Studies on Ischnoceran Mallophaga Parasitic on Turdidae (Sens. Lat.)

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INTRODUCTION

The Mallophaga are obligatory parasites occurring both on mammals and birds. Their whole life cycle, from generation to generation may be spent on one host individual. The host and the parasite are so closely associated that the louse normally do not willingly leave so long as their host is alive. During close contact between similar hosts, however, the exchange of the parasites may ordinarily take place. The eggs are glued to the hairs and feathers. The nymphal instars are all found on the host. The adults and nymphs of Ischnoceran Mallophaga in particular, are in the habit of firmly holding hair or the barbule of a feather with the mandibles and on the death of the host they also die in this position. This closer host-parasite association has given rise to the following conditions.

These insects are poorly equipped for transfer from one host to the other in general. Sensory response of lice are such as to deter them from leaving the living host. Their negative response to bright light and to changes of humidity and their positive response to rough texture and to temperature approximately of the host, tends to keep them within the feathery (or hairy) covering of the host. Their positive response to smell of the host coupled with the above requirements have probably made them highly specific.

Favourable opportunities for the natural transfer of lice from host are intraspecific. The actual contact of the males and females during copulation is probably the most orthodox method for the spread of these parasites. Transfers from parents to the nestlings take place during the breeding season. Huddling together of the gregarious birds also offer conditions for the walk over of the parasites from one bird to the other.

Apart from the above methods, the Ischnoceran Mallophaga have been frequently observed utilising more mobile insects to provide them transport. The Hippoboscid flies play an important role in taking louse from one host species to another (Clay and Meinertzhagen 1943; Ansari 1946). The lice carried away by these means meet one of the following possibilities. In cases where the transporting agency is also specific the louse is apt to reach its normal host and resume the normal life. This method cannot be regarded regular means of transfers but may serve the purpose of occasional, though important, method of dispersal. The unlucky individuals which are carried to an unsuitable host, widely different from that which constituted their normal habitat would probably die of starvation or poison. On the other hand the lice transferred to an abnormal host closely related to original host will find suitable food. This new host may be either already parasitised by lice nearly related to the imported individual or may be infested with lice of its own. In the former case, crossing between the two species will tend to produce an abnormal proportion of males and many gymandromorphs (Bacot 1912, Keilin and Nuttal 1919). Such a strain will be weak and therefore survive for a very short period.

Frequently the lice occurring on the prey have been recorded from the predator. We collected a female specimen of the head louse of chickens [Cucullo-gaster heterographus (Nitzsch)] from the pariah kite (Milvus migrans gowinda Sykes) (Ansari 1947). Such migrations will be comparatively easier where the victim is brought to the nest for the young predator.

The parasites of the foster parents may also move to the brood parasite. Miss
Clay and Col. Meinertzhagen (1943) recorded on *Ornithomyia avicularis* Linn. a female *Brucella merulensis* (Denny) (a parasite of the blackbird—*Turdus m. merula* Linn.). The Hippoboscid fly was collected from a juvenile specimen of *Cuculus c. canorus* Linn. They also noticed one female of *Brucella merulensis* (Denny) and two females of *Philopterus* sp. (probably *P. excisus* Nitzsch, a parasite of the house martin—*Delichon urbica* (Linn.)) from a recently fledged cuckoo picked up dead in a forest. It is interesting to know that in spite of optimum conditions of migration by contact, the lice of the passerine hosts (foster parents) have not been able to establish themselves on the cuckoos (brood parasites) (Ansari 1949). This condition strengthens the view that these insects are undoubtedly ‘most specific’ of all the ectoparasites.

The common dust bath may also play an important role for the dispersal of lice from one bird to the other. Birds roosting together, basking together or sharing common nests, living together or in close proximity under domestic conditions or in zoological gardens may also exchange their parasites. The normal parasites of chickens, *Lipeurus caponis* Linn. for example, have been frequently collected by us from guinea fowls (*Numida meleagris domestica*) and turkey fowls (*Meleagris gallopavo domestica*).

From what has been said above it is inferred that there are usually minimum chances for any given individual to miss a suitable host. The extra-specific movements of the parasite are however negligible. The close host-parasite association and remote chances of missing a suitable host, has reduced the rate of reproduction in these insects to a bare minimum (Martin 1934, Ansari 1939, Wilson 1934-1939).

The long practice of these insects of spending entire life, from generation to generation on the body of one host species, has made them very conservative and has been a strong factor for the development of a very high degree of host specificity in these ectoparasites. Under natural conditions, their survival period after the death of the host is very brief. In high temperature incubation, however, one can keep them for several months (Martin 1934, Ansari 1943).

The reasons, as to why a lice normally cannot flourish on any abnormal species of host, are many and varied. The chemical constitution of blood, skin and plumage of the unnatural host is such that its body not only does not provide an attractive source of food but may possibly provide actual lethal conditions for the straggling parasite (Baker 1931). Texture of the barbules of the host probably also play an important role in this connection. Hopkins (1949) has pointed out that lice are unable to work in hair of a widely different texture from that to which they are accustomed.

The association of lice with their hosts are of extraordinary interest but our knowledge of them is rather meagre. In many groups of Mallophaga, it is the normal rule that every host species has its own species or subspecies of louse and in certain groups of hosts, it sometimes even found that each subspecies of host is infested by different species or subspecies of Mallophaga. When the higher categories of the host are taken into consideration, it is found that almost every major division has its own characteristic group or groups of lice. It is normally, therefore, possible to tell the host from the Mallophagan parasites and *vice versa*. It follows that if the systematic position of a host is in dispute, the examination of its Mallophaga may provide a very valuable evidence to its correct status.

It will not be out of place to mention that there are several factors which limit the utility of Mallophaga as evidence for the phylogeny of their hosts. Hopkins (1949) and Clay (1950) have discussed instances of secondary absence, secondary infestation, convergent or parallel evolution and bad taxonomic work in this connection.

It is obvious that unless the relationship between the genera of Mallophagan species themselves are correctly evaluated any deduction of host relationship will be invalidated (Clay 1950). It is both
interesting and important point to know that most of the Ischnoceran genera are basically similar in both internal and external characters and are distinguished from each other by very minor characters. Some of these genera are widely distributed and obscure the host relationship. To achieve far-reaching conclusive results from systematic work of Mallophaga an extensive study of one genus occurring on one particular host-group is imperative.

Before beginning any systematic work, it is necessary to frame some sort of definition of what we mean by a species. Ferris (1930-1935), Huxley (1940) and Hopkins (1949) define it as "a group of individuals so separated genetically from all other such groups that it would not form with any of them a single permanently interbreeding community if given the opportunity in natural conditions." A species is therefore a group of individuals capable of forming a single interbreeding community and the major differences are regarded as evidence of specific value. What character or characters are of specific value is difficult to fix. However we have found small difference in size and proportion of body segments, genital armature, degree of chitinisation and pigmentation of subspecific value when the specimens come from different host. The shape of the subgenital plate in the female and the chaetotaxy of vulvar plate may some times help in separating subspecies. When these differences are greater, they may be called specific. The shape of the head, abdominal chaetotaxy, characters of the preantennal region and hind head always provide sufficiently reliable clue to a good species. It will not be out of place to mention that the term subspecies should in no case be used as waste paper basket for controversial forms. This procedure normally introduces errors (Colloss 1954).

The males and the females superficially resemble each other in most Ischnoceran Mallophaga. The antennae, however, bow sexual differences, dorsal abdominal chaetotaxy and last abdominal segments exhibit sexual variations. The females of several closely related species are identical in all respects. It is, more than frequently, most difficult to relegate a particular female specimen to the proper species unless the evidence is at hand to demonstrate that it was collected from the host from which the opposite sex is available. Males are easily distinguishable and therefore are used as type in all the specimens heretofore described.

In the present report, all the measurements were made by means of stage micrometer (E. Leitz). The measurements of typical male and female are given as indication of general size and proportion of sexes. All the linear measurements were taken along the mid line. The length of the preantennal region represents distance from the anterior margin to the origin of the antennae. The region beyond is taken as hind-head. The maximum transverse measurement of the respective body parts is given as width. The cephalic index (preantennal and hind-head index) represents the ratio of the length to the width of head (preantennal region and hind-head).

Holotype (male) and allotype (female) are in the collection of Mr. M. A. Carriker Jr. Paratypes are deposited in the author's collection. All the text-figures were drawn from the type material.

ACKNOWLEDGEMENTS

It is our pleasant duty to record our indebtedness to Miss T. Clay (Department of Entomology, British Museum: (Natural History, London) for suggesting the work and placing an extensive collection of Brueillia species occurring on Turdidae at our disposal. We had the privilege of studying New World material loaned to us by Mr. M. A. Carriker Jr. The help received from him is acknowledged with gratitude. Our thanks are also due to Mr. Saleim Rahman for inking the figures and to Mrs. Zohra for relieving us of much mechanical work entailed in the preparation of this paper.

GENUS BRUELIA KELLER

Bruelia Keller 1936, a genus of Ischnocera, was sliced off from the unwieldy old genus Degeeriella Neumann 1906 (Nom. Nov. for Nirmus Nitzsch 1818 nec Hermann 1804). It occurs on Trogoniformes (Trogonas), Coraciformes (Momotoides
and Meropidae), Piciformes (Capitonidae and Picidae) and Passeriformes. The fact that families belonging to varied orders are parasitised by species of the genus also occurring on Passerines, suggests some basic relationship between them. A striking likeness of the structure of the feathers of some avian orders has been already shown by Chandler (1916). This evidence also lends support to the phylogenetic relationship of these families.

The Mallophaga have a host-wise and not a geographical distribution. Hopkins and Clay (1952) listed about 125 valid Brueelia species. Because of the smaller numbers of specimens and species available for study to any single worker, it has been and still is impossible to prepare a thoroughly comprehensive revision of the genus. The most feasible procedure to obtain significant results seems to study the genus from the individual host-groups. We have been fortunate in securing a considerable number of species of this interesting group. At the suggestion of Miss Theresa Clay, we initiated the study of this type of lice in 1932. We first studied Brueelia species of Corvidae. Our second plan covered Brueelia species occurring on True Thrushes. In the present communication we have dealt with the collection from Turdidae of the new world.

Brueelia is one of the most intricate genus and presents considerable difficulty in the recognition of species. The main causes of the difficulty are the brief and incomplete description of the species erected by earlier workers. Typical material from any one host group available for comparison is scarce in the world's best Natural History Museums. Some forms are distinct and are easily recognised while others from closely related host are most difficult to be split. The more we study this fascinating genus, the more we are convinced that we are dealing with a large number of species composed of numerous very closely related subspecies. Many of these species are typical and may split up into easily recognisable subspecies while others differ very slightly among themselves. This fact seems important to interpret the phylogenetic relationship of the host themselves. We have not expressed any opinion in this respect since we think it too early to draw any conclusion at this stage. Our knowledge from all the avian hosts of this genus is so far much less extensive and the evidence now in hand from Corvidae and Turdidae does not help us to express any opinion. The superficial resemblance between the parasites from distinctly related avian families call for more serious studies.

This genus to our way of thinking is still unwieldy. As far as the characters of the abdomen are concerned, these species form a compact group but show a considerable diversity in the characters of the preantennal region. A series of species are with entire marginal carina and no anterior plate. Other species fall in a group with medianly and laterally interrupted marginal carina and well-developed anterior plate. In those with entire marginal carina, the median is either less heavily sclerotised or indented, and the anterior margin at this point is hyaline. In the indented part of the marginal carina, there is always a triangular sclerotised area. In some species, however, there is a distinct dorsal suture which cuts off a simple anterior plate. The dorsal suture may or may not pass across the head. In the latter case, the posterior part of the anterior plate is continuous with the dorsal sclerotisation of the head. Clay (1951) has stated that any attempt to separate these species on the head characters alone would mean the erection of five or six genera which would not only grade into each other but completely obscure the relationships and in some cases would mean the association of a number of species not forming a natural group.

The Brueelia species also exhibit a variety of male genitalia. The abdominal chaetotaxy is also not of uniform pattern. A true picture will only be available when all the host families are adequately studied. To make any change at this stage will probably add to the confusion.

The females of the closely related groups are indistinguishable from each other. The older workers on Mallophaga neither understood the value of male
genitalia as specific criteria nor possessed a medium for preserving their specimens in such a way that the genitalia could be effectively studied. The result of this was that most of the old species are composit. A monoxenous species is frequently alleged to occur on several species of unrelated hosts. We have recognised all species on the characters of male specimens alone.

Hopkins and Clay (1952) do not consider Corvonirmus Eichler 1944, Meropisiella Conci 1944, Poinjunirmus Ansari 1947, Trathoriiella Ansari 1947, Guimaraesitella Eichler 1949, and Xobugirado Eichler 1949 separable from Bruelia Keller 1936. As far as the preantennal region is concerned, these groups intergrade completely but when further studied, it is felt that some of them may turn out to be excellent subgenera.

**KEY TO THE SPECIES OF BRUELIA OCCURRING ON TURDIDAE**

1. Head more or less square or subpentagonal. Forehead more or less twice as broad long ............Bruelia carrikeri sp. nov.
   Head oblong or conical. Forehead less than quarter to two times as broad as long ..................2

2. Head pointed, wedge-shaped. Small species......Bruelia pointu sp. nov.
   Head parabolic or truncate in front. Longer species....................3

3. Head nearly resembling a cone, frontal margin parabolic. Male genitalia long and narrow.............4
   Head truncate. Male genitalia long and broad.....Bruelia busharai sp. nov.

4. Preantennal region narrow (index 1: 1.71). Mesosome and parameres long. Subgenital plate smoothly rounded.....Bruelia saghirae sp. nov.
   Preantennal region comparatively wider (index 1: 1.52). Mesosome and parameres small. Subgenital plate in female pointed.....Bruelia capitus sp. nov.

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**1. BRUELIA CARRIKERI SP. NOV.**

*(text-fig. 1: a-e)*

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**Male (holotype) 1.50 × 0.60 mm.** Head 0.45 × 0.48 mm., cephalic index 1: 1.06, squat. Preantennal region 0.21 × 0.40 mm. index 1: 1.91. Frontal region broad, straight or slightly concave in the middle, marginal carina entire and depressed in the middle, anterior margin of the head at this point hyaline. Ventral carina well formed, continuous with the preantennal carina. Hind head 0.24 × 0.48 mm., index 1: 2, marginal carina and ocular nodus well developed and narrow. The number and arrangement of the cephalic setae as described by Clay (1951). Prothorax 0.10 × 0.28 mm. with a long posterolateral seta.
Pterothorax 0.16 × 0.44 mm., trapezoidal, broadly angulate over abdomen, laterally divergent with 5 long setae on the dorsal posterior margin, one long and a short latero posterior seta arising ventrally. Abdomen elliptical, 0.82 × 0.60 mm. Tergal plates II-IX well developed, interrupted in the middle, paratergal components well pigmented, II-VIII with one long seta, IV-V with one post-spiracular seta, VI-VIII with 2 post-spiracular setae; IV with one long, one short, one long, 3 short and one long seta on each side of the middle line. Pleural plates simple, rod like. II-III bare, others with 1-3 long setae, Male genitalia well developed of the pattern shown in the figure. 0.45 mm. long, basal plate 0.3647 mm. long, anterior width 0.1735 mm., posterior width 0.1529 mm.; mesosome well sclerotised, 0.1412 × 0.1028 mm.; parameres short and simple, 0.0917 mm.

One specimen of female from Turdus olivater sanctae-martae (Todd) closely resembles the male described above. We have pointed elsewhere that the female of the allied species are commonly indistinguishable from each other. It is always the male which is reliable for establishing a species. The description of this specimen is given here with a view to provide the probable description of the female of this group. It is not at all claimed that it is conspecific.

**Female**: 1.83 × 0.73 mm. Head 0.46 × 0.50 mm., cephalic index 1 : 1.08. Preantennal region 0.21 × 0.44 mm., index 1 : 2.1. Hind head 0.25 × 0.5 mm., index 1 : 2, prothorax 0.12 × 0.31 mm. Pterothorax 0.16 × 0.46 mm. Abdomen 1.13 × 0.73 mm. Tergal plates II-VIII with one long seta on each side of the middle line. IV-VII with one post-spiracular seta, IX with 3 setae on each side. Pleural plates II and III bare, IV-V with one, VI-VII with three, VIII with 4 and IX with 4 long and 8 short setae. Subgenital plate well developed, vulvar plate with 8 setae on each side.

**Material examined**: Holotype (male) from Turdus serratans; atrosericus (Lafresnaye), Venezuela (Tabay), Carriker 28668, July 11, 1922. One female from Turdus olivater sanctae martae (Todd), Columbia (Vista Niere, Magdalene), Carriker 7009, October 2, 1945.

### 2. BRUELIA Pointu SP. NOV.

(text-fig. 2, a-e)

**Male** (holotype) 0.93 × 0.42 mm. Head 0.33 × 0.32 mm., cephalic index 1 : 0.97. Preantennal region 0.18 × 0.24 mm., index 1 : 1.33, forehead extremely narrow in front, marginal carina interrupted both in front and laterally, dorsal plate not well developed. Ventral carina well developed. Hind head 0.15 × 0.32 mm., index 1 : 2.13. Head chaetotaxy as given by Clay. Prothorax 0.07 × 0.21 mm., lateral angle furnished with one seta. Pterothorax 0.12 × 0.29 mm., moderately diverging posterior angle broad, one-third of the postero lateral margin with five long setae. Abdomen 0.67 × 0.42 mm., tergal plates well formed, interrupted in the middle, II-VIII with one tergo-central seta on each side, IV-VI and VIII-IX with one post-spiracular seta. VII with one short and one long post-spiracular seta, IX with 2 fine short setae in the middle, X-XI with 3 short setae on anterior and one posterior long seta. Pleural plates simple, II-III bare; IV-V and IX with one seta, VI-VIII and last segments with 2 setae. Male genitalia well developed, of the pattern shown in the figure, 0.149 mm. long, basal plate 0.129 mm. long, anterior width 0.084 mm. posterior width 0.056 mm., Mesosome 0.0513 × 0.054 mm. Parameres 0.041 mm.

**Female** (allotype) similar to male. 1.38 × 0.46 mm. Head 0.34 × 0.36 mm., cephalic index 1 : 1.06. Preantennal region 0.18 × 0.27 mm., index 1 : 1.50. Hind head 0.16 × 0.36 mm., index 1 : 2.25. Prothorax 0.08 × 0.21 mm. Pterothorax 0.14 × 0.32 mm. Abdomen 0.84 × 0.46 mm., abdominal chaetotaxy as in Brueelia saghirae. Vulvar plate as shown in the figure.

**Material examined**: Holotype (male), allotype (female) and paratypes (one female on slide 5142 and another on separate slide in my collection) from Turdus n. nudigenis Lafresnaye, Trinidad Is. (Heights of Aripo), Carriker 5142, August 25, 1909.
Fig. 2. Bruelia pointu (a) dorsal and ventral aspects of male, (b) male genitalia, (c) various aspects of mesosome, (d) paramere, (e) portion of female subgenital plate.
3. **BRUELIA BUSHARAE SP. NOV.**

(text-fig. 3 : a-f)

*Male* (holotype) 1.32×0.43 mm. Head 0.41×0.38 mm., cephalic index 1:0.93, conical with narrow clypeal region. Preantennal region 0.20×0.27 mm., index 1:1.35, forehead concave, marginal carina interrupted in front and on the side, clypeal signature (dorsal plate) well formed, concave in front and rounded posteriorly, ventral carina entire. Hind head 0.21×0.38 mm., index 1:1.81. Temporal carina well formed, narrow. Prothorax 0.09×0.21 mm., latero-posterior angle rounded, with one seta. Pterothorax 0.14×0.33 mm., diverging laterally, posterior margin almost rounded or obtusely angulate on the abdomen, lateral angle with a small and a long seta followed by 5 subequal setae, confined towards lateral one-third. Ventrum with one seta on each side of the sternite. Abdomen 0.73×0.43 mm., ovate, tergal plates II-VII quadrilateral, VIII-IX steadily narrowing towards the middle, all interrupted in the middle, II-VIII with one median seta on each side in the middle, IV with one long post-spiracular seta, V-VII with one small and one long post-spiracular seta, VIII with 3 long posterior setae; IX with one small, 3 long and 3-4 minute setae on each side, X with 2 small and a minute seta in the anterior row and 3 long setae in the posterior row. Paratergal plates and pleural plates well developed, pleural plates rod like with prominent re-entrant heads, II-III bare, IV-V and IX with one VI-VII and X-XI with 2, VIII with 3 long setae. Sternal plates as in other species, II-VI with one posterior seta on each side. Male genitalia well developed, 0.198 mm. long, basal plate 0.160 mm. long, anterior width 0.01 mm., posterior width 0.008 mm. long. Meso- some 0.0703×0.07 mm., well developed with central penis. Parameres 0.0594 mm. long, of the shape in the figure.

Fig. 3. *Bruelia busharne* (a) dorsal and ventral aspects of male, (b) male genitalia, (c-d) various aspects of mesosome, (e) various aspects of parameres, (f) portion of female subgenital plate.
Female (allotype) resembles male, from which it differs in the dorsal abdominal chaetotaxy and last abdominal segments. 1.73×0.48 mm. Head 0.44×0.41 mm., cephalic index 1: 0.932. Preantennal region 0.20×0.31 mm., index 1: 1.55. Hind head 0.24×0.41 mm., index 1: 1.81. Prothorax 0.10×0.25 mm. Pterothorax 0.18×0.37 mm. Abdomen 1.03×0.48 mm. Tergal plates II-IX with one median seta on each side, IV-VI and VIII-IX with a post spiracular seta, VII with two post-spiracular setae. Pleural plates IV and V with one, VI-VII with 2, VIII with 3 and IX with 6-7 ventral short setae, and 3 long setae on the side. Vulvar plate as shown in the figure with 12 setae on each side.

Material examined: Holotype (male), allotype (female), paratypes (one male and one female) from Entomestes leucotes (Tschudi), Peru (Huacapistana), Carrker 343-4, December 8, 1929.

4. BRUELIA SAGHIRAE SP. NOV. (text-fig. 4: a-e)

Male (holotype) 1.66×0.52 mm. Head 0.40×0.39 mm., cephalic index 1: 0.91, conical. Preantennal region 0.21×0.32 mm., index 1: 1.52, clypeal region rounded in front, slightly convex laterally, marginal carina well developed and well pigmented, interrupted in front and laterally, clypeal signature well formed, concave in front, sides rounded, posterior margin convex. Hind head 0.19×0.39 mm., index 1: 2.05, temples almost straight, carinae well developed. Prothorax 0.12×0.25 mm., with one elongate seta in the latero-posterior angle. Pterothorax 0.15×0.36 mm., median posterior angle well marked; latero-posterior angle with one small and one long seta followed by 5 long setae on each side. Pterothoracic sternite well formed, with a single, small anterior seta on each side. Abdomen 0.96×0.52 mm., tergite II-VIII rectangular, IX triangular and narrow, all interrupted in the middle, II-VIII with one ergo-central seta; IV-V, VIII and IX with one ergo-lateral seta, VI-VII with one short and a long post-spiracular seta; IX with one short, one long and 2 short setae on each side; X-XI with 3 short setae. Para-tergal plate swell developed and slightly heavily pigmented. Pleural plates rod-like with well developed re-entrant heads, pleural plate moderately long, II-III bare, IV-V with one VI with 2, VII with 3, VIII with 4 and IX with 2 setae. Segments X and XI fused to form a rounded lobe, furnished with 2 marginal setae on each side. Male genitalia 0.174 mm. long, basal plate 0.148 mm. long, anterior width 0.077 mm. posterior width 0.066 mm., sides more or less straight. Parameres 0.051 mm. long, of the shape shown in the figure. Mesosome 0.061×0.061 mm.
Female (allotype) 1.82×0.52 mm., similar to male in all respects, but differs from it in dorsal abdominal chaetotaxy. Head 0.41×0.39 mm., cephalic index 1:0.95. Preantennal region 0.19×0.32 mm., index 1:1.68. Hind head 0.22×0.37 mm., index 1:1.77. Prothorax 0.11×0.25 mm. Pterothorax 0.18×0.36 mm. Abdomen 1.12×0.52 mm., tergal plates IV and VIII with one tergo-central and one post-spiracular seta on each side. IX with one long, one short and one long seta on each side. Segment X+XI fused and with a short seta on the ventrum. Subgenital plate of the shape shown in the figure, vulvar plate with 10+12 marginal setae.

Material examined: Holotype (male), allotype (female), paratype (one female) in Carriker collection and one male and one female in Ansari collection from Turdus serranus fuscobrunneus, (Chapmann), Columbia (Ventana: Valdivia), Carriker 13806, July 7, 1948.

5. BRUELIA SAGHIRAE VAR. CAPITUS NOV.

(text-fig. 5 : a-c)

This species resembles Bruelia saghira from Turdus serranus fuscobrunneus (vide sup.) very closely and can be separated by the head and dorsal chaetotaxy of the IX abdominal segment.

Male (holotype) 1.56×0.52 mm. Head 0.41×0.42 mm., cephalic index 1:1. Preantennal region 0.21×0.36 mm., index 1:1.71. Hind head 0.20×0.41 mm., index 1:2.05. Prothorax 0.13×0.27 mm. Pterothorax 0.19×0.37 mm. Abdomen 0.87×0.52 mm. IX segment with one long, one short, one long, 2 short, one long one short seta on each side. Male genitalia 0.175 mm. long, basal plate 0.140 mm. long, anterior width 0.062 mm. posterior width 0.067 mm. Mesosome 0.041×0.041 mm. Parameres 0.032 mm. long.

Female (allotype) 1.80×0.57 mm. Head 0.43×0.41 mm., cephalic index 1:0.95. Preantennal region 0.22×0.36 mm., index 1:1.64. Hind head 0.21×0.41 mm., index 1:1.95. Prothorax 0.13×0.27 mm. Pterothorax 0.19×0.37 mm. Abdomen 1.10×0.57 mm. Vulva with 11-12 setae on each side.

Fig. 5. Bruelia capitus (a) dorsal and ventral aspect of male, (b) male genitalia, (c) paramere, (d) ventral aspect of mesosome, (e) a portion of female subgenital plate.
Material examined: Holotype (male) back row, left), allotype (female, back row, left), paratypes (3 males, 11 females) from Turdus fuscater quindio Chapmann, Columbia (Purace: Covea), Carriker 21255, January 23, 1952.

GENUS PHILOPTERUS NITZSCH

The species of Philopterus from Turdidæ present a general uniformity of appearance. A critical study of the male genitalia together with other structures, however, show that there are a number of easily recognisable species, and in some cases distinct subspecies are involved.

The Philopterus species described here are heavily sclerotised forms. The forehead is broad. Dorsal plate is prominent and posteriorly pointed. Tergal plates and abdominal chaetotaxy is of uniform pattern. Male genitalia showing marked specific differences.

KEY TO THE SPECIES OF PHILOPTERUS OCCURRING ON TURDIDÆ

1. Head narrow in front. Preantennal index 1 : 1.19. Temples not projecting laterally. Dorsal plate 0.23 × 0.12 mm .........
   Philopterus carrikeri sp. nov.

Head broad in front. Preantennal index 1 : 1.29-1.66. Temporal lobes laterally projecting. Dorsal plate 0.27-0.33 × 0.16-0.18 mm. ..........2

2. Distance between the anterior setae of the subgenital plate in male 0.35 mm. Dorsal plate 0.23 × 0.18 mm.
   Philopterus confusio sp. nov.
   Distance between the anterior setae of the subgenital plate 0.06-0.14 mm. Dorsal plate 0.23-0.28 × 0.16-0.18 mm. ....... 3

3. Male genitalia 0.18 × 0.46 mm. Parameres 0.027 mm. long.......
   Philopterus husinæ sp. nov.
   Male genitalia 0.26-0.29 × 0.43-0.86 mm. Parameres 0.041-0.057 mm... 4

4. Genitalia comparatively wider (0.26 × 0.086 mm.). Parameres long 0.057 mm. Distance between the anterior setae of the subgenital plate in male 0.14 mm...........
   Philopterus zerini sp. nov.

Genitalia comparatively narrow (0.27-0.29 × 0.43-0.057 mm.) Parameres shorter (0.041-0.048 mm.) Distance between the anterior setae of the subgenital plate 0.07-0.11 mm... ....5

5. Preantennal region long and narrower (0.30 × 0.40 mm.)......
   Philopterus sartajæ sp. nov.
   Preantennal region shorter and wider (0.25 × 0.41 mm.)
   Philopterus zulfi sp. nov.

6. PHILOPTERUS CARRIKERI SP. NOV.
   (text-fig. 6 : a-f)

Fig. 6. Philopterus carrikeri (a) dorsal and ventral aspects of male, (b) dorsal clypeal plate, (c) male genitalia, (d) distal portion of male genitalia, (e) female subgenital plate, (f) vulvar chaetotaxy.
Male (holotype) 1.33 × 0.56 mm. Head 0.40 × 0.42 mm., cephalic index 1 : 1.05, mm. general arrangements of sclerotised bands typical of the genus. Preamantennal region 0.26 × 0.31 mm., index 1 : 1.19 mm., dorsal plate 0.23 × 0.12 mm., anterior margin concave, projecting as far as the line passing through the eyes. Hind head 0.24 × 0.42 mm., index 1 : 1.75. The number and arrangement of the large setae as in other species. Prothorax 0.12 × 0.25 mm., latero-posterior angle with a long seta. Pterothorax 0.19 × 0.37 mm., posterior margin with a row of setae on each side, the number is not necessarily symmetrical each side of the same specimen. Abdomen 0.59 × 0.56 mm., as shown in the figure, tergal plate II approximate, III-VIII confined submarginally, IX entire, II with one solitary seta on each side in the middle and a posterior row of 7 setae, III-VI with 8, IV and V with 9, VII-VIII with 1+4, IX with one and X+XI with 3 setae on each side. Subgenital plate as shown in the figure, distance between the anterior setae 0.13 mm. Male genitalia 0.1946 mm. long, anterior with 0.0676 mm., posterior width 0.0568 mm. Basal plate 0.1297 mm. long. Mesosome 0.0541 × 0.0757 mm., transverse with well-developed median lobe. Parameres 0.0271 mm. long, small papillae furnished with a small setae.

Female (allotype) 1.72 × 0.62 mm. Head 0.53 × 0.43 mm., cephalic index 1 : 0.91. Preamantennal region 0.27 × 0.34 mm., index 1 : 1.25, dorsal plate 0.27 × 0.15 mm. Hind head 0.26 × 0.48 mm., index 1 : 1.84. Prothorax 0.15 × 0.31 mm., Pterothorax 0.21 × 0.43 mm. Abdomen 0.81 × 0.62 mm. Dorsal chaetotaxy more or less as in male, VII tergite with 7-8 setae, VIII with one seta on each side. Vulvar plate with 8-10 setae as in the figure. Subgenital plate of the shape shown in the figure, distance between the anterior setae 0.23 mm.

Material examined: Holotype (male), allotype (female) and paratypes (3 females) from Catharus fuscater sanctae-martae-maritae Ridgeway, San Migrol: Sierra Nerada (S. M. Columbia), April 23, 1914.

This species differs from other allied species; the shape of the head. The clypeal region is comparatively narrow, temporal lobes moderate, dorsal plate short and narrow. Distance between the anterior subgenital setae in male is considerably smaller than P. confusio, but almost equal to P. zerini, P. zulfi, P. sartaiae, P. husinae.

7. PHILOPTERUS CONFUSIO SP. NOV.

(test-fig. 7 : a-g)

Male (holotype) 1.60 × 0.68 mm. Head 0.61 × 0.55 mm., cephalic index 1 : 0.90. Preamantennal region 0.31 × 0.40 mm., index 1 : 1.29, more or less straight in front clypeal signature 0.33 × 0.18 mm. Hind head 0.30 × 0.55 mm., index 1 : 1.83, temporal lobes considerably projecting, gular region well developed. Prothorax 0.16 × 0.32 mm., transverse, more or less trapezoidal in shape, postero-lateral angle rounded with a single seta. Pterothorax 0.18 × 0.47 mm., considerably projecting laterally, posterior margin angulate in the middle, latero-posterior angle and posterior margin beset with 1+3 long setae. Sternites as shown in the figure, with 2 setae on each side. Abdomen 0.79 × 0.68 mm., tergal plates II-VIII triangular, submarginal, II with one solitary anterior seta and 10 setae in the posterior row, III and VII with 11-12, IV-VI with 13-14, VIII with 7 and IX with one seta on each side of the middle line. Abdominal sternites II-VIII with 2, 4, 6, 6, 6, 1, 1 seta on each side respectively. Subgenital plate as shown in the figure, distance between the anterior setae 0.35 mm. Pleural plates IV-IX with 1, 2+3, 2+4, 2+4, 2+1, and 3 setae respectively. Male genitalia 0.2459 mm. long, anterior width 0.0486 mm. posterior width 0.0676 mm. Basal plate 0.1811 mm. long. Mesosome 0.0670 × 0.0811 mm. projecting in the middle. Parameres 0.0486 mm. long, with two apical setae.

Female (allotype) similar to the male but larger. 2.11 × 0.85 mm. Head 0.65 × 0.65 mm., cephalic index 1 : 1.00, preantennal region 0.30 × 0.44 mm., index 1 : 1.47. Dorsal plate 0.30 × 0.16 mm. Hind head 0.35 × 0.65 mm., index 1 : 1.85. Prothorax 0.16 × 0.35 mm. Pterothorax 0.24 × 0.55 mm. Abdomen 1.11
×0.85 mm., chaetotaxy almost as in the male, II-IV with a solitary seta in the anterior row, II and VII with 12 setae on each side, III with 14, IV with 15, V with 11, VI with 13, VIII with 8 and IX with 2 setae on each side. Sternal plates II-IV with 5-6 setae, V-VI with 4 setae VII-VIII with one seta on each side. Subgenital plate as shown in the figure, distance between the anterior setae 0.23 mm. Vulvar plate with 2 irregular rows of 9-10 setae on each side. Pleural plates III-X with 1, 2+4, 4+2, 4+1, 5+1, 5, 1 and 3+4 setae respectively.

Fig. 7. Philopterus confusio (a) dorsal and ventral aspects of male, (b) thoracic sternites, (c) subgenital plate of male, (d) male genitalia, (e) distal portion of male genitalia, (f) subgenital plate of male, (g) vulvar chaetotaxy.
Material, examined: Holotype (male), allotype (female) and paratypes (one male and four females) from Turdus fulviventris Sclater, Venezuela (Tabayi), Carraker 28665, July 11, 1922.

8. PHILOPTERUS HUSINAЕ
SP. NOV.

(text-fig. 8: a-g)

Fig. 8. Philopterus husinae (a) dorsal and ventral aspects of male, (b) mandibles (c) male genitalia, (d) distal portion of male genitalia, (e) distal end of mesosome, (f) paramere, (g) subgenital plate of male.

Male (holotype) 1.51 × 0.49 mm. Head 0.49 × 0.50 mm., cephalic index 1 : 1.02. Preantennal region 0.21 × 0.35 mm., index 1 : 1.66, dorsal plate 0.27 × 0.19 mm. Hind head 0.28 × 0.50 mm., index 1 : 1.78. Prothorax 0.14 × 0.28 mm., transverse. Pterothorax 0.18 × 0.41 mm., trapezoidal, posterior margin rounded, latero-posterior angle with one long seta followed by 9 setae along the posterior margin. Abdomen 0.72 × 0.49 mm., elongate, tergal plate II-VIII triangular, approximate, II with 5, III with 1+5, IV-VI with 6-7, VII with 2+4, VIII with one and IX with 2 short, one long and a short seta on each side. Stermites with 3, 4, 5, 5, 5, 1 and one seta on each side. Distance between the anterior subgenital seta 0.06 mm. Pleural plates IV-X with one, 3, 5, 5, 5, 2 and 5 setae respectively. Male genitalia 0.1838 mm. long, anterior width 0.0459 mm., posterior width 0.0865 mm. Basal plate 0.1351 mm. long, presenting a peculiar feature. Mesosome 0.0727 × 0.0948 mm., posterior margin with well sclerotised struts as shown in the figure. Parameres unlike any other species rather short, 0.0272 mm. long, slender and simple papillae with an apical seta, proximal heads as in the figure.

Material examined: Holotype (male) from Turdus fumigatus obsoletus lawrence, Costa Rica (Guapiles), March 1903.

This species differs from the allied forms in the shape of the head. Male genitalia is smaller than in other species, the parameres are short, simple and slender papillae. The dorsal abdominal chaetotaxy is very much different from other species.

9. PHILOPTERUS ZERINI
SP. NOV.

(text-fig. 9: a-f)

Male (holotype) 1.73 × 0.73 mm. Head 0.57 × 0.52 mm., cephalic index 1 : 0.91. Preantennal region 0.27 × 0.39 mm., index 1 : 1.44 mm. Hind head 0.30 × 0.52 mm., index 1 : 1.73 mm. Dorsal plate 0.28 × 0.18 mm., of the shape shown in the figure. Prothorax 0.18 × 0.30 mm. Pterothorax 0.25 × 0.45 mm., posterior margin considerably projecting backwards so as to cover major portion of the abdominal segment II, latero-posterior margin with 12 long setae. Abdomen
0.84 × 0.73 mm., tergal plates II-VIII triangular, confined marginally, each with 10, 11, 11, 11, 12, 10 and 5 setae on from Turdus c. chiguango Lafr. and d’Orbig., Obrajillo (Peru), Carrick November 18, 1929.

10. PHILOPTERUS SARTAJAE SP. NOV.

(text-fig. 10: a-e)

Fig. 9. Philopterus zerini (a) dorsal and ventral aspects of male, (b) dorsal clypeal plate, (c) male genitalia, (d) distal portion of male genitalia, (e) paramere, (f) subgenital plate.

each side, tergal plate IX entire, with one seta. Ventral chaetotaxy as in allied forms. Distance between the anterior setae of the subgenital plate 0.14 mm. Male genitalia 0.2595 mm. long, anterior and posterior widths almost equal (0.0865, 0.0838 mm.). Basal plate 0.1919 mm. long, more or less parallel-sided. Parameres rather slender, nearly straight to about three-quarters where they begin to taper, tip with a small seta. Mesosome with a projecting lobe in the middle, showing distinctly different characters from the others.

Material examined: Holotype (male)

Fig. 10. Philopterus sartajae, (a) dorsal and ventral aspects of head, male, (b) dorsal clypeal plate, (c) male genitalia, (d) portion of the distal end of male genitalia, (e) ventral aspect of the last abdominal segments of female showing subgenital plate.
Male (holotype) 1.60 × 0.67 mm. Head 0.57 × 0.52 mm., cephalic index 1 : 0.91 mm. Preantennal region 0.30 × 0.40 mm., index 1 : 1.33, forehead wide, dorsal plate 0.27 × 0.16 mm. Hind head 0.27 × 0.52 mm., index 1 : 1.93. Prothorax 0.14 × 0.30 mm. Pterothorax 0.22 × 0.45 mm. Abdomen 0.73 × 0.67 mm. Subgenital plate as shown in the figure, distance between anterior setae 0.13 mm. Male genitalia 0.2676 mm. long, anterior width 0.0432 mm. Basal plate 0.2162 mm. Posterior width 0.865 mm. Mesosome 0.0513 × 0.0945 mm. Parameres 0.0405 mm. long, small papillae like with an apical seta.

Female allotype 1.95 × 0.86 mm. Head 0.63 × 0.61 mm., cephalic index 1 : 0.97. Preantennal region 0.32 × 0.44 mm., index 1 : 1.38, dorsal plate 0.30 × 0.18 mm. Hind head 0.31 × 0.61 mm. index 1 : 1.96. Prothorax 0.16 × 0.34 mm. Pterothorax 0.22 × 0.53 mm. Abdomen 1.04 × 0.86 mm., distance between the anterior set of subgenital setae 0.2 mm. Vulvar plate with 12 setae

Material examined: Holotype (male), allotype (female) and paratypes (2 males and 6 females) from Turdus nigrescens Cabanis, Costa Rica (Vol. Iraza) Carriker 16, February 1902.

11. PHILOPTERUS ZULFI
SP. NOV.

(text-fig. 11 : a-g)

Male (holotype) 1.56 × 0.69 mm. Head 0.54 × 0.55 mm., cephalic index 1 : 1.02. Preantennal region 0.25 × 0.41 mm., index 1 : 1.64, dorsal plate 0.25 × 0.17 mm., Hind head 0.29 × 0.55 mm., index 1 : 1.89. Prothorax 0.17 × 0.32 mm. Pterothorax 0.21 × 0.46 mm. posterior margin with 2+11 setae. Abdomen 0.77 × 0.69 mm., tergal plates II-VII with 11-12 setae, VIII with 6, IX with one, X+XI with one seta in anterior row and 2 setae in the posterior row on each side. Ventral plates with 6, 6, 5, 5, 5, 1 and one seta. Distance between the anterior setae of subgenital plate 0.11 mm. Pleural plates IV-X with 1+4, 5, 3, 3, 2, 1 and 3 setae. Male genitalia 0.2919 mm. long, anterior width 0.0568 mm.; posterior width 0.0702 mm. Basal plate 0.2271 mm. long, with margins straight and concave a little beyond the middle. Mesosome 0.0541 × 0.973 mm., with a horse-shoe shaped sclerotisation in the middle, margin at this point projecting as far as the parameres. Parameres 0.0486 mm. long, short and simple and project half of their size beyond the mesosome.

Female (allotype) similar to the male, 2.10 × 0.95 mm. Head 0.64 × 0.65 mm., cephalic index 1 : 1.01. Preantennal region 0.28 × 0.46 mm., index 1 : 1.64 dorsal plate 0.4 × 0.21 mm. Hind head 0.36 × 0.65 mm., index 1 : 1.82. Prothorax 0.16 × 0.36 mm. Pterothorax 0.41 × 0.55 mm. with a row of 2+11–12 setae.

Abdomen 1.16 × 0.95 mm., tergites II-V with 11, VI with 10, VII with 9, VIII with 8 and IX with one seta on each side. Ventrum with 4, 6, 6, 6, 6, 1+1 setae on each side, distance between the anterior subgenital setae 0.18 mm. Vulvar plate with 5+8+8+5 seta 4 in two irregular rows. Pleural plates IV-IX with 3, 4, 5, 4, 3, 5 setae respectively.

Material examined: Holotype (male), allotype (female) and paratypes (2 males and 3 females) from Turdus fuscater gigantodes Cabanis, Peru (Huacapistan), Carriker 1477, March 20, 1930.

GENUS STURNIDOECUS EICHLER

This genus was very recently established by Eichler (1944) for those Philopterus species which have considerably narrow clypeal region; large, narrow trabeculae, temples well projecting and rounded. The abdominal chaetotaxy is scarce, pleural plates narrow. Subgenital plate anchor-shaped. Male genitalia with long, sword-like parameres.

KEYS TO THE SPECIES OF STURNIDOECUS OCCURRING ON TURDIDAE

1. Preantennal region index
   1 : 1.44 or more.................. 2
   Preantennal region index
   1 : 1.31 or less ............. 6

2. Hind head index 1 : 2.0,
   body long and narrow,
   1.89 × 0.47 mm ................

   Sturnidoecus perunensis sp. nov.
Fig. 11. *Philopterus zuifi* (a) dorsal and ventral aspects of male, (b) male antenna, (c) male genitalia, (d) distal end of male genitalia, (e) female antenna, (f) vulvar chaetotaxy, (g) ventral aspect of the last abdominal segments of female showing subgenital plate.
Hind head index 1 : 1.86 or less. Body short and broad, 1.41-1.62×0.51-0.62 mm. .......................... 3

3. Male genitalia three times as long as the parameres...
   *Sturnidoecus regalis* sp. nov.

Male genitalia not more than 2.5 times as long as the parameres .......................... 4

4. Pterothorax with a row of 18 setae...
   *Sturnidoecus rehanae* sp. nov.

Pterothorax with a row of 24 setae .......................... 5

5. Tergal plate IX with one short, one long, 4 short, one long and 2 short setae on each side. Last abdominal segment with 6 marginal setae. Female subgenital plate oblong and pointed ..........................
   *Sturnidoecus intermedius* sp. nov.

Tergal plate IX with 2-3 long and 6 short setae on each side. Last abdominal segment with 9 marginal setae. Female subgenital plate blunt posteriorly vulvar plate with 12-13 thick and 8-10 fine seta on the posterior margin
   *Sturnidoecus carrikeri* sp. nov.

6. Hind head index 1 : 1.74. Male genitalia comparatively short and broad. Parameres narrow .... ....
   *Sturnidoecus obsoletus* sp. nov.

Hind head index 1 : 2.0, male genitalia comparatively long and narrow. Parameres comparatively well developed ............................ .......................... 6
   *Sturnidoecus incompertus* sp. nov.

12. **STURNIDOECUS PERUNENSI**
    SP. NOV.

   (text-fig. 12 : a-f)

*Male* (holotype) 1.89×0.47 mm. Head 0.47×0.48 mm., cephalic index 1 : 1.02. Premaxillar region 0.23×0.35 mm, index 1 : 1.52. Hind head 0.24×0.48 mm., index 1 : 2.0. Prothorax 0.12×0.26 mm.

*Pterothorax* 0.16×0.39 mm., posterior margin not strongly angulate, posterolateral angle with 2 setae followed by 9 setae on the posterior margin. Abdomen 0.78×0.47 mm., tergites II-IX well-developed, triangular, consisting of left and right components, II-V with four postero-central setae in each side, IV with one latero-posterior seta, V-VII with 2 such setae, VI with 2 postero-central setae, VII with one long and one short postero-central seta, VIII with 3 postero-lateral setae and one postero-central seta, IX with one short, one long followed by 6 short setae on each side, IX+XI with 3 short setae on each side. Ventral segments II-VII with one seta on each side. Pleural plates brief, II-III bare, IV with one, V and IX with 2, VI-VII with 3, VIII with 4, X+XI with 9 setae. Male genitalia 0.2946 mm. long. Basal plate 0.1757 mm. long, anterior width 0.1108 mm., posterior width 0.0892 mm. Mesosome 0.0973×0.0568 mm. Parameres 0.1108 mm. long of the shape shown in the figure, proximal heads well developed.

*Female* (allotype) 2.02×0.55 mm. Head 0.48×0.5 mm., cephalic index 1 : 1.04. Premaxillar region 0.24×0.35 mm., index 1 : 1.46 Hind head 0.24×0.5 mm., index 1 : 2.04. Prothorax 0.12×0.26 mm. Pterothorax 0.16×0.39 mm. Abdomen 0.95×0.55 mm. Abdominal chaetotaxy as in the male. VIII tergite with 1-1 setae on each side; IX with one short, one long, one short and one long seta on each side, subgenital plate of the shape as shown in the figure, squat and blunt posteriorly. The chaetotaxy of the vulvar plate differs considerably from other species, 16 thick setae in the anterior row and 4 long setae in the posterior row.

**Material examined** : Holotype (male), allotype (female) and paratypes (one male and two females) from *Turdus ignobilis debilis*. Hellmay, Peru (Meyabamba), Carriker 7803, October 2, 1933.

13. **STURNIDOECUS REGALIS**
    SP. NOV.

   (text-fig. 13 : a-h)

*Male* (holotype) 1.62×0.62 mm. Head 0.52×0.51 mm., cephalic index 1 : 0.98.
Fig. 12. *Sturnidocus perunensis* (a) dorsal and ventral aspects of male, (b) dorsal clypeal plate, (c) male genitalia, (d) various aspects of mesosome, (e) parameres, (f) subgenital plate.
Fig. 13. *Surnidoecus regalis* (a) dorsal and ventral aspects of male, (b) male antenna (c) thoracic sternites, (d) male genitalia, (e) paramere, (f) various aspects of mesosome, (g) female, antenna, (h) subgenital plate of female.
Preantennal region 0.24×0.36 mm., index 1 : 1.5. Hind head 0.28×0.51 mm., index 1 : 1.82. Prothorax 0.10×0.27 mm. Pterothorax 0.19×0.45 mm., latero-posterior angle with one long and one short seta, posterior margin beset with 12 setae on both sides of the middle line. Abdomen 0.84×0.64 mm. Tergal plates II-IX well formed, interrupted in the middle, II with 3+4 tergo-central setae on each side, III-VI with 4 such setae, VII with 2, IV and VIII with one post-spiracular seta, V-VII with 2 setae, VIII with one short, one long, one short seta on each side, IX with one short, one long and 3 short, one long and 2 short setae on each side. X-XI with 3 dorsal setae. Sternal plates II-VII with one long seta on each side. Pleural plates well developed, II and III bare IV and V with one, VI and VII with 3, VIII with 4, IX with 2 and X+XI with 5 setae on each side. Male genitalia 0.2946 mm. long. Basal plate 0.2027 mm., anterior width 0.1135 mm., posterior width 0.0919 mm. Mesosome 0.1135×0.0919 mm. Parameres 0.1027 mm. long, proximal heads well developed.

Female (allotype) similar to male, 1.93×0.61 mm. Head 0.56×0.51 mm., cephalic index 1 : 0.91. Preantennal region 0.27×0.36 mm., index 1 : 1.33. Hind head 0.29×0.51 mm., index 1 : 1.8. Prothorax 0.10×0.27 mm. Pterothorax 0.22×0.45 mm. Abdomen 1.05×0.61 mm. Dorsal chaetotaxy as in the above species. Pleural plate IX with 10 setae. Vulvar plate with 12 stout setae in the anterior row and 7 fragile setae in the posterior row. Subgenital plate of the shape shown in the figure, furnished with 5 week setae on both sides.

Material examined: Holotype (male), allotype (female), paratype (one female) from Turdus fulviventer Sclater, Venezuela (Tabey), Carriker 28665, July 11, 1922.

14. STURNIDOECUS REHANAE
   SP. NOV.
   (text-fig. 14: a-d)

Male (holotype) 1.52×0.51 mm. Head 0.49×0.46 mm., cephalic index 1 : 0.94. Preantennal region 0.24×0.35 mm., index 1 : 1.46. Hind head 0.25×0.46 mm. on each side, V with 3, VI-VII with 2, VIII with one tergo-lateral seta, IV-VII with 2 and VIII with one tergo-lateral seta, IX with one short, one long and 3 short setae on each side, last tergite with 3 short setae on each side. Pleural plates II and III bare, III with one, IV-VII with 3+4, VIII with 2 and IX with 6 long setae. Male genitalia 0.3054 mm. long, Basal plate 0.1702 mm. long, anterior width 0.1108 mm., posterior width 0.0919 mm. Mesosome 0.1108×0.0595 mm. Parameres 0.1297 mm long.

Material examined: Holotype (male: on left), paratype (one male, on right)
from *Turdus nigriceps* Cabanis, Bolivia (Samaipatai), Carriker 16472, November 10, 1937.

15. **STURNIDOCUS INTERMEDIUS** SP. NOV.

(text-fig. 15: a-f)

*Male* (holotype) 1.62×0.62 mm. Head 0.52×0.52 mm, cephalic index 1:1. Preantennal region 0.24×0.37 mm, index 1:1.54. Hind head 0.28×0.52 mm, index 1:1.86. Prothorax 0.11×0.28 mm. Pterothorax 0.19×0.45 mm, latero-posterior angle with one long and one short seta followed by 11-12 setae along the latero-posterior margin. Abdomen 0.87×0.62 mm, dorsal chaetotaxy as in *Sturnidocus rehanae*, IX tergite with one short, one long and 4 short, one long and 2 short setae on each side. Male genitalia 0.3243 mm long. Basal plate 0.1973 mm long, anterior width 0.1243 mm, posterior width 0.0946 mm. Mesosome 0.0946×0.06 mm Parameres 0.1189 mm, of the pattern seen in *Sturnidocus regalis*, squat and almost straight, proximal head very typical.

*Female* (allotype) 1.98×0.61 mm. Head 0.57×0.60 mm, cephalic index 1:1.05. Preantennal region 0.76×0.39 mm, index 1:1.5. Hind head 0.31×0.60 mm, index 1:1.93. Prothorax 0.13×0.28 mm. Pterothorax 0.19×0.48 mm, posterior margin with 10-11 setae. Abdomen 1.14×0.61 mm, dorsal chaetotaxy almost as in other species, IX pleurite with 2-7 setae on each side, terginal plate VIII with one post-spiracular and 2 tergocentral setae, IX with 2 tergo-lateral and one tergo-central setae, subgenital plate as shown in the figure, with 5 short setae, vulvar plate with 12-13 thick setae in the anterior row and 8-10 fragile setae in the posterior row.

*Material examined:* Holotype (male), allotype (female) and paratype (one female) from *Turdus olivater sanctaemartae* (Todd.), Colombia (Chinchicue), January 15, 1946, Carriker 7398.

16. **STURNIDOCUS CARRIKERI** SP. NOV.

(text fig. 16: a-h)

*Male* (holotype) 1.61×0.52 mm. Head 0.47×0.50 mm, cephalic index 1:1.06. Preantennal region 0.20×0.33 mm, index 1:1.65. Hind head 0.27×0.50 mm, index 1:1.85. Prothorax 0.12×0.25 mm. Pterothorax 0.19×0.41 mm, postero-lateral angle with 2 setae followed by 12 setae along the posterior margin. Abdomen 0.86×0.52 mm, tergites II, VI-VII with 3 tergo-central setae, III-V with 4, VIII with one tergo-central seta, IV-V and VIII with one and VI-VII with 2 tergo-lateral setae, IX with 6 short setae on each side, X+XI with 3 short setae. Pleural plates IV with one, V and IX and last with 2, VI with 4, VII-VIII with 3 setae, posterior segment with 9 setae on each side. Male genitalia 0.3057 mm long. Basal plate 0.1801 mm long, anterior with 0.1216 mm, posterior width 0.0946 mm. Mesosome 0.135×0.0676 mm Parameres 0.1379 mm long, curved inwards, proximal head typical.

*Female* (allotype) 1.98×0.61 mm. Head 0.57×0.60 mm, cephalic index 1:1.05. Preantennal region 0.76×0.39 mm, index 1:1.5. Hind head 0.31×0.60 mm, index 1:1.93. Prothorax 0.13×0.28 mm, Pterothorax 0.19×0.48 mm, posterior margin with 10-11 setae. Abdomen 1.14×0.61 mm, dorsal chaetotaxy almost as in other species, IX pleurite with 2-7 setae on each side, tergal plate VIII with one post-spiracular and 2 tergocentral setae, IX with 2 tergo-lateral and one tergo-central setae, subgenital plate as shown in the figure, with 5 short setae, vulvar plate with 12-13 thick setae in the anterior row and 8-10 fragile setae in the posterior row.

*Material examined:* Holotype (male), allotype (female) and paratype (one female) from *Turdus olivater sanctaemartae* (Todd.), Venezuela (Guameto), Carriker 27634, May 16, 1922.
Fig. 15. *Sturnidocetus intermedius* (a) dorsal clypeal plate, (b) gular and thoracic plate, (c) male genitalia, (d) paramere, (e) various aspects of mesosome, (f) subgenital plate of female.
Fig. 16. **Surnioecus carrikeri** (a) dorsal and ventral aspects of male head, (b) mandibles and pharyngeal sclerite, (c) dorsal and ventral aspects of last abdominal segments, (d) male genitalia, (e) various aspects of mesosome, (f) paramere, (g) subgenital plate of female, (h) IX pleurite setae.
Fig. 17. *Sturnidoecus obsoletus* (a) dorsal and ventral aspects of head, male, (b) male antenna, (c) male genitalia, (d) paramere, (e) various aspects of mesosome, (f) dorsal and ventral aspects of last abdominal segment, male. (g) subgenital plate of female.
thorax 0.19×0.42 mm., projecting laterally, latero-posterior angle with 2 setae, posterior margin characteristically angulate on the abdomen and furnished with 10 long setae. Thoracic sternites well developed. Abdomen 0.75×0.62 mm., ovate, with slightly projecting segments, tergites II-VIII well built, interrupted in the middle, II with 4, IM-V with 5, VI with 3, VII with 2, VIII with one tergo-central seta, IV and VIII with one, V-VII with 2 tergo-lateral setae, IX with one short, one long and 5 short setae as in Sturnidoecus regalis Male genitalia 0.2621 mm. long. Basal plate 0.1702 mm. long, anterior width 0.1243 mm., posterior width 0.0811 mm. Meso-some 0.0919×0.0541 mm. Parameres 0.1054 mm. long.

Female (allotype) 1.73×0.62 mm. Head 0.50×0.51 mm., cephalic index 1:1.04. Preantennal region 0.23×0.34 mm., index 1:1.48. Hind head 0.27×0.51 mm., index 1:1.89. Prothorax 0.11×0.26 mm. Pterothorax 0.21×0.42 mm. Abdomen 1.04×0.62 mm., subgenital plate squat, and pointed. Vulvar plate with two rows of 7+5 setae respectively on each side.

Material examined: Holotype (male, posterior row), allotype (female), paratypes (2 males, 4 females) from Turdus fumigatus obsoletus Lawrence, Costa Rica (Guapiles), Carricker May, 1903.

18. STURNIDOECUS INCOMPTUS SP. NOV.

(text-fig. 18: a-f)

Male (holotype) 1.62×0.58 mm. Head 0.51×0.50 mm., cephalic index 1:0.98. Preantennal region 0.26×0.34 mm., index 1:1.31, lateral margin steadily tapering posteriorly dorsal plate elongate, deeply concave anteriorly. Hind head 0.25×0.50 mm., index 1:2.0. Temples expanded. Prothorax 0.12×0.27 mm. with a long setae in the latero-posterior angle. Pterothorax 0.26×0.41 mm., posterolateral angle with 2 setae followed by 9 setae on the posterior margin. Abdomen 0.77×0.58 mm., tergite II-V with 4 tergo-central setae, VI-VII with 3, IV with one tergo-lateral seta, V-VII with 2 tergo-lateral setae, VIII with one tergo-lateral and one tergo-central seta, IX with one short and one long seta followed by 6 short setae, X+XI with 3 short setae. Sternal plates as

Fig. 18. Sturnidoecus incomptus (a) dorsal and ventral aspects of male head, (b) portion of male genitalia, (c) mesosome, (d) paramere, (e) IX pleurite setae, (f) female subgenital plate.
in other species, II-VII with one sternolateral seta on each side. Pleural plates II and III bare, IV with one, V and IX with 2, VI-VIII with 3 and X+XI with 12-13 setae on each side. Male genitalia 0.2838 mm. long. Basal plate 0.1892 mm. long, anterior width 0.1189 mm., posterior width 0.0892 mm. Mesosome 0.1081×0.0595 mm. Parameres 0.1108 mm. long, shape and proximal head typical for the species.

**Female** (allotype) 1.75×0.59 mm. Head 0.52×0.50 mm., cephalic index 1:0.95. Preantennal region 0.26×0.34 mm., index 1:1.31. Hind head 0.26×0.5 mm., index 1:1.92. Prothorax 0.12×0.27 mm. Pterothorax 0.23×0.41 mm. Abdomen 0.91×0.59 mm., dorsal chaetotaxy as in other species, subgenital plate of the shape shown in the figure, furnished with 5 short setae on both sides of the triangular blotch, vulvar plate with a row of 11 thick setae and a posterior row of 7 long setae.

This species differs from the allied form in the shape of the head and male genitalia.

**Material examined**: Holotype (male, top right), allotype (female), paratypes (2 males and one female) from Turdus grayi incomptus (Bangs), Columbia (Fonseca: D. Magdalena), Carriker 26389.

**GENUS PENENIRUM CLAY AND MEINERTZHAGEN**

On Passerine hosts there occur three distinct genera of Philopteridae, true Philopterus Nitzsch, Sturnidocus Eichler, and Penenirmis C. et M. This genus is readily distinguished from the allied genera by the following characters: "Head with lateral clypeal margins converging sharply towards clypeal suture, from thence margins converging more gradually towards anterior hyaline margin of head. Clypeal signature present and pointed posteriorly. Trabeculae narrow and pointed in both sexes, antennae filiform in two sexes but showing slight sexual differences. Temples rounded but never swollen beyond the extension of the line of the lateral clypeal margin. Ventral occipital bands present, but no dorsal occipital bands as in Philopterus. Occiput with curved suture, originating from antennal fossa each side. Prothorax rectangular, pterothorax narrow and pointed posteriorly. Abdomen elongate and hairy, with terminal segment rounded posteriorly in the male and bilobed in the female. Pleurites distinct with re-entrant heads, tergal plates either narrowly separated medially or continuous or joined by a narrow posterior chitinous strip. Male genitalia characteristic, with paramera curved and not protruding beyond the mesosome, the latter consisting of a flattened plate with central penis."

19. **PENENIRMUS SARWATAE**

SP. NOV.

text-fig. 19: a-g

**Male** (holotype) 1.41×0.55 mm. Head 0.47×0.47 mm., cephalic index 1:1 general arrangements of the sclerotised bands typical of the genus. Preantennal region 0.21×0.32 mm., index 1:1.52, clypeal region narrow and tapering. Hind head 0.21×0.32 mm., index 1:1.81., temples broadly rounded, posterior margin almost straight. Eyes flatly rounded, ocular blotch indistinct. Prothorax 0.11×0.26 mm., transverse, latero-posterior angle with a long seta. Pterothorax 0.19×0.39 mm. projecting laterally, latero-posterior angle with 2 setae, posterior margin obtusely angulate on the abdomen with 11 setae on each side. Abdomen 0.66×0.55 mm., ovate, segments II-IX with well pigmented tergal plates, interrupted in the middle. II-V with 4 tergo-central setae, VI-VIII with 2 such setae. IV-VII with 2 tergo-lateral setae, VIII with one tergo-lateral and a tergo-central seta, IX with one short, one long seta followed by 6 short setae on each side, X+XI with 3 short setae. Sternal plates II-VII well formed, each with one latero-posterior seta. Pleural plates narrow with anteriorly projecting re-entrant heads, IV with one seta, V with 2, VI-IX with 3-4 and last with 7 setae.
Fig. 19. *Penenirmus sarwatae* (a) dorsal and ventral aspects of male, (b) dorsal clypeal plate, (c) male genitalia, (d) mesosome, (e) IX pleurite setae, (f) female subgenital plate, (g) paramere.
Male genitalia 0.2514 mm. long. Basal plate 0.1729 mm. long. Anterior width 0.1265 mm. Posterior width 0.0973 mm. Mesosome 0.0949 x 0.0594 mm., with well-developed lateral bands and central apophysis of the shape shown in the figure. Parameres typical, 0.0811 mm. long, proximal head well developed and projecting inwards, blade of uniform thickness throughout, twisted inwards at the posterior one forth.

Female (allotype) similar to male, 1.67 x 0.55 mm. Head 0.51 x 0.51 mm. cephalic index 1:1. Prenatal region 0.24 x 0.35 mm., index 1:1.45. Hind head 0.27 x 0.51 mm., index 1:1.88. Prothorax 0.12 x 0.26 mm. Pterothorax 0.20 x 0.39 mm. Abdomen 0.88 x 0.55 mm., tergal plates II, III, VI and VII with 3 tergo-central setae, IV-V with four such hairs, IV-V and VIII-IX with one and V-VI with 2 tergo-lateral setae, VIII with one tergo-central seta, IX with a stout seta between the tergo-lateral and central seta. Pleural plates as in the male, VIII with 11 setae. Subgenital plate as shown in the figure, vulvar plate furnished with 16-17 short and 5-6 long setae along the margin.

This species differs from the allied forms in the shape of the head, abdominal chaetotaxy and male genitalia. The parameres in this species are very typical.

Material examined: Holotype (male), allotype (female): paratypes (2 females) from Turdus r. rufiventris (Vieillot), Bolivia (Samatpata), Carriker 16456, November 4, 1937.

HOST PARASITE INDEX

1. Catharus fuscater sanctaemartae Ridgway
2. Entomobius leucos (Tschudi)
3. Turdus chingano Lafr. et d'Orbig.
4. Turdus fultivetsris Sclater
5. Turdus fumigatus obsoletus Lawrence
6. Turdus fuscator gigantodes Cabanis
7. Turdus fuscator quindio Chapmann
8. Turdus grayi incompitus (Bangs)
9. Turdus ignobilis debilis Hellmayr
10. Turdus nigrescens Cabanis
11. Turdus nigricps Cabanis
12. Turdus n. nudigenis Lafresnaye
13. Turdus olivater sanctaemartae (Todd)
14. Turdus r. rufiventris (Vieillot)
15. Turdus serranus-atrosfericus (Lafresnaye)
16. Turdus serranus fuscobrunneus (Chapmann)

Philopterus carrikeri
Brueila busharae
Philopterus zerini
Philopterus confuso
Sturnidocys regalis
Philopterus husiniae
Sturnidocys obsoletus
Philopterus sulfi
Brueila capitis
Sturnidocys incompitus
Sturnidocys perunensis
Philopterus sartajae
Sturnidocys retiniae
Brueila pointu
Brueila carrikeri (?)
Sturnidocys carrikeri
Penenirnius sarutae
Brueila carrikeri
Sturnidocys intermedius
Brueila saghirae.

REFERENCES


