

and project so far into the ventral vessel that they might be mistaken for valves proper to the ventral vessel itself.

The course of the blood flow is determined by the disposition of the valves as well as by the direction of the pulsations, and there is evidently entire agreement between the results of the physiological experiments and anatomical investigation. It is obvious that in small vessels or in such as receive blood from a capillary system so that there is no great pressure in the usual course, there may occur temporary reversals of flow due to movements of the body or other causes. Such reversals might most readily take place in the subneural vessel and such phenomena are probably the basis for Harrington's statement that the blood flows now forward, now backward in the subneural. However, the general course of the blood flow is strictly determined, as shown by the consistent experimental and anatomical results, and no considerable or long-continued reversal or interruption of the usual current are possible except as the result of violent interference such as decapitation of the worm.

The valves in the vessels have received very meager notices heretofore. The mention of valves in the dorsal vessel by Benham has been noticed above. A recent writer<sup>1</sup> has mentioned the presence within the dorsal vessel of cells similar to the chloragogue cells. These are also doubtless the valves of the dorsal vessel.

#### EXPLANATION OF FIGURES.

*Abbreviations:* *b.w.*, body wall; *c.t.*, connective tissue layer of blood vessels; *d.*, dorsal vessel; *d-i.*, dorso-intestinal vessel; *d-t.*, dorso-typhlosolar vessel; *end.*, endothelial lining of vessels; *i.v.p.*, vascular plexus of intestine; *l.n.*, lateral neural vessel; *m.*, layer of circular muscle fibers in walls of vessels; *nph.*, nephridium; *p.*, parietal vessel; *s.*, septum; *s-n.*, subneural vessel; *t.s.*, typhlosolar sinus; *v.*, ventral vessel; *va.*, valve; *v.i.*, ventro-intestinal vessel.

<sup>1</sup>Rice, Wm. J., "Studies in Earthworm Chloragogue," *BIOL. BULL.*, Vol. III., Nos. 1-2, 1902.

## TWO NEW GENERA OF MALLOPHAGA.

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There have come to me recently specimens of Mallophaga, taken from birds from mid-ocean islands, which demand the founding of two new genera in this interesting but little-studied order of parasitic insects. In the order, as at present known, there are about 1,500 species, comprising twenty-three genera. The small number of genera is striking in itself, but is made more amazing when it is remembered that eleven of the genera comprise but thirty of the species, leaving thus nearly the whole bulk of the species included in the twelve remaining genera. The addition of two new genera is, therefore, rather notable in the development of our systematic knowledge of the group. Although about two hundred new species of Mallophaga have been described from North American birds but one new genus (my *Giebelia*, with only one species, from shearwaters) has had to be established, all the other North American species being referable to genera founded on Old World species and specimens. The following revised key to the known genera of the order (including the two new genera described in this paper) is presented for the use of beginning students of the group, or of general entomologists:

#### ANALYTICAL KEY TO SUBORDERS OF MALLOPHAGA.

With filiform, 3- or 5-segmented, exposed antennæ; no labial palpi; mandibles vertical; œsophageal sclerite and accompanying glands usually present and normal; meso- and metathoracic segments fused; crop a saclike diverticulum; ingluvial glands present; testes four; egg tubes five..... ISCHNOCERA.  
With clavate or capitate, 4-segmented, concealed antennæ; with 4-segmented labial palpi; mandibles horizontal; œsophageal sclerite and accompanying glands absent or modified; meso- and metathoracic segments with sutural line usually visible; crop simple; ingluvial glands absent; testes six; egg tubes three to five.

AMBLYCERA.

#### ANALYTICAL KEY TO GENERA OF THE SUBORDER ISCHNOCERA.

A With 3-segmented antennæ; tarsi with one claw; infesting mammals (family Trichodectidæ)..... *Trichodectes* Nitzsch.  
AA With 5-segmented antennæ; tarsi with two claws; infesting birds (family Philopteridæ).

B Antennæ similar in both sexes.

C Meso- and metathoracic segments not fused..... *Nesiotinus* Kellogg.

CC Meso- and metathoracic segments fused.

D Front deeply angularly notched..... *Akidoproctus* Piaget.

DD Front convex, truncate, or rarely with a curving emargination, but never angularly notched.

E Species broad and short, with large, movable trabeculæ (at the anterior angle of antennal fossa).

F Forehead with a broad transverse membranous flap projecting beyond lateral margins of the head in the male, barely projecting in the female..... *Giebelia* Kellogg.

FF Without such membranous flap..... *Docophorus* Nitzsch.

EE Species elongate, narrow, with very small or no trabeculæ.

*Nirvus* Nitzsch.

BB Antennæ differing in the two sexes.

C Species wide, with body elongate-oval to suborbicular.

D Temporal margins rounded; last segment of abdomen roundly emarginated; antennæ of male without appendage; third segment very long..... *Eurymetopus* Taschenberg.

DD Temporal margins usually angulated; last segment of abdomen convex, rarely angularly emarginated, with two points.

E First segment of antennæ of male large, sometimes with an appendage; third segment always with an appendage.

*Goniodes* Nitzsch.

EE First segment of antenna of male enlarged, but always without appendage; third segment without appendage; last segment of abdomen always rounded behind.

*Goniocotes* Nitzsch.

CC Species elongated narrow, sides subparallel.

D Third segment of antenna of male without an appendage.

*Ornithobius* Denny.

DD Third segment of antenna of male with an appendage.

E Front deeply angularly notched.. *Bothriometopus* Taschenberg.

EE Front not angularly notched.

F Forehead with a broad transverse membranous flap or fold projecting beyond lateral margins of the head.

*Philoceanus* Kellogg.

FF Without such membranous flap.

G Antennæ and legs long; a semicircular oral fossa.

*Lipeurus* Nitzsch.

GG Antennæ and legs short; oral fossa narrow, elongate, extending as a furrow to the anterior margin of the head..... *Oncophorus* Rudow.

#### ANALYTICAL KEY TO GENERA OF THE SUBORDER AMBLYCERA.

A Tarsi with one claw; infesting mammals (family Gyropidae)... *Gyropus* Nitzsch.

AA Tarsi with two claws; infesting birds (excepting *Boopis*?) (family Liotheidae).

B Ocular emargination distinct, more or less deep.

C Forehead rounded, without lateral swelling; antennæ projecting beyond border of the head..... *Colpocephalum* Nitzsch.

CC Forehead without strong lateral swellings.

D Antennæ projecting beyond border of the head; temporal angles projecting rectangularly; eye large and simple..... *Boopis* Piaget.

DD Antennæ concealed in groove on under side of the head; temporal angles rounded or slightly angular; eye divided by an emargination and fleck.

E Mesothorax separated from metathorax by a suture.

*Trinoton* Nitzsch.

EE Meso- and metathorax fused; no suture.

*Læmbothrium* Nitzsch.

BB Ocular emargination absent or very slight.

C Sides of the head straight or slightly concave, with two small projecting labral lobes..... *Physostomum* Nitzsch.

CC Sides of the head sinuous; forehead without labral lobes.

D Ocular emargination filled by a strong swelling; sternal markings forming a quadrilateral without median blotches.. *Nitzschia* Denny.

DD Ocular emargination without swelling, hardly apparent or entirely lacking; median blotches on sternum.

E Very large; with two 2-pointed appendages on ventral aspect of hind head; anterior coxæ with very long lobe-like appendages..... *Ancistrana* Westwood.

EE Small or medium; without bipartite appendages of hind head..... *Menopon* Nitzsch.

#### PHILOCEANUS gen. nov.

In a collection of Mallophaga taken by Mr. Rollo Beck from birds of the Galapagos Islands (the collecting of birds and parasites was done by Mr. Beck in the summer of 1901), are five specimens, including one male, three females, and one young, from a single specimen of *Procellaria tethys* (Wenman Id.) of a Mallophagan species not assignable to any of the known genera. The shape and habitus of whole body and the secondary structural differences between the sexes, shown in antennæ and abdominal segments, are those of *Lipeurus*, while the well-developed and unusual transversal membranous clypeal flap is that of *Giebelia*. The curious prolongation of the postero-lateral angles of the mesothorax is a character peculiar to the new genus. As *Giebelia* with its short, broad body and antennæ similar in both sexes stands to *Docophorus*, so the new genus, which may be called *Philoceanus*, with its elongate body, and differing antennæ, stands to *Lipeurus*.

The characteristics of the new genus may be given as follows: body Lipeuroid, elongate; head, thorax and abdomen of about

equal width (in widest places); antennae differing in the sexes, that of male having an appendage on third segment; abdomen of male narrower than in female, parallel-sided, and with segments 6-8 each about twice as long as each of preceding segments; head with a broad, thin, transvenal, membranous clypeal flap projecting far on each side of forehead in an angulated and folded process; metathorax with postero-lateral angles conspicuously

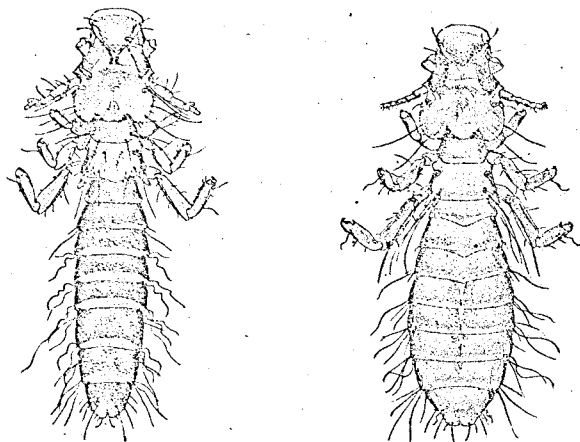


FIG. 1. *Philoceanus becki*, male. FIG. 2.) *Philoceanus becki*, female.  
(Length, 1.6 mm. (Length, 1.5 mm.)

produced into tapering, blunt-pointed, backward-projecting processes.

*PHILOCEANUS BECKI* sp. nov. (Figs. 1 and 2.)

Five specimens (one male, three females, one-immature) taken from *Procellaria tethys* (one specimen) Wenman Id. of the Galapagos group, summer of 1901, by Mr. Rollo Beck.

*Description of Male.*—Body, length 1.6 mm., width .27 mm. (abdomen), pale yellowish brown, with darker to blackish-brown marginal and transverse bands which cover so much of the surface as to give the posterior half of the body a general dark brown coloration.

Head, length .4 mm. width .3 mm., large in comparison with rest of body, wider than any other part of body, and conspicuously large, *i. e.*, wider and longer than the thorax; clypeal front broad, flatly convex and with distinct thin uncolored rounding margin; clypeal sutures distinct, broad, and with two conspicuous hairs at the marginal termination; these clypeal sutures form a V-shaped figure enclosing the distinct clypeal signature between the anterior prongs; the clypeus bears a conspicuous mem-

branous flap or fold, thin and uncolored, which rises from about in transverse line with the mandibles and projects forward to the point of the clypeal sutures, and laterally conspicuously beyond the margins of the head; in these lateral extensions the flap is folded back (towards the head margin) on itself; eye with rather long hair; the temples are not much swollen and each bears two long and a few short hairs; the antennae (Lipeuroid) have the first segment as long as all the others combined and the third segment with an appendage; the ground color of the head is pale translucent yellowish-brown with the clypeal signature, a broad submarginal angulated band on each side of head, extending from clypeal suture to base of antennae, darker brown.

Thorax small; prothorax with rounded postero-lateral angles with two separated longish hairs in each; metathorax a little wider and about twice as long, with postero-lateral angles conspicuously produced as thick, tapering, blunt pointed, finger-like processes, a long hair rising from base of each process and another not so long and two or three short ones rising from general postero-lateral angular region; posterior margin of metathorax slightly angulated in the middle and slightly concave in the space between this median angle and the postero-lateral angle; color pale translucent yellowish-brown with darker rather broad lateral margins.

Abdomen elongate, rather narrow, subparallel-sided; segments 1-5 each about one half as long as segments 6-8; long, flexible curling hairs in postero-lateral angles of segments 2-7, and terminal segment with many short fine hairs; pale yellowish-brown ground color almost wholly obscured by strong dark to blackish-brown lateral and transversal bands.

*Female.*—About same size as male but with abdomen wider (.4 mm.) in the middle and thus not parallel-sided; ground color of whole body less pale and translucent than in male; head with transversal clypeal flap as in male; antennae without appendage on third segment and with first segment shorter than second; thorax with postero-lateral finger-like processes of meta-segment and with three or four long hairs in postero-lateral region; abdomen with second segment longest, others about equal among themselves, and segments 4-6 (in middle of abdomen) wider than others, so that the whole abdomen is elongate elliptical in outline; last segment with slight angular median emargination on posterior margin.

*NESIOTINUS* gen. nov.

A single female Mallophagan specimen of well-defined character received from Dr. G. Enderlein, of Berlin, proves to be a form which it is impossible to ascribe to any known genus of the order. This specimen was taken from *Aptenodytes longirostris*, a new penguin species from Kerguelen Id., collected by the German Deep-sea Expedition in 1899.

This new Mallophagan form unites in striking manner the important antennal characters of the family Philopteridae with the general habitus and body characters of the family Liotheidae. The shape of head, and the distinctly free metathoracic segment are characteristics heretofore peculiar to the genera *Menopon* and *Trinoton* (of the Liotheidae), but the short, slender, five-segmented antennae not lying in special antennal cavities identify the species as a Philopterid, but one not assignable to any known Philopterid genus. The new form represents a *Menopon*- and *Trinoton*-like

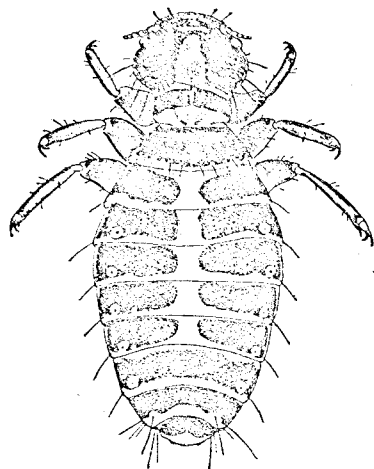


FIG. 3. *Nesiotinus demersa*, female.  
(Length, 5 mm.)

genus in that family to which *Menopon* and *Trinoton* do not belong! The only other Mallophagan species taken from the penguin genus *Aptenodytes* is *Goniodes brevipes*, a small species very unlike this new form, described by Giebel (from a female specimen) in the *Phil. Trans. Roy. Soc.*, Vol. 168, extra Vol. This specimen also came from Kerguelen Id.

The distinguishing characters of this genus are its *Menopon*-like form, the small suborbicular head with slightly-produced subrectangular temples, the distinctness of the meso- and meta-thoracic segments in a degree unequalled elsewhere among the known Mallophaga unless it be in *Trinoton*, the very small characteristically Philopterid antennae, the sharp division of each eye into practically a pair of eyes, the large size of the hind body in comparison with the head, the heavy transverse blotches of the abdomen and the five pairs of abdominal spiracles instead of the usual six pairs.

NESIOTINUS DEMERSA sp. nov. (Fig. 3.)

*Female*. — Body, length 5 mm., width 2.1 mm.; head, length .75 mm., width 1.15 mm.; thorax, length 1.25 mm., width of prothorax .8 mm., width of mesothorax 1.30 mm., width of widest segment, the first, 2.16 mm.; chestnut brown, with large blackish-brown blotches on thorax and abdomen.

Head small in comparison with rest of body, hardly as wide as mesothorax, with flatly rounded front, no orbital sinus, temples slightly swollen, rounded, but with postero-lateral angle slightly obtusely produced, occipital margin slightly curving; eyes divided so as to give the effect of one pair on each side; antennae short, slender, tapering; pustulated hairs on temporal margins and two small hairs with large pustulation on dorsal surface of each temple, also four smaller pustulations on postero-median dorsal surface, and one mesad from each eye pair; color chestnut-brown with blackish eye flecks and dark brown markings along temporal margin and in postero-mesial angles of each temporal region.

Thorax of three distinct segments regularly widening posteriorly, the meta-segment being nearly as wide as first (widest) abdominal segment and resembling an abdominal segment; prothorax with slight median angulated point on anterior margin, with parallel straight lateral margins and rounded antero-lateral and postero-lateral angles, anterior half dark brown, posterior half light brown; mesothorax with diverging lateral margins, small pustulated hairs in angles and flatly rounding posterior margin: anterior four fifths of segment dark brown with series of weak hairs in demi-pustulations along the hind margin of this dark region; metathorax with diverging lateral margins, and with large lateral transverse dark brown blotches leaving a rather narrow light brown median space. Legs with heavy short femora and long slender tibiae with few short, weakly pustulated spiny hairs on each segment; two terminal tibial spines; femur darker than the translucent pale brown tibiae.

Abdomen forming with meso- and metathorax an ellipse; segments 1 and 2 widest and others tapering slowly posteriorly; hairs few and inconspicuous; segments 1-5 with conspicuous spiracles each showing as a small brown spot in a large clear circular pustulation; segments 1-4 with large lateral transverse dark brown blotches leaving a lighter median space which is narrower on each successive segment posteriorly; segments 5-7 with dark-brown transverse bands extending clear across body; all transverse blotches and bands blacker and slightly wider at lateral ends, with slight anteriorly projecting process; indications of demi-pustulations in lateral portions of posterior margin of each blotch and band; posterior margin of terminal segment flatly rounded, and longest hairs of the body in lateral angles.

NOTE. — In a paper published while this paper was in press, on the Mallophaga from Birds of Costa Rica (*Univ. Studies*, Vol. 3, pp. 123-197, 1903, *Univ. Nebraska*) M. A. Carriker, Jr., describes two new genera of Mallophaga, under the names *Ornicholax* and *Kelloggia*.