow, pendunculate basally and enormously flattened anteriorly to accommodate segment IV, which is globular or elongate. The articles are furnished with small hairs, the clearly visible hairs are only shown in the figures. A detailed comparative study of the different genera available to me, is given below.

1. *Laemobothrion* Nitzsch (text-fig. 1). I have examined the antennae of *Laemobothrion titan* (Piaget) from the Common Pariah Kite (*Milvus migrans govinda* Sykes), *Laemobothrion* sp. from the Himalayan Griffon Vulture (*Gyps himalayensis* Hume)

—text-fig. 1, and *Laemobothrion tinnunculi* (Linn.) from Lagger Falcon (*Falco jugger* Gray). In all these forms segment I is pyriform, broader apically. Segment II is obliquely pyriform, rather squat, apical margin slightly produced outwardly to one side, it is inserted sub-apically on one side of segment I. Segment III is obliquely bell-shaped, (more or less of a truncated fig.), narrow basally and abruptly diverging apically to accomodate the globose, segment IV. The visible hairs are disposed of as shown in figure 1.

2. *Trinoton* Nitzsch (text-fig. 7).—The antennae of *Trinoton querquedulae* (Linn.), from the Common Teal [*Nettion c. crecca* (Linn.)] and the Dun Bird [*Nyroca f. ferina* (Linn.)], *Trinoton* sp., from the Ruddy Sheldrake [*Casarca ferruginea* (Pallas)]—text-fig. 7, and the Himalayan Whistling Thrush (*Myophonus coeruleus temminckii* Vigors: certainly a straggler) were examined. In all the specimens, segment I is smallest, somewhat broader basally than apically. Segment II obliquely pyriform, latero-apical margin enormously produced outwardly on one side. It neatly sits on the apex of segment I. Clay 1947 has pointed out that I and II segments of antenna are with distal anterior expansion. Segement III bell-shaped, gradually tapering towards the base, inserted on one side of segment II. Segment IV obliquely globose, truncate subapically, neatly resting on segment III. The chaetotaxy is as shown in figure 7. Clay (1947) figured antenna of *T. querquedulae*.

3. *Menacanthus* Neumann (text fig. 13).—The author had the opportunity of examining the antennae of *Menacanthus safedgal* Ansari from the White-cheeked Bulbul [*Molpastes l. leucogenys* (Gray)], *Menacanthus dudiyalatore* Ansari from the Indian Grey Shrike [*Lanius excubitor lahtora* (Sykes)], *Menacanthus gulabimaina* Ansari from the Rose coloured Starling (*Pastor roseus Linn.*)—text-fig. 13, and *Menacanthus himalayicus* Ansari from the Himalayan Starling (*Sturnus vulgaris humii* (Brooks), *Menacanthus spiniferum* (Piaget) from the Common Myna (*Acridotheres t. tristis* Linn.), *Menacanthus quadrifasciatum* (Piaget) from the Indian House Sparrow (*Passer domesticus indicus* Jard. and Selby.) and *Menacanthus* sp. from the Indian Yellow-throated sparrow [*Gymnoris x. xanthocollis* (Burt.)] Segment I is transverse, small, squat, very slightly convex dorsally and concave ventrally, serving as a pedestal for the next segment. Segment II is pear-shaped with its apical margin minutely produced (to varying degrees)to one side, and bulging slightly on the other. Clay 1947, stated that distal anterior angle of II antennal segment not prolonged. Segment III bell-shaped, pedunculate basally and regularly diverging towards the apex, basal stalk tucked in sub-medianly on the apex, of segment II. Segment IV elongate, irregularly cylindrical with sub-apical groove furnished with minute hairs. The distribution of visible hairs is as shown in the figure 13.

4. *Neumannia* Uchida (*Uchida* Ewing) (text-fig. 6). The antennae of *Uchida abdominalis indicus* Ansari from the Gray Quail [*Coturnix c. coturnix* (Linn)]—text fig. 6, *Uchida kalatitar* Ansari from the Indian Black Partridge (*Francolinus f. asia* Bonap.) and *Uchida* sp. from the Himalayan Griffon (*Gyps himalayansis* Hume: probably a straggler from gallinaceous bird) were examined. In these examples the segment I is small as in the preceding group, segment II is irregularly pyriform with narrow base which is inserted apically in segment I; apical margin produced to one side, tendency of going beyond the apex. Segment III ventricose at the apex and stalked, inserted apically in the middle of segment II. Segment IV broadly ovate, sub-apically excavated and well-lodged in the preceding segment. Chaetotaxy as shown in the figure.

5. *Menopon* Nitzsch (text-fig. 2).—*Menopon meinertzhagen* Clay from the Common Peacock (*Pavo cristatus* Linn.), *Menopon gallinae* Linn.) from the Common Domestic Hen (*Gallus gallus domesticus* (Linn.)—text-fig. 2, and *Menopon interpositus* Ansari from the Northern Grey Partridge (*Francolinus pondicerianus interpositus* Hart.)

were available for examination. In these forms segment I is squat, small segment; segment II is of simple form not protruded on any side as in other forms. Segment III is calyciform, driven in the preceding segment. Segment IV cylinderical wrinkled, (the cylinder may be squat or elongate). The distribution of hairs is as shown in figure 2. Clay (1947) stated "antennae with all segments narrow and elongate," and figured antenna of *Menopon gallinae* (Linn.)

6. *Actornithophilus* Ferris (text fig. 5). The antennae of *Actornithophilus trilobatus* (Giebel) were examined from the Little Stilt *Erolia m. minuta* (Leis.) and *Actornithophilus affine* (Nitzsch) from the Black-winged stilt [*Himantopus h. himantopus* (Linn.)] and the Green Sand-piper (*Tringa ochrophus* Linn.)—text-fig. 5. Segment I is quadrate and placed over it is calyciform segment II which is narrow at the base and uniformly spread out at the apex. Segment III is of the shape of an ice-cream cup, the pedestal of which is driven sub-apically or apically in segment II. Segment IV is broadly thimble-shaped, with excavated top, which is furnished with hairs. The hairs are distributed as in figure 5.

7. *Austromenopon* Bedford (text-figs. 3,4).-*Austromenopon cursorius* (Giebel) from the Cream-coloured Courser [*Cursorius cursor cursor* (Lath.)] and *Austromenopon icterum* (Nitzsch) from the Black-winged Stilt [(*Himantopus h. himantopus* (Linn.)] and the Green Sand-piper (*Tringa ochrophus* Linn.) were available for examination. Segment I is well-developed as is shown in the figure. Segment II is pear-shaped, but not distinctly produced apically to one side. Segment III calyciform, with tilted apical margin. Segment IV is of the usual type cone-shaped with a grooved sub-apical margin on one side. Hairs arranged as shown in text-figures 3,4.

8. *Cuculiphilus* Uchida (text-fig.8).-*Cuculiphilus pupiya* Ansari from the Pied Crested Cuckoo [(*Clamator j. jacobinus* (Bodd)] text fig. 8, and *Cuculiphilus upak* Ansari from the Common Hawk Cuckoo (*Hierococcyx varius* (Vahl.) were examined. In this group the antennae are definitely five segmented. Segment I is short, squat, and quadrate. Segment II obliquely campanulate with a stout basal stalk, fitting into segment I, apical half goblet shaped. Segment III calyciform with short narrow peduncle placed apically on one side of the middle line of segment II. Segment IV obliquely trough-shaped, narrow basally, to fit uniformly in segment III and broad apically to accommodate obliquely hemispherical segment V, which is narrowly excavated at the apex and furnished with numerous tactile hairs. According to Clay (1947) the terminal segment of antennae with definite signs of division into two. Distribution of visible hairs is shown in figure 8. Clay (1947) figured antennae of *Cuculiphilus fasciatus* (Scopoli).

9. *Colpocephalum* Nitzsch (text-fig.10).-Specimens of *Colpocephalum tricinctum* Nitzsch from the Himalayan Griffon (*Gyps himalayensis* Hume), the Lagger Falcon *Falco jugger* Gray) and the Common Pariah Kite (*Milvus migrans govinda* Sykes) were examined. Segment I is simple, and short. Segment II is pear-shaped without lobes. Segment III calyx-shaped, with almost obliquely straight apics the basal stalk driven in sub-apically into segment II. Segment IV distorted, pinnacle shaped, with a latero-apical pit furnished with fine hairs. Setae scattered as shown in figure 10.

10. *Galliferrisia* Ansari (text fig.9):—Numerous specimens of *Galliferrisia tausi* Ansari were obtained from the Common Pea-Fowl (*Pavo cirstatus* Linn). Segment I of usual shape. Segment II swollen submedially, obliquely reduced apically. Segment III calyciform, cup shallow, oblique, stalk inserted apically on segment II. Segment IV cylinderical, well-developed, apical, depression well marked, studded with sensory hairs. The well defined chaetotaxy as shown in figure 9.

11. *Columbimenopon* Ansari (text-fig.11) The antennae of *Columbimenopon medestus* Ansari from the Indian Blue Rock-Pigeon

(*Columba livia intermedia* strick.) and the Indian Ring Dove (*Streptopelia d. decaocta* (Frical.)]—text-fig.11, were examined.

The antennae of the group exhibit very outstanding characters. Segment I short, squat on which fits exactly the segment II which is more or less of the shape of an antique Egyptian lampion, one side is produced into a lobe or arm (antennule) which extends latero-apically far forward; the antennule being longer than the body of the joint: Segment III calyciform with shallow cup and short peduncle which is immediately inserted in the well marked depression of the lampad segment II. Segment IV, irregularly spherical, resting obliquely in the shallow cavity of the calyx, apical depression well defined. Visible chaetotaxy disposed of as in figure 11.

12. *Myrsidea* Waterston (text-fig.12). The antennae of *Myrsidea mesoleucum* (Nitzsch) were examined from the Punjab Raven [*Corvus corax laurencei* (Hume)]. the Eastern Rook [*Corvus frugilegus tschusii* (Hart)] and the Common House Crow (*Corvus s. splendens* Vieill.) ; *Myrsidea flavirostratus* Ansari from the Yellow-billed Magpie [*Uroeci issa f. flavirostris* (Blyth.)] and the Red-billed Magpie [*Urocissa meanocephala occipitalis* Blyth)]; *Myrsidea brunnea* (Nitzsch) from the Himalayan Nutcracker [*Nucifrage caryocatactes hemispila* (Vigors)]—text-fig. 12. *Myrsidea sehri* Ansari from the Simla Streaked Laughing Thrush [*Trochalopteron linealum grisescentior* (Hart)]., *Myrsidea satbhai* Ansari from the Bengal Jungle Babbler (*Turdoides terricolour sindianus* Ticehurst); *Myrsidea chilchil* Ansari from the Common Babbler [*Argya c. caudata* (Dumont)]; *Myrsidea* sp. from the Eastern Red-start [*Phoenicurus ochrurrors rufiventris* (Vieil)] ; *Myrsidea sultanpurensis* Ansari from the Himalayan Whistling Thrush *Myophonus coeruleus temminckii* (Vigors), *Myrsidea cuculare* from the Himalayan starling (*Sturnus vulgaris humii* Brooks); *Myrisdea lyallpurensis* Ansari from the Common Myna (*Acridotheres t. tristis* Linn.); *Myrsidea brunnea* Nitzsch from the Indian Black Drongo (*Dicrurus macrocercus peninsularis* Ticeh.); *Myrsidea dukhunensis* Ansari from the white-Headed Pidi (*Motacilla alba dukhunensis* Sykes); *Myrsidea* (*Alcediniphilus*) *kuluensis* Ansari from the Himalayan Great Pied King-fisher (*Ceryle lugubris guttulata* Stj.); *Myrsidea* sp. from the Sand Grouse *Pterocles exustus erlangeri* Neumann) and the Northern Chukor *Alectoris graeca pallescens* Hume) : both appear stragglers.

In these forms segment I is short; segment II bulbously dilated to one side, broader than long. Segment III oblique, calyciform, stalk short immediately inserted apically on one side of segment II. Segment IV dorso-ventrally flattened orbit, tilted to one side, sub-apical depression well marked. The visible hairs are disposed of as shown in figure 12.

An attempt is made below, to tabulate the results obtained, in the form of a key. In submitting this key to the fellow workers, the fact may be emphasized' that all such productions are of transitory value. "Keys are not created for the convenience of systematists", explains the issue. It must be borne in mind that the primary purpose of dichotomous key is the determination of species, genera or families. The more scientific, if less obvious, characters must give way before the more obvious, if the latter are sufficient to attain the main object of determination.

TENTATIVE KEY TO THE GENERA.

1. Antennae situated on bulbous capsides; adelocratous species..... .....*Laemobothrion* Nitzsch.
   Antennae lying in ventrally situated antennary furrows..... 2

2. Pedicel enormously produced into a lobe, which extends latero-apically forward..... 3
   Pedicel not enormously produced ... 4

3. III antennal segment bell-shaped, uniformly tapering towards the base .....*Trinoton* Nitzsch.
   III antennal segment calyciform, abruptly stalked, cup shallow..... .....*Columbimenopon* Ansari,

4. Antennae 5-segmented.....*Cuculiphilus* Uchida.
   Antennae 4-segmented. ... 5
5. Antennae with all segments narrow and elongate .....*Menopon* Nitzsch.
   Antennae without such characters. 6
6. Segment IV cylindrical ... 7
   Segment IV bulbous ... 11
7. Segment IV with distinct apical depression ...*Actornithophilus* Ferris.
   Segment IV sub-apically grooved 8
8. Segment II slightly produced apico-laterally ... *Neumannia* Uchida.
   Segment II not so produced, may be swollen ... 9
9. Segment II uniformly pear-shaped ...*Galliferrisia* Ansari.

   Segment II distorted pear-shaped 10
10. Segment III calyciform, cup being shallow and tilted towards one side...*Colpocephalum* Nitzsch.

    Segment III companulate, cup well formed...*Menacanthus* Neumann.

11. Segment IV apically angulate, with sud-apical depression...*Austromenopon* Bedford.

    Segment IV spherical dorsoventrally pressed ... *Myrsidea* Waterston.

SUMMARY

The classification of the Amblyceron Mallophaga has been in chaos for a long time. The gross external characteristics being used for determination are given. A comparative study of antennal structures for various genera available, is presented here with a view to show their value for taxonomic purposes.

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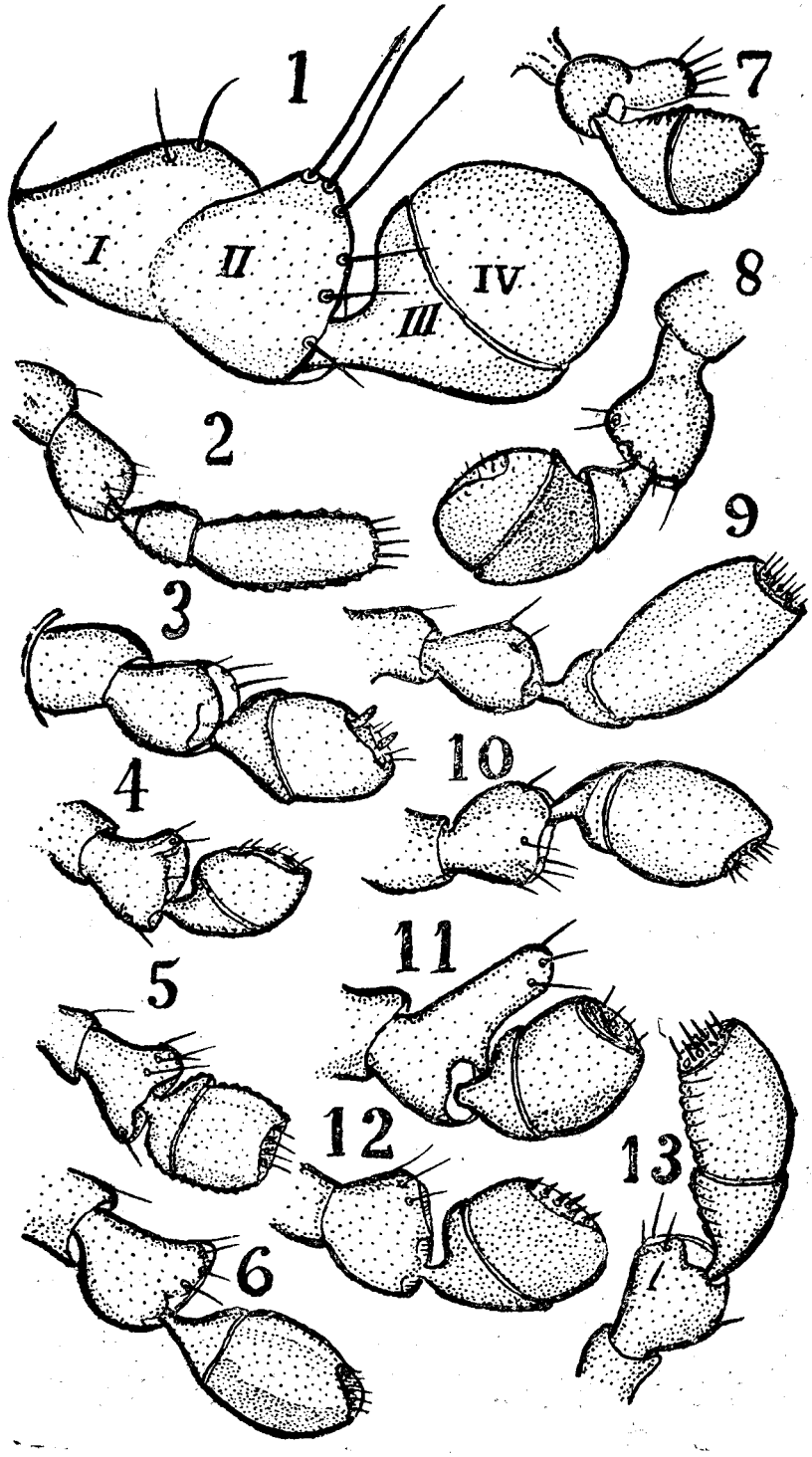
Explanation of Figures.

Figs. 1—13 : Antennae of female *Amblyceron. Mallophaga* (much enlarged).

1. *Laemobothrion* sp from *Gyps himalayensis* Hume.
2. *Menopon gallinae* (Linn). from *Gallus g. dometsicus* Linn.
3. *Anstromenopon cursorius* (Giebel) *Cursorius cursor cursor* (*Lath.*).
4. *Austromenopon icterum* (Nitzsch) from *Tringa ochrophus* Linn.
5. *Actornithophilus affine* (Nitzsch) from *Tringa o. ochrophus* Linn.
6. *Uchida abdominalis indicus* Ansari from *C. c. coturnix* (Linn).
7. *Trinoton* sp. from *Casarca ferruginea* (Pallas).
8. *Cuculiphilus pupiya* Ansari from *Clamator j. jacobinus* (Bodd).
9. *Galliferrisia tausi* Ansari from *Pavo cristatus* Linn.
10. *Colpocephalum tricinctum* Nitzsch from *Gyps. himalayensis* Hume.
11. *Columbimenopon modestus* Ansari from *Streptopelia d. decaocta* Frivalsaky.
12. *Myrsidea brunnea* (Nitzsch) from *Nucifraga caryocatactes hemispila* (Vigors) and
13. *Menacanthus gulabimaina* Ansari from *Pastor roseus* Linn.



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