

REVISIONS OF THE GENERA OF MALLOPHAGA. *COLILIPEURUS*  
BEDFORD AND A NEW GENUS.

By THERESA CLAY.

(British Museum (Natural History).)

With 1 Plate and 51 Text Figures.

INTRODUCTION.

THE genus *Colilipeurus* was erected by Bedford (1930 : 167) for the distinctive Ischnoceran species found on the bird order Coliiformes. These species are characterised by the form of the head and of the tergal plates of the abdomen, the presence of a vulval fringe, the distinctively-shaped alveoli of the lateral setae of the female genital region, the form of the male terminal abdominal segments and genitalia. Setae with rather similar elongated alveoli are found on the female genital region of some species of *Pectinopygus* (e.g. *P. bassani*), and *Vernoniella* has a vulval fringe, but there is no other described group of species which in any way resembles *Colilipeurus*. However, three new species parasitising the genus *Microhierax* of the order Falconiformes are found to have the characters listed above which distinguish *Colilipeurus* from other known genera. In the male sex the two groups further resemble one another in the form of the antenna and in the general form of the genitalia, especially in the paramere which has a partly free sclerite articulating with the basal plate and which allows the considerable backward movement of the paramere for the copulatory position. In the female both groups have a similar arrangement of the lateral genital setae, no sclerotised calyx in the spermatheca and individuals with and without central tergal sclerotisation (see below). In fact, the only significant differences are the shape of the conus of the nymphs, and in the adults the abdominal chaetotaxy, the form of the abdominal sclerites and differences in the sclerotisation of the whole exoskeleton, the species from *Microhierax* being more heavily sclerotised. It is the resulting colour pattern which makes the two groups of species so distinct at a casual glance (Plate I). Colour pattern, however, is an unsatisfactory character for generic separation, as shown by such genera as *Quadriceps* and *Philopterus*, where it seems to be dependent on the colour of the plumage of the hosts. The similarity in basic characters of the two groups is the more remarkable in that they are characters which are not of a generalized kind found in other genera of the Mallophaga, but are extremely distinctive and never or rarely found elsewhere in the suborder. These facts suggest that the two groups are related and that the similarity cannot be explained by any form of convergence or parallel evolution. It is possible that the two groups should not be separated generically, but on taking into account their distribution, their superficial distinctive appearance, the difference in the abdominal sclerites and chaetotaxy, and in the nymphs, together with the fact that there is no overlap of these characters between the species of the two groups, suggests that it would be more satisfactory to place the species from *Microhierax* in a different genus. It is, however, not unlikely that the taxon may later be considered to be no more than a subgenus, if this category (which indicates difference without hiding relationships) should prove a useful one in Mallophaga.

## HOST DISTRIBUTION.

The host distribution of these two groups is difficult to explain: *Colilipeurus* is found only on the Coliiformes, a small order geographically restricted, occurring only in the Ethiopian Region, and of doubtful affinities; *Microhierax*, a genus comprising five species found from the W. Himalayas to S.E. Asia, is included in a subfamily of the Falconiformes, the Polihieracinae which contains five genera found in S. America, Africa and Asia. Mallophaga have been seen from hosts belonging to four of these genera as follows: *Degeeriella sens. str.* from *Gampsonyx* (Argentina) and *Neohierax* (Burma), *Neopsittaconirmus* from *Polihierax* (Somaliland) and the new genus described below from *Microhierax* (Burma, Thailand and the Philippines). The specimens of *Neopsittaconirmus*, a distinctive genus hitherto found only on parrots, were taken from *Polihierax semitorquatus* under conditions which precluded any contamination during collecting. Eleven specimens of *Polihierax* were examined: no Mallophaga were taken from six of these, but 56 specimens were taken from the remaining five birds from three localities in British Somaliland; in no instance was a parrot collected on the same day. Mr. John G. Williams of the Coryndon Museum, Nairobi, says (*in litt.*) that in British Somaliland the parrot, *Poicephalus rufiventris*, roosts in nests of the buffalo weaver and that *Polihierax semitorquatus* takes over the old nests of this weaver for nesting purposes. Thus, the occurrence of *Neopsittaconirmus* might be a case of natural straggling on an exceptionally large scale, or the parrot parasites may have become established on the hawk.

Since there is no evidence of relationship between the Coliiformes and *Microhierax* and if the affinities of *Colilipeurus* and the new genus have been correctly evaluated, then a possible explanation of the distribution of these two genera would be that a parasite of an ancestral Coliiformes became established on a forerunner of *Microhierax* at a time when, it must be assumed the ranges of these birds overlapped. This establishment may have been assisted by the absence or rarity of a resident louse population on the small falcon, a factor which may also help to explain the occurrence at the present time of a parrot parasite on *Polihierax*. As both groups of Mallophaga now comprise a number of species it must be presumed that the interspecific transfer took place at a fairly remote date, the parasite species becoming differentiated on the different species of *Microhierax* as these became separated. The main differences between the two parasite groups are shown in the sclerotisation, probably an adaptation to the different plumage structure of the two host groups.

*Microhierax* is also parasitised by a species belonging to the Amblycera which does not belong to any of the genera typical of the Falconiformes, nor is it related to the characteristic *Colimenopon*, the only other genus found on *Colius*. No specimens of genera belonging to the Mallophagan fauna characteristic of the Falconiformes have been taken from *Microhierax*.

## ABDOMINAL DIFFERENCES IN THE FEMALES.

A casual glance at populations of species of both these genera suggests that among the fully hardened females there are two forms: one (group A) in which the divided tergal plates of some segments are joined by a central area of sclerotisation (figs. 22 and 41) and the other (group B) in which this central sclerotised area is absent (figs. 23 and 42). The question is whether this is

dimorphism, an extra nymphal stage or an extended duration of the teneral condition. Females of a similar type are found in *Pectinopygus* and *Falcolipeurus*.

In the few species of *Mallophaga* of which adults have been reared under artificial conditions three nymphal instars were found, each instar increasing in size and in the complexity of the chaetotaxy. Wilson (1939 : 319) has drawn attention to the importance in *Lipeurus* of the postero-dorsal setae of the pterothorax for recognising the various instars. Metrical and morphological examinations of nymphs of a number of Ischnoceran genera confirm the presence of three nymphal instars and the importance of the pterothoracic setae : all first stage nymphs examined have on each side one elongated posterodorsal pterothoracic seta and a small, often spine-like, more lateral seta ; the second instar has more pterothoracic setae and the third has more and/or stouter setae, the numbers and position depending on the adult chaetotaxy. In those species in which the adult head is highly modified the first instar may have the marginal carina complete and unmodified or already somewhat resembling the adult head, but the fully modified head does not appear until after the last moult ; the ventral carina is usually in its adult form at least by the second stage. Abdominal sclerites are not apparent in the first instar, but the second and third instars frequently resemble each other and differ from the adult in having the tergal plates separated from the pleural plates, while in some genera (e.g. *Fulicoffula*) the tergites of IX and X appear as separate plates, not fused together as in the adult. Thus, even apart from the unsclerotised condition of most of the exoskeleton, there is no difficulty about distinguishing last stage nymphs from adults. A fairly detailed study has been made of nymphs and females of *Pectinopygus gyricornis* (Denny). The three usual nymphal stages are present. Amongst those specimens with the adult type of abdomen and head are the obviously teneral forms, over-lapping in abdomen length with the largest of the third instar nymphs, but distinct in the breadth of the temples ; lighter in general colour than the adults, with no sclerotised area between the tergites and with the abdominal segments compressed in an antero-posterior direction. The mean of the breadth of the head of group A and group B, including obvious tenerals, is the same. Excluding obvious tenerals and considering only adults which are similar in the dark colour of the sclerites, there is a range from those in which the irregular sclerotised areas completely fill the space between the tergites through those with smaller areas and those with very faint sclerotised areas, to those in which the cuticle between the tergal plates shows no sign of sclerotisation. Out of 51 females of *P. gyricornis* examined 28 had some sign of sclerotisation (group A) and 23 (including obvious tenerals) had no sign of sclerotisation (group B). None of group A had an abdomen less than 1.48 mm. long (maximum 1.69, coefficient of variation 3.4) and less than 0.70 mm. (maximum 0.85) wide. All these specimens had well developed ova in the abdomen. Group B had lower minimum measurements for the length and breadth of the abdomen : 1.20 mm. (maximum 1.55 mm., coefficient of variation 6.8) in length and 0.58 mm. (maximum 0.74 mm.<sup>1</sup>) in breadth.

<sup>1</sup> Two specimens appeared to be larger than this, but had already been treated with KOH and mounted in canada balsam so that the measurements may not be comparable with those taken from specimens mounted in a saturated solution of phenol in 70 per cent. alcohol and warmed slightly to clear ; this method seems to cause little distortion and enables the ova to be measured within the abdomen. Space is not available to give the full measurements taken, but the results are based on length and breadth of head and abdomen.

The mean of both abdominal length and breadth was greater in group A. The majority of group B had no developed ova, and only one specimen (but the ova of two of the largest could not be measured) had ova of comparable size to those normal in group A.

In *Colilipeurus* and *Falcolius* gen. n., of which smaller series were available, there appears to be a comparable situation. In *Colilipeurus* the first instar has the typical pterothoracic setae, entire marginal carina and no apparent abdominal sclerites. The second instar has a small central hyaline margin; five pterothoracic setae each side, of which one is minute, one fine and long, one stout and long and two fine; there are more abdominal setae, and only the pleural plates are sclerotised. In the third instar the head is similar; the dorsal pterothoracic setae are still five in number but differ in position and size, and the elongated lateral pterothoracic seta with sunken alveolus is now present; the abdominal setae are more numerous and both tergal and pleural plates are sclerotised. Specimens which are adult in the form of the head, abdomen and chaetotaxy range from obviously teneral specimens without the central sclerotised strip, apparently normal adults without the strip (fig. 23), intermediates in which some of the tergal plates are joined and some only by faint sclerotised strips, to those with a fully sclerotised strip joining the two plates (fig. 22). A range of measurements similar in type to those for the *Pectinopygus* species was found: no difference in head breadth between group A and B, an overlap in length and breadth of abdomen, but with higher means for group A, all those in group A showing well developed ova and only a small number of group B with ova of a comparable size to those of A. Two pairs, the females each of group B, were found *in copula* and the majority of this group, with the exception of the obviously teneral specimens, had fairly well developed ova, a higher proportion than was the case of group B in the *Pectinopygus* species. In *Falcolius* only second and third instars of *F. jordani* and only third instars of *F. elbeli* are available; in the former species the second and third instars resemble one another and differ markedly from the adult and from the nymphs of *Colilipeurus* (fig. 20) in having sclerotised recurved and pointed conia (fig. 21) which resemble those of the adults of some species of *Paragoniocotes*. In the second instar there is a small hyaline margin; the lateral pterothoracic seta is present and there are four dorsal setae each side, of which one is minute, two fine and long, and one stout and long; pleural and tergal plates are present. The third instar has the head similar to that of the second instar, the pterothoracic setae in the adult number and positions but less stout, and the abdomen (except for the larger size and the greater number of setae) is similar to that of the second instar; the smallest specimen of this instar measured was longer than the largest of the second by 0.18 mm. There are also a number of pharate adults<sup>2</sup> which in the male have the genitalia apparently complete but unsclerotised, and in the female the elongated lateral setae of segments IX-X present, but unsclerotised. Amongst 27 females of *F. jordani* 15 belong to group A (fig. 41) and 12 to group B (fig. 42); there are no intermediates. The range and means of the measurements are comparable with those of *Pectinopygus* and *Colilipeurus*; little evidence is available about the size of the ova, but at least one female of group B had ova of comparable size to one of group A.

These results suggest that the cause of the apparent dimorphism of the

<sup>2</sup> Pharate adult is a third stage nymph immediately before its moult which shows the adult still enclosed within the skin of the 3rd instar (see Hinton, 1946: 552).

females is the same in the three genera examined and that the central sclerotised area of the abdomen is formed during the hardening and stretching of the teneral abdomen; that in some cases this process is either not fully completed (e.g. mature females of *Pectinopygus gyricornis* with small and faint areas) or there is no sclerotisation of this area (e.g. full-sized females with fully-developed ova and without sclerotisation) or the sclerotisation of this area may be a long process which continues after the adult is mature and begins to lay eggs. A decision on these alternatives must wait for the examination of further material, especially of *Colilipeurus* and *Falcolius* and the following of the stages in artificially maintained populations.

#### COLILIPEURUS Bedford.

*Colilipeurus radiatus* (Neumann), 1912. (Plate I, figs. 1-2; text-figs. 1-4, 6-7, 10, 12, 14, 16-17, 22-26.)

*Lipeurus radiatus* Neumann, 1912, *Arch. Parasit.* 15 : 378, figs. 23-26. Host : Undetermined birds nos. 30 and 32 collected in Harar, Abyssinia.

*Lipeurus radiatus nun* Neumann, 1912, *Arch. Parasit.* 15 : 380. Host : *Ploceus abyssinicus*.

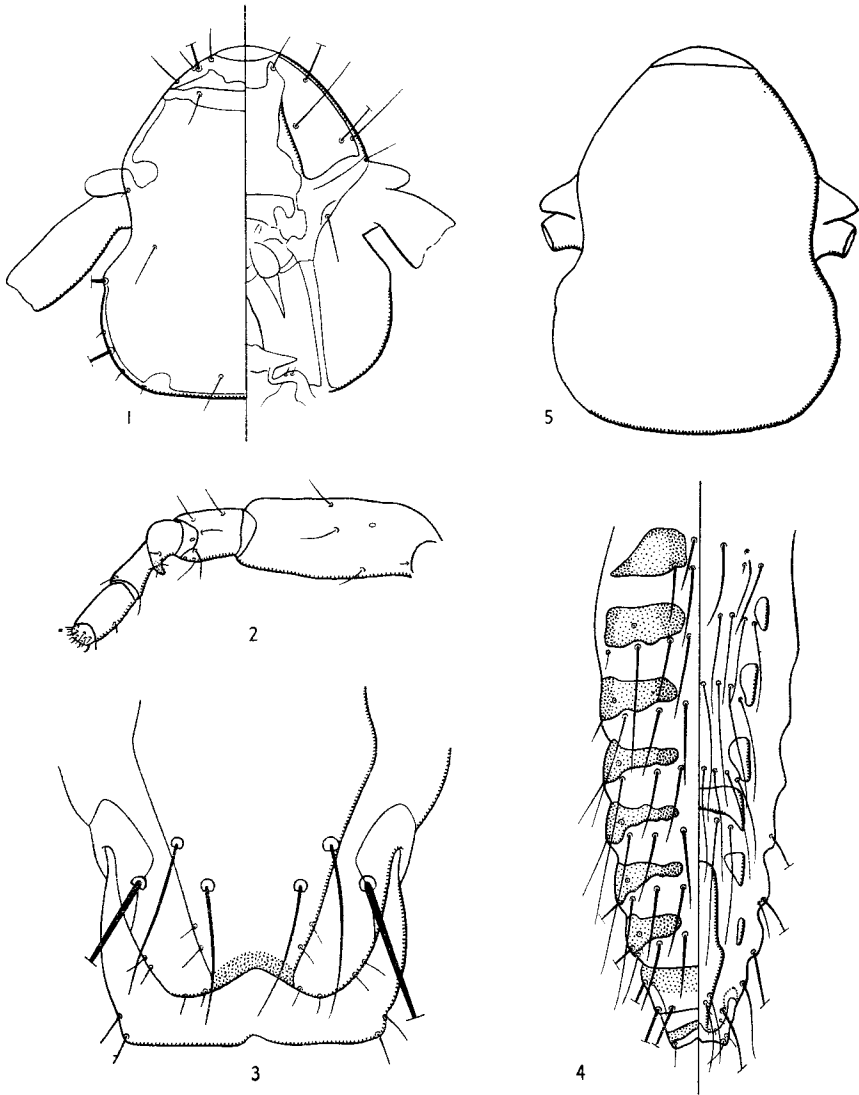
The specimens on which Neumann based his descriptions of *Lipeurus radiatus* and *L. nun* were taken from three birds collected on the same day by M. de Rothschild at Harar. The two undetermined birds must have been either *Colius striatus hilgerti* Zedlitz or *C. m. macrourus* (Linn.) and the single female taken from *Ploceus abyssinicus* on the same day must have been a straggler from a *Colius*. Dr. J. Dorst of the Muséum National d'Histoire Naturelle in Paris has most kindly searched for the two undetermined birds numbered 30 and 32, but has been unable to find them and believes them to have been destroyed. It has not been possible, either, to trace the type material of Neumann's forms and it is therefore necessary to try to identify them from his original descriptions. The species from *Colius striatus* and *C. macrourus* differ in the shape of the head, the parameres of the male and the sclerites of the female genital region. Although Neumann's figure of a whole female *radiatus* appears to resemble, in the shape of the head, the female of the species found on *macrourus*, there is no doubt that the figure of the male genitalia represents those of the species from *C. striatus*. It can, therefore, be presumed with reasonable certainty that the male of *radiatus* at least is the species normally found on *Colius striatus* and redescribed below. If the type material should be found, it is presumably a specimen of this sex which will be designated as lectotype. The figure of the female, which may represent a teneral specimen of either the species found on *C. striatus* or *C. macrourus* is of the type with the unjoined tergal plates (see above), while the single specimen from which *radiatus nun* was described was a female with the joined tergal plates and can be assumed to be the same as *radiatus*.

*Male* (Plate I, fig. 1 and text-figs. 1-4, 6-7, 10, 12, 16) : The dorsal surface of the head has many minute setae not present in the female. Dorsal prothoracic pigmented patch (fig. 12) usually present. Post-spiracular setae are present on segments III-VIII<sup>3</sup> with contiguous sensilli (Clay, 1954 : 716) on III-V; tergo-central setae stout and pointed, both

<sup>3</sup> First apparent abdominal segment is segment II.

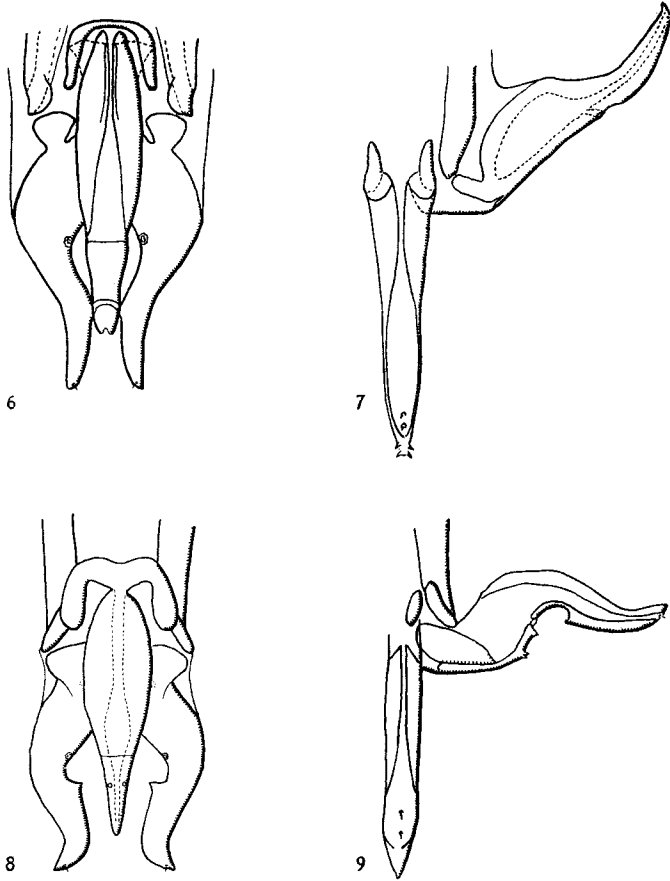
these and the sternal setae may vary in number by one to three a segment. The male genitalia are complicated in structure and two views of these are shown (figs. 6-7) as the sclerites appear very different in the resting and copulatory positions. Measurements of both sexes shown in Tables I-II.

*Female* (Plate I, fig. 2 and text-figs. 14, 17, 22-26): Tergoventral setae stout and pointed as in the male; post-spiracular setae and sensilli as in the male. The variation in the form of the tergites has been discussed above. Variation of tergoventral setae as follows: II, 6 or 7; III-V, 8 or 9 (rarely 6 or 7); VI-VII, 6 or 7.



FIGS. 1-5.—(1-4) *Colilipeurus r. rubiatus*, ♂. (1) Head. (2) Antenna. (3) Terminal segments of abdomen, ventral. (4) Abdomen, dorsal and ventral. (5) *C. c. colius*, outline of head, scale as in 1.

*Specimens examined*: 43 males and 55 females from *Colius striatus* subsp. from Kenya, Uganda, N. Rhodesia and Cape Colony.



FIGS. 6-9.—Male genitalia. (6) *C. r. radiatus*, resting position, dorsal. (7) As 6, extruded, ventral. (8) *C. c. colius*, resting position, dorsal. (9) As 8, extruded, ventral.

*Colilipeurus radiatus obscurior* subsp. n. (Text-figs. 13, 15, 18-19, 27.)

Type host: *Colius colius* (Linn.).

Only one male of this form is available, the genitalia of which appear to be the same as those of the nominate form. The subspecies differs in both sexes in the form of the gular plate (figs. 18-19), which varies in outline but in general is smaller and narrower, and in having the pigmented areas of the thorax larger (figs. 13, 15). The postero-ventral margin of the abdomen of the single male is more deeply and narrowly indented and the sclerites of the female genital region differ in shape (fig. 27). For measurements see Table I-II.

Described from 1 ♂, 6 ♀ from *Colius colius* Potchefstroom, W. TRANSVAAL, 4. iv. 1953.

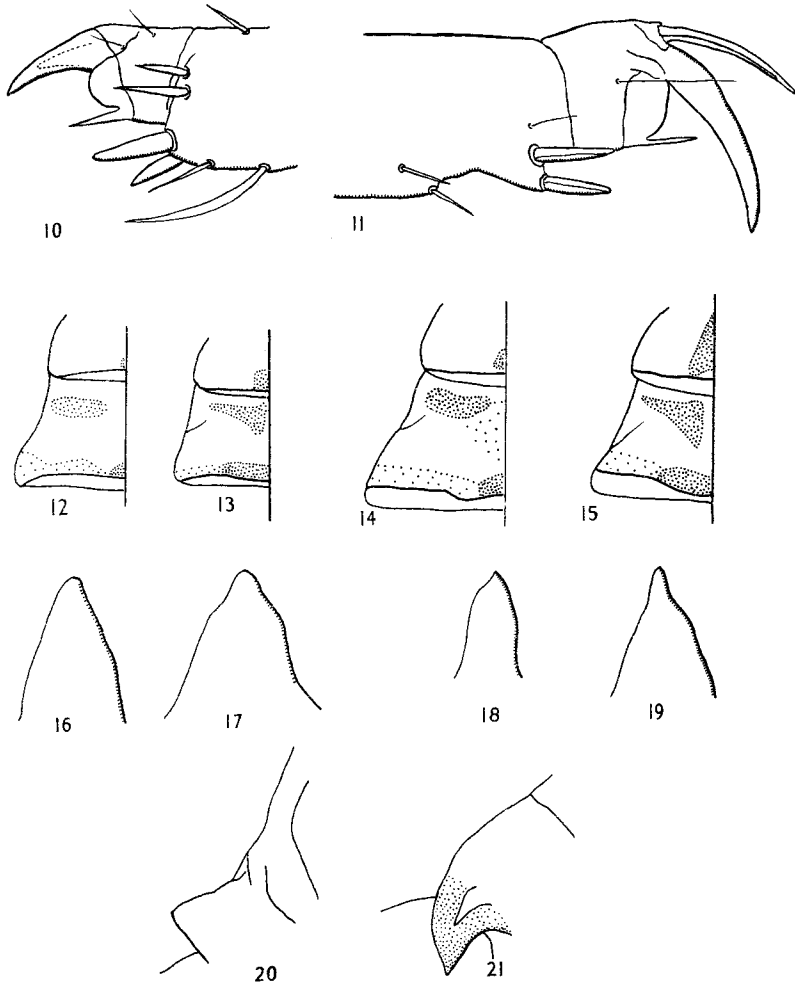
*Holotype* male in the South African Institute for Medical Research, Johannesburg. *Paratypes*: 6 ♀. All type material with the above data.

*Colilipeurus colius* (Bedford), 1920. (Text-figs. 5, 8-9, 11, 20, 28, 29.)

Type host: *Colius indicus transvaalensis* Roberts.

*Esthiopterum colius* Bedford, 1920, *Rep. vet. Res. S. Afr.* 7-8: 731, pl. 7, figs. 1, 2. Host: *Colius indicus*.

*Male*: Distinguished from *radiatus* by the proportions of the head (fig. 5) and by the male genitalia, especially in the shape of the paramere and the presence of two to three small thorn-like hyaline protuberances on its inner margin (figs. 8-9). Prothorax usually without dorsal posterior pigmented area. Sternite VI is interrupted medianly. Measurements shown in Table I.

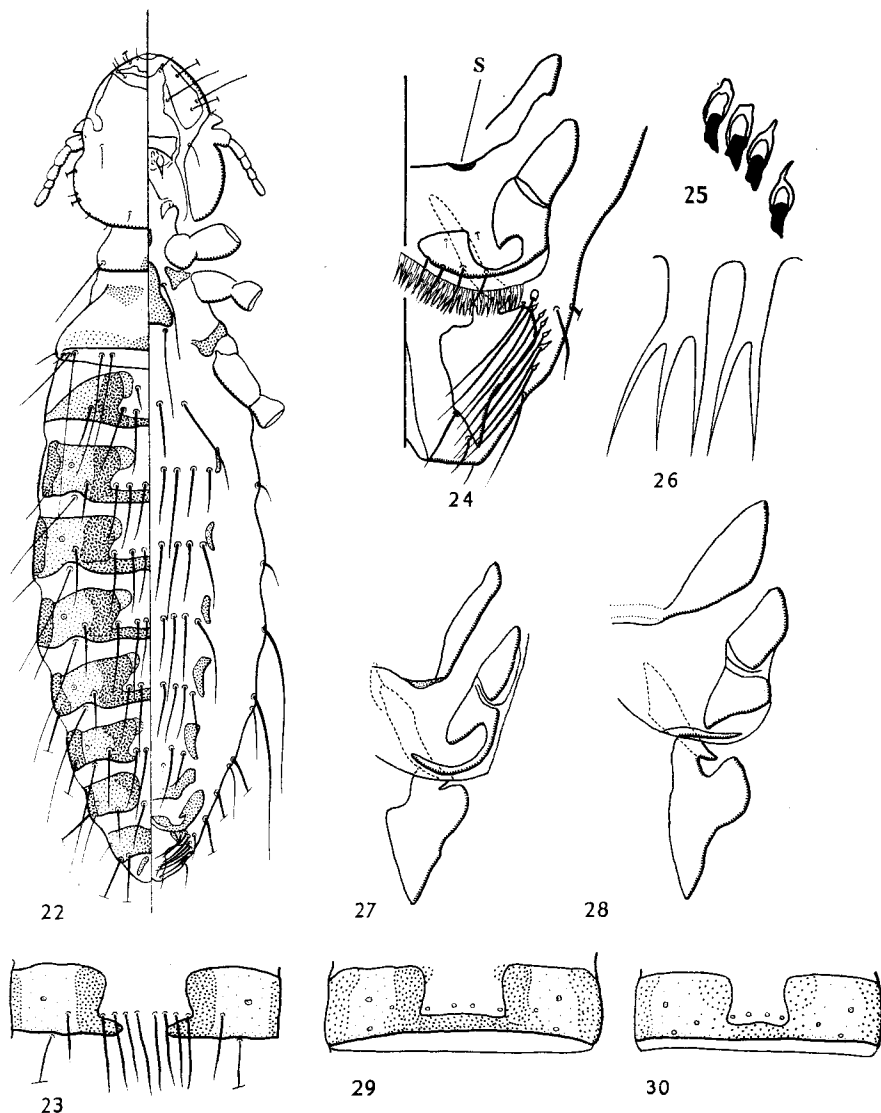


FIGS. 10-21.—(10-11) Terminal part of legs. (10) *Colilipeurus r. radiatus*, first leg. (11) *C. c. colius*, third leg. (12-15) Dorsal view of thorax. (12) *C. r. radiatus*, ♂. (13) *C. r. obscurior*, ♂. (14) *C. r. radiatus*, ♀. (15) *C. r. obscurior*, ♀. (16-19) Gular plates. (16) *C. r. radiatus*, ♂. (17) As 16, ♀. (18) *C. r. obscurior*, ♂. (19) As 18, ♀. (20-21) Conus of nymph. (20) *C. c. colius*. (21) *Falcolius jordani*, pharate ♀.



*Female*: Distinguished from *radiatus* by having the prothoracic pigmented patch greatly reduced or absent, in the details of the sclerites of the female genital region (fig. 28) and in the absence of a crescent-shaped thickening each side of the posterior margin of the genital plate (fig. 24, s). Measurements shown in Table II. Abdomen usually with 2-3 fewer tergocentral setae on each of segments III-V than in *radiatus*.

*Specimens examined*: 27 ♂, 30 ♀ from *Colius indicus* subsp. from King William's Town, Cape Colony, Transvaal and S.W. Africa.

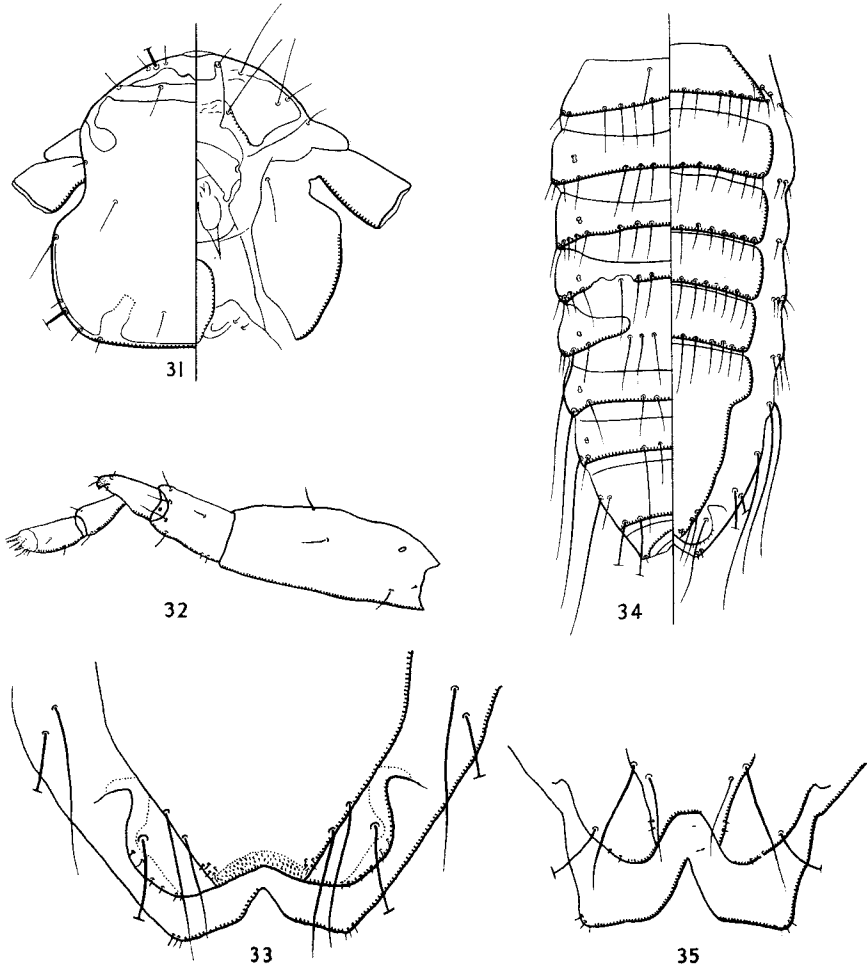


FIGS. 22-30.—(22-26) *Coliipeurus r. radiatus*, ♀. (22) Dorsal and ventral views. (23) Tergum of abdominal segment III, teneral specimen. (24) Genital region. (25) Alveoli of lateral setae of segments IX-X. (26) Elements of vulval fringe. (27-28) Sclerites of ♀ genital region. (27) *C. r. obscurior*. (28) *C. c. colius*. (29-30) Tergum of abdominal segment IV, ♀. (29) *C. c. colius*. (30) *C. c. pallidior*.

*Colilipeurus colius pallidior* subsp. n. (Text-fig. 30.)

Type host : *Colius macrourus macrourus* (Linn.).

The populations from *Colius macrourus* are separable from *Colilipeurus colius* by the smaller and lighter sclerotised areas and in the means of the measurements. In the male there is no sclerotised patch on the pterothorax, the genital plate is not easily seen except in heavily stained specimens and the whole of the sclerotised areas are lighter in colour. In the female the pterothoracic patch is smaller, as is also the inner vertical sclerotised area of the tergites (fig. 30); as in the male all the sclerotised areas are lighter in colour. The measurements tend to be smaller, but there is a certain amount of overlap (Tables I-II). Populations differing only in the mean of the measurements should not, in the opinion of the present writer (Clay, 1955: 5),<sup>4</sup> be separated subspecifically, but in this



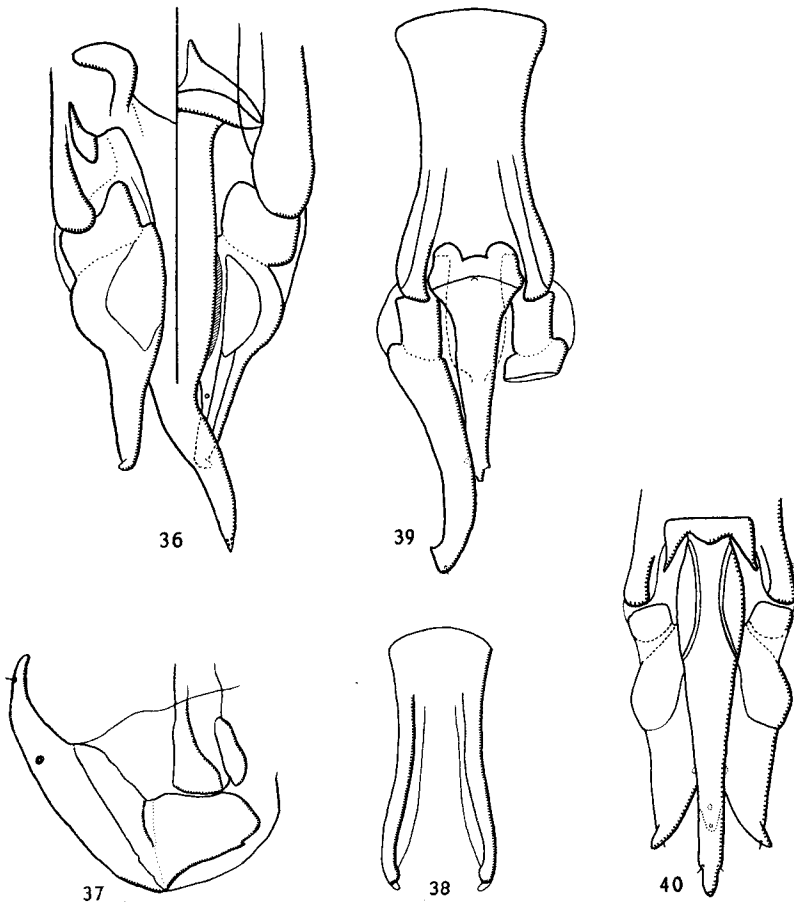
FIGS. 31-35.—(31-34) *Falcolius jordani*, ♂. (31) Head. (32) Antenna. (33) Terminal segments of abdomen, ventral. (34) Abdomen, dorsal and ventral views. (35) *F. samarensis*, terminal segments of ♂ abdomen, ventral.

<sup>4</sup> On page five of this paper somehow between manuscript and final printing the word "not" has managed to insinuate itself into line twenty-six, which should, of course, read "which on the different hosts differ only in size in proportion to".

case the smaller size is accompanied by differences in sclerotisation and a subspecies has therefore been erected for the *macrourus* population.

*Holotype* male and *allotype* female: slide no. 17071a in the Meinertzhagen Collection in the British Museum (Natural History) from *Colius m. macrourus* from Port Sudan. *Paratypes*: 37 males and 28 females with the same data.

*Colilipeurus* as now known comprises four taxa which show a range of sclerotisation from the most heavily sclerotised form, *C. r. obscurior* through *C. r. radiatus* and *C. c. colius* to the most lightly sclerotised *C. c. pallidior*. The differences are slight and are found chiefly in the extent of the thoracic dorsal sclerotised areas. The relationships between the taxa of *Colilipeurus* reflect those usually accepted for their hosts, that is *Colius striatus* and *C. colius* being included in one species group (or the genus or subgenus *Colius*) and *C. indicus* and *macrourus* in another species group (or the genus or subgenus *Urocolius*). Each species group is parasitised by a species of *Colilipeurus* with a subspecies



FIGS. 36-40.—♂ genitalia of *Falcolius* species. (36) *F. jordani*. (37) *F. jordani*, paramere in extruded position. (38) *F. jordani*, basal plate. (39) *F. samarensis*. (40) *F. elbeli*.

on each of the included host species ; no Mallophaga have been seen from two of the species of the *striatus* group.

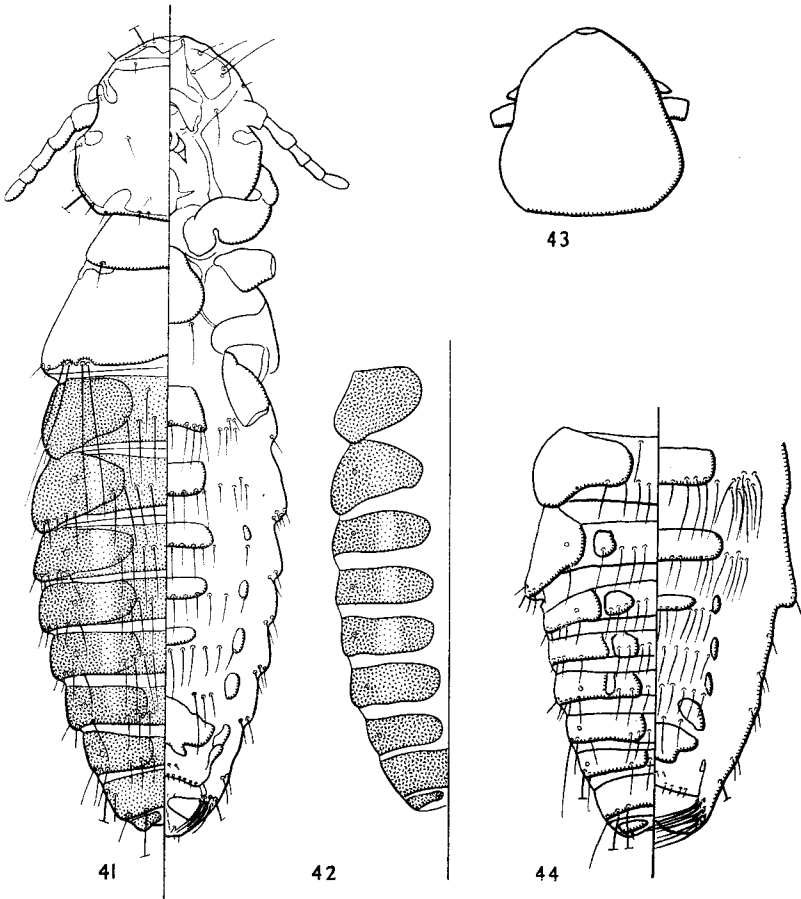
### FALCOLIUS gen. n.

Elongated Ischnocera. Marginal carina depressed centrally with small hyaline margin, central part enlarged dorsally and ventrally, dorsal enlargement with indented posterior margin ; ventral carina interrupted medianly and prolonged towards anterior margin each side ; transverse dorsal preantennal suture. Temple with only one elongated seta. Abdominal segments II-IV, at least, with central sternal plates ; male with tergal plates II-V continuous across segment ; female tergites without inner vertical sclerotised area (contrast figs. 22 and 41). Male with ventral genital opening of characteristic form (fig. 33). Female with vulval fringe and with ventral group of long stout setae with irregular, elongated alveoli, each side of segments IX-X (figs. 47-49).

Type species : *Falcolius jordani* sp. n.

Distribution : The genus *Microhierax* of the order Falconiformes.

The gender of the genus is masculine.



FIGS. 41-44.—(41-42) *Falcolius jordani*. (41) ♀, dorsal and ventral views. (42) Tergum of abdomen of teneral ♀. (43) *F. elbeli*, ♀ head, scale as in 41. (44) *F. elbeli*, ♀ abdomen.

*Affinities*: Apparently closely allied to *Cobilipeurus*, from which it can be separated by the presence of central sternal plates on abdominal segments II–IV, the abdominal chaetotaxy, the form of the tergites, and in the nymphs by the con. *Cobilipeurus* itself has no obvious affinities to any other known genus and reflects the isolated position of its host order, the Coliiformes.

**Falcolius jordani** sp. n. (Pl. I, figs. 3 and 4; text-figs. 21, 31–34, 36–38, 41–42, 47–49.)

Type host: *Microhierax caerulescens burmanicus* Swann.

This species is distinguished from the other two known species of the genus in the male by the genitalia and in the female from *elbeli* by the form of the abdomen and from *samarensis* by the shape of the head and details of the chaetotaxy.

*Male* (Plate I, fig. 3, and text-figs. 31–34, 36–38): The dorsal surface of the head has minute setae as in *C. radiatus*. Fine post-spiracular setae on segments III–VIII with contiguous sensilli on segments III–V. The margin of the genital opening has fine serrations. The male genitalia, as in the species from *Colius*, are complicated and the apparent shape of the sclerites varies according to the position on the slide and whether the parameres are in the turned-back position (fig. 37). In fig. 36 the penis is shown fully extended, in many specimens it appears shorter, due to being bent back on itself. Variation of chaetotaxy shown in Table V and measurements in Table III.

*Female* (Plate I, fig. 4 and text-figs. 41–42, 47–49): There is some individual variation in the shape of the subvulval sclerite (fig. 48). This species differs from *elbeli* in having the cuticle surrounding the opening of the spermathecal tube sclerotised. Variation of chaetotaxy shown in Table VI, and measurements in Table IV.

*Holotype* male and *allotype* female slide no. 628 in the British Museum (Natural History) from *Microhierax caerulescens burmanicus* from Myitkyina, Burma, 16.iii.1945. *Paratypes*: 28 males and 22 females from the same host form from Burma and Thailand.

This species is named in honour of Dr. Karl Jordan, F.R.S., as a small tribute to a great entomologist and in particular to his unique contributions to the study of ectoparasites.

**Falcolius samarensis** sp. n. (Text-figs. 35, 39, 45, 51.)

Type host: *Microhierax erythrogenys meridionalis* Ogilvie-Grant.

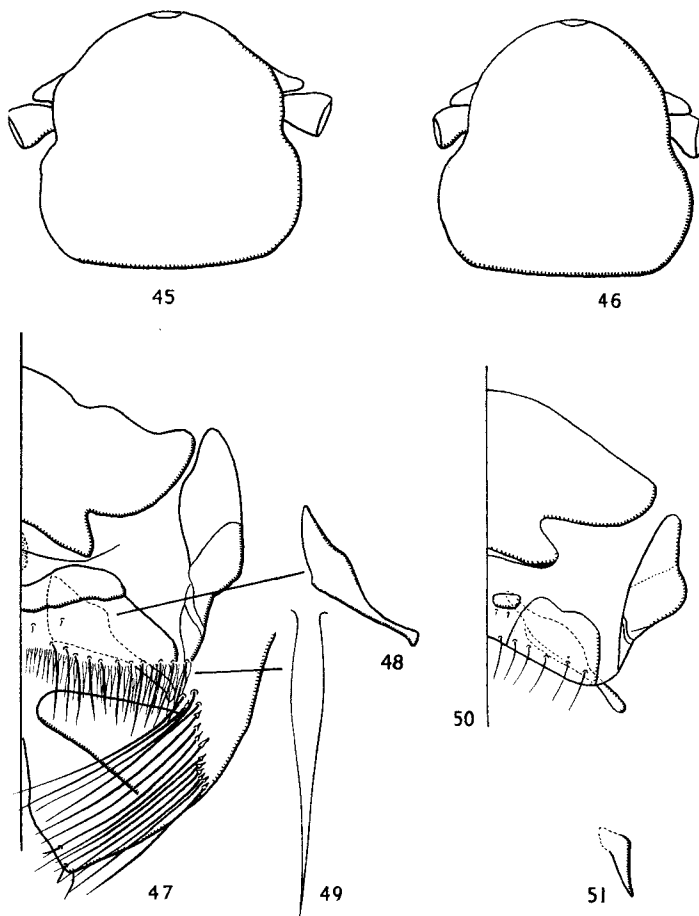
This species is distinguished from *jordani* in the male by the genitalia and in the female by the shape of the head, the apparent absence of the genital plate, form of the vulval fringe and by the details of the abdominal chaetotaxy; it differs from *elbeli* in the male by the genitalia and in the female by the form of the abdomen.

*Male*: Resembles that of *jordani* except in size (Table III), the form of the last segment (fig. 35) and the genitalia (fig. 39). The single male is not in sufficiently good condition to compare the form of the tergal plates with those of *jordani*. The abdominal chaetotaxy of the single male is shown in Table V and measurements in Table III.

*Female*: Similar to that of *jordani*, but the head is proportionally narrower across the preantennal region and resembles that of *elbeli* (fig. 43). The tergal plates are less heavily sclerotised, there is no apparent genital plate nor any other sclerite associated with the genital region except for the subvulval sclerite of which only the distal part can be clearly distinguished (fig. 51). The parts of the vulval fringe are bifid or trifid as in *Cobilipeurus*,

there are fewer of the elongated lateral genital setae (9 + 9) and there is a small amount of sclerotisation round the spermathecal opening. The abdominal chaetotaxy of the single female is shown in Table VI; this differs from that of *jordani* in the fact that the central sternal setae of segment III are all minute, the pleural setae fewer in number and the seta immediately lateral to the post-spiracular seta on each side of segment VI long and stout. Chaetotaxy as shown in Table VI and measurements in Table IV.

*Holotype* male and *allotype* female slide no. 629 in the British Museum (Natural History) from *Microhierax erythrogonyx meridionalis* from Samar Island, Philippines 21. vi. 1948 presented by Mr. G. H. E. Hopkins.



FIGS. 45-51.—(45-46) Outline of ♂ head, scale as in fig. 31. (45) *Falcolius samarensis*. (46) *F. elbeli*. (47-49) *F. jordani*, ♀. (47) Genital region. (48) Subvulval sclerite from another specimen. (49) Element of vulval fringe. (50) *F. elbeli*, ♀ genital region. (51) *F. samarensis*, subvulval sclerite.

***Falcolius elbeli* sp. n.** (Text-figs. 40, 43-44, 46, 50.)

Type host: *Microhierax fringillarius* (Drapiez).

This species is distinguished from the two preceding ones in the male by the genitalia and in the female by the form of abdominal segments II and III.

*Male*: Similar to that of *jordani* but differs in the shape of the head (fig. 46), size (Table III) and in the characters of the male genitalia (fig. 40). Segment VI may have an irregular-shaped sclerotised area between the two tergal plates. The abdominal chaetotaxy is shown in Table V.

*Female*: Head similar to that of *jordani* but differs in shape (fig. 43). The abdomen (fig. 44) differs markedly from that of the two preceding species in the enlargement of segments II and III and from *jordani* in the division of the tergal plates of III and IV into two sclerites each side, such a division being only indicated in the latter species. Ventrally segments II-III have central sclerites, IV (and in one specimen, V) a central and two lateral sclerites and V or VI-VII lateral sclerites only. The genital region is similar to that of *jordani*, but the shapes of the sclerites are different (fig. 50) and there is no sclerotisation round the spermathecal opening. Variation of the chaetotaxy shown in Table VI and measurements in Table IV.

*Holotype* male and *allotype* female in the British Museum (Natural History) from *Microhierax fringillarius* from Prachuap Khiri Khan, Thailand, 24.xii. 1952. *Paratypes*: three males and six females from the same host species from Borneo, Malaya and Thailand.

This species is named after Mr. Robert E. Elbel in grateful thanks for the loan of specimens of this species and of a large series of *jordani* which made a full study of the new genus *Falcolius* possible.

#### Key to *Colilipeurus* and *Falcolius*.

- |    |   |                           |
|----|---|---------------------------|
| 1  | Abdominal segments II-IV without central sternal plates; ♂ with tergites II-IV interrupted medianly; ♀ with less than 10 setae on 2nd sternum . . . . .             | ( <i>Colilipeurus</i> ) 2 |
| -  | Abdominal segments II-IV, at least, with central sternal plates; ♂ with tergites II-IV not interrupted medianly; ♀ with more than 10 setae on 2nd sternum . . . . . | ( <i>Falcolius</i> ) 9    |
| 2  | (1) Males . . . . .   | 3                         |
| -  | Females . . . . .   | 6                         |
| 3  | (2) Inner edge of paramere with pointed projection . . . . .  | 4                         |
| -  | Inner edge of paramere without pointed projection . . . . .   | 5                         |
| 4  | (3) Pterothorax without central postero-dorsal pigmented area . . . . .   | <i>c. pallidior</i>       |
| -  | Pterothorax with small postero-dorsal pigmented area . . . . .  | <i>c. colius</i>          |
| 5  | (3) Prothoracic and pterothoracic central pigmented areas large (fig. 13) . . . . .   | <i>r. obscurior</i>       |
| -  | Prothoracic (if present) and pterothoracic areas half the size (fig. 12) . . . . .  | <i>r. radiatus</i>        |
| 6  | (2) Crescent-shaped thickenings on posterior margin of genital plate absent . . . . .   | 7                         |
| -  | The above character present . . . . .   | 8                         |
| 7  | (6) Inner vertical sclerotised area of tergites reduced . . . . .   | <i>c. pallidior</i>       |
| -  | Inner vertical sclerotised area of tergites not reduced . . . . .   | <i>c. colius</i>          |
| 8  | (6) Prothoracic dorsal pigmented area reaching to anterior margin of prothorax . . . . .  | <i>r. obscurior</i>       |
| -  | Prothoracic pigmented area not reaching above middle of prothorax . . . . .   | <i>r. radiatus</i>        |
| 9  | (1) Males . . . . .   | 10                        |
| -  | Females . . . . .   | 12                        |
| 10 | (9) Penis in resting position not reaching beyond parameres . . . . .   | <i>samarensis</i>         |
| -  | Penis in resting position reaching beyond parameres . . . . .   | 11                        |

- 11 (10) Total length under 1.60 mm.; total length of genitalia under 0.40 mm.; genitalia as in fig. 40 . . . . . **elbeli**  
 - Total length over 1.80 mm.; total length of genitalia over 0.50 mm.; genitalia as in fig. 36 . . . . . **jordani**
- 12 (9) Length of lateral sclerotised margin of abdominal segment III more than  $2\frac{1}{2}$  times that of IV; no central sternal plate on segment VI . . . . . **elbeli**  
 - Length of margin of segment III less than twice that of IV; central sternal plate on segment VI . . . . . 13
- 13 (12) Seta immediately lateral to post-spiracular seta on VI long and stout; elements of vulval fringe bifid or trifid. . . . . **samarensis**  
 - Above seta short; elements of vulval fringe simple . . . . . **jordani**

## SUMMARY

The genus *Colilipeurus* and its affinities with a group of three new species from the avian genus *Microhierax* together with the problems of the host distribution are discussed. Some remarks on the sclerotisation of teneral specimens are included. The two known species of *Colilipeurus* are redescribed, and two new subspecies of this genus and a new genus with three new species are described.

## ACKNOWLEDGMENTS.

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## REFERENCES.

- BEDFORD, G. A. H., 1930, New genera and species of Mallophaga from S. African hosts. *Rep. vet. Res. S. Afr.* **16**: 153-173.  
 CLAY, T., 1954, The post-spiracular seta and sensillus in the Mallophaga. *Ann. Mag. nat. Hist.* (12) **7**: 716-718.  
 —, 1955, A new genus of Ischnocera. *Proc. R. ent. Soc. Lond.* (B) **24**: 1-6.  
 HINTON, H. E., 1946, *Nature, Lond.*, **157**: 552-553.  
 WILSON, F. H., 1939, The life-cycle and bionomics of *Lipeurus caponis*. *Ann. ent. Soc. Amer.* **32**: 318-320.



TABLE I.—Measurements (mm.) of male *Colilipeurus* species in Canada Balsam.

|                   | <i>r. radiatus.</i> |           | <i>r. obscurior.</i> |       | <i>c. colius.</i> |            | <i>c. pallidior.</i> |           |
|-------------------|---------------------|-----------|----------------------|-------|-------------------|------------|----------------------|-----------|
|                   | Range.              | Mean.     | Range.               | Mean. | Range.            | Mean.      | Range.               | Mean.     |
| <i>Length:</i>    |                     |           |                      |       |                   |            |                      |           |
| Head . . .        | 0.36-0.40           | 0.38 (15) | 0.37 (1)             |       | 0.37-0.40         | 0.375 (21) | 0.33-0.37            | 0.35 (25) |
| Abdomen . . .     | 0.78-0.90           | 0.84 (9)  | 0.78 (1)             |       | 0.73-0.82         | 0.785 (20) | 0.73-0.78            | 0.76 (21) |
| Total . . .       | 1.46-1.68           | 1.52 (9)  | 1.40 (1)             |       | 1.33-1.49         | 1.440 (20) | 1.36-1.48            | 1.40 (20) |
| Genitalia . . .   | 0.31-0.32           | (3)       | .                    | .     | 0.28              | (2)        | 0.26-0.29            | 0.27 (8)  |
| <i>Breadth:</i>   |                     |           |                      |       |                   |            |                      |           |
| Head . . .        | 0.31-0.34           | 0.32 (15) | 0.28 (1)             |       | 0.27-0.30         | 0.29 (21)  | 0.25-0.28            | 0.27 (25) |
| Prothorax . . .   | 0.22-0.27           | 0.24 (9)  | 0.22 (1)             |       | 0.18-0.23         | 0.21 (20)  | 0.18-0.21            | 0.19 (22) |
| Pterothorax . . . | 0.32-0.37           | 0.35 (8)  | 0.32 (1)             |       | 0.30-0.37         | 0.33 (20)  | 0.27-0.31            | 0.29 (19) |
| Abdomen . . .     | 0.30-0.38           | 0.33 (9)  | 0.28 (1)             |       | 0.23-0.35         | 0.31 (20)  | 0.23-0.29            | 0.27 (20) |
| Head Index . . .  | 0.80-0.87           | 0.84 (15) | 0.76 (1)             |       | 0.73-0.79         | 0.76 (20)  | 0.74-0.83            | 0.77 (23) |

Numbers in brackets denote numbers of specimens measured.

TABLE II.—Measurements (mm.) of female\* *Colilipeurus* species.

|                   | <i>r. radiatus.</i> |           | <i>r. obscurior.</i> |          | <i>c. colius.</i> |           | <i>c. pallidior.</i> |           |
|-------------------|---------------------|-----------|----------------------|----------|-------------------|-----------|----------------------|-----------|
|                   | Range.              | Mean.     | Range.               | Mean.    | Range.            | Mean.     | Range.               | Mean.     |
| <i>Length:</i>    |                     |           |                      |          |                   |           |                      |           |
| Head . . .        | 0.45-0.48           | 0.47 (16) | 0.42-0.45            | 0.44 (5) | 0.45-0.52         | 0.48 (21) | 0.43-0.46            | 0.44 (13) |
| Abdomen . . .     | 1.20-1.38           | 1.30 (15) | 1.15-1.25            | 1.20 (4) | 1.08-1.35         | 1.25 (20) | 1.11-1.28            | 1.17 (12) |
| Total . . .       | 2.00-2.26           | 2.14 (14) | 1.90-2.04            | 1.96 (4) | 1.34-2.20         | 2.05 (20) | 1.92-2.10            | 1.96 (12) |
| <i>Breadth:</i>   |                     |           |                      |          |                   |           |                      |           |
| Head . . .        | 0.37-0.42           | 0.40 (16) | 0.35-0.37            | 0.36 (5) | 0.33-0.40         | 0.38 (21) | 0.34-0.38            | 0.36 (12) |
| Prothorax . . .   | 0.27-0.30           | 0.29 (14) | 0.25-0.28            | 0.27 (5) | 0.25-0.32         | 0.28 (20) | 0.25-0.30            | 0.26 (12) |
| Pterothorax . . . | 0.47-0.52           | 0.50 (13) | 0.42-0.45            | 0.43 (4) | 0.42-0.53         | 0.49 (20) | 0.38-0.48            | 0.43 (9)  |
| Abdomen . . .     | 0.55-0.68           | 0.62 (15) | 0.45-0.57            | 0.54 (5) | 0.52-0.65         | 0.59 (19) | 0.48-0.55            | 0.51 (12) |
| Head Index . . .  | 0.79-0.91           | 0.84 (16) | 0.80-0.86            | 0.83 (5) | 0.73-0.81         | 0.78 (20) | 0.78-0.84            | 0.81 (12) |

\* Females with central tergal sclerites. Numbers in brackets denote numbers of specimens measured.

TABLE III.—Measurements (mm.) of male *Falcolius* species in Canada balsam.

|                   | <i>jordani.</i> |            | <i>elbeli.</i> |           | <i>samarensis.</i> |
|-------------------|-----------------|------------|----------------|-----------|--------------------|
|                   | Range.          | Mean.      | Range.         | Mean.     | Range.             |
| <i>Length:</i>    |                 |            |                |           |                    |
| Head . . .        | 0.44-0.47       | 0.46 (16)  | 0.40-0.43      | 0.420 (4) | 0.41               |
| Abdomen . . .     | 1.06-1.16       | 1.11 (7)   | 0.79           | (2)       | 0.78               |
| Total . . .       | 1.87-2.01       | 1.95 (7)   | 1.51-1.52      | 1.515 (2) | 1.52               |
| Genitalia . . .   | 0.55-0.60*      | 0.58 (7)   | 0.32           | (1)       | 0.36               |
| <i>Breadth:</i>   |                 |            |                |           |                    |
| Head . . .        | 0.45-0.47       | 0.460 (16) | 0.38-0.42      | 0.405 (4) | 0.42               |
| Prothorax . . .   | 0.35-0.37       | 0.360 (10) | 0.30-0.33      | 0.315 (2) | 0.33               |
| Pterothorax . . . | 0.53-0.57       | 0.550 (7)  | 0.43-0.45      | 0.440 (2) | 0.43               |
| Abdomen . . .     | 0.52-0.53       | 0.525 (8)  | 0.38-0.40      | 0.390 (2) | 0.42               |
| Head Index . . .  | 0.96-1.05       | 1.01 (16)  | 0.90-1.00      | 0.970 (4) | 1.02               |

\* Variation depends partly on position of penis

TABLE IV.—Measurements (mm.) of female *Falcolius* species in Canada Balsam.

|                       | <i>jordani</i> . |           |           |           | <i>elbeli</i> . |           | <i>samarensis</i> . |
|-----------------------|------------------|-----------|-----------|-----------|-----------------|-----------|---------------------|
|                       | Range.*          | Mean.*    | Range.†   | Mean.†    | Range           | Mean.     | Range.              |
| <i>Length</i> :       |                  |           |           |           |                 |           |                     |
| Head . . . . .        | 0.50-0.53        | 0.52 (13) | 0.47-0.52 | 0.50 (12) | 0.48-0.50       | 0.50 (6)  | 0.50                |
| Abdomen . . . . .     | 1.20-1.37        | 1.33 (9)  | 1.12-1.30 | 1.20 (9)  | 1.14-1.32       | 1.23 (4)  | ?‡                  |
| Total . . . . .       | 2.14-2.40        | 2.29 (9)  | 2.04-2.26 | 2.15 (11) | 2.13-2.22       | 2.17 (4)  | ?                   |
| <i>Breadth</i> :      |                  |           |           |           |                 |           |                     |
| Head . . . . .        | 0.52-0.55        | 0.54 (13) | 0.48-0.54 | 0.53 (12) | 0.50-0.52       | 0.510 (6) | 0.52                |
| Prothorax . . . . .   | 0.43-0.48        | 0.45 (10) | 0.42-0.45 | 0.44 (10) | 0.43-0.45       | 0.440 (4) | 0.45                |
| Pterothorax . . . . . | 0.68-0.75        | 0.71 (10) | 0.63-0.70 | 0.67 (9)  | 0.67-0.68       | 0.675 (4) | 0.72                |
| Abdomen . . . . .     | 0.66-0.80        | 0.76 (10) | 0.57-0.77 | 0.65 (10) | 0.77-0.78       | 0.775 (2) | ?                   |
| Head Index . . . . .  | 1.00-1.06        | 1.03 (13) | 1.02-1.08 | 1.04 (12) | 0.98-1.04       | 1.010 (6) | 1.04                |

\* With central tergal sclerite.

† Without central tergal sclerite.

‡ The single female was dissected before measurement.

TABLE V.—Abdominal chaetotaxy of male *Falcolius*.

|                | <i>jordani</i> . |     |       | <i>elbeli</i> . |     |       | <i>samarensis</i> . |     |     |
|----------------|------------------|-----|-------|-----------------|-----|-------|---------------------|-----|-----|
|                | Pl.              | Tg. | St.   | Pl.             | Tg. | St.   | Pl.                 | Tg. | St. |
| II . . . . .   | 0-4              | 7-8 | 17-22 | 0               | 6-7 | 15-18 | 0-1                 | 4   | 16  |
| III . . . . .  | 4-7              | 8-9 | 15-19 | 4-6             | 6-7 | 13-14 | 3                   | 6   | 11  |
| IV . . . . .   | 4-8              | 6-7 | 13-16 | 4               | 5-6 | 12    | 2-3                 | 5   | 12  |
| V . . . . .    | 4-7              | 5-8 | 12-15 | 4-5             | 4   | 11    | 2                   | 4   | 9   |
| VI . . . . .   | 4-6              | 6-7 | 11-14 | 4-5             | 4   | 10-12 | 3                   | 4   | 10  |
| VII . . . . .  | 3                | 5-6 | 0     | 2-3             | 4   | 0     | 3                   | 4   | 0   |
| VIII . . . . . | 2                | 4-5 | 0     | 2               | 4   | 0     | 2                   | 4   | 0   |

Pl. = pleural. Those setae lateral to the post-spiracular setae (which are omitted from table) and given for one side only.

Tg. = tergal setae. The two anterior setae on segment II are omitted for all species.

St. = sternal setae.

TABLE VI.—Abdominal chaetotaxy of female *Falcolius*.

|                | <i>jordani</i> . |      |       | <i>elbeli</i> . |      |       | <i>samarensis</i> . |     |     |
|----------------|------------------|------|-------|-----------------|------|-------|---------------------|-----|-----|
|                | Pl.              | Tg.  | St.   | Pl.             | Tg.  | St.   | Pl.                 | Tg. | St. |
| II . . . . .   | 0-3              | 7-9  | 18-24 | 0               | 8-10 | 30-33 | ?2                  | 9   | ?19 |
| III . . . . .  | 6-10             | 7-12 | 15-19 | 6-8             | 8-11 | 17-22 | 5                   | 10  | ?16 |
| IV . . . . .   | 7-10             | 8-12 | 13-17 | 5-6             | 9-12 | 12-19 | 3                   | 9   | 12  |
| V . . . . .    | 4-9              | 7-9  | 11-16 | 5-4             | 8-9  | 12-15 | 3                   | 9   | 10  |
| VI . . . . .   | 4-8              | 7-8  | 11-15 | 5-6             | 7-8  | 10-15 | 4                   | 9   | 11  |
| VII . . . . .  | 2-3              | 4-6  | 6-7   | 3               | 7-8  | 5-6   | 3                   | 7   | 10  |
| VIII . . . . . | 2                | 4    | *     | 2               | 4    | *     | 2                   | 4   | *   |

See notes under Table V; sternal setae on segment VII include two minute setae.

\* Sternal setae of VIII-XI as in figures or descriptions.

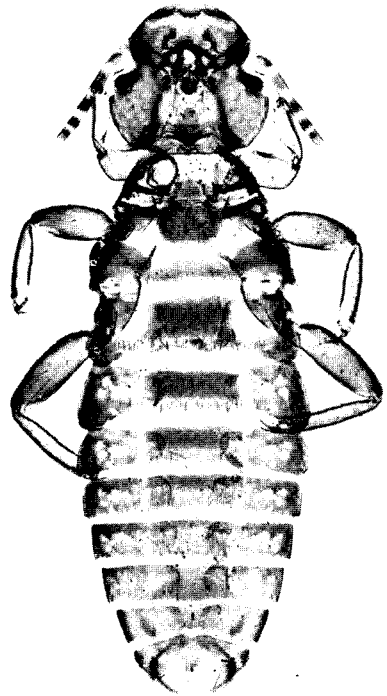
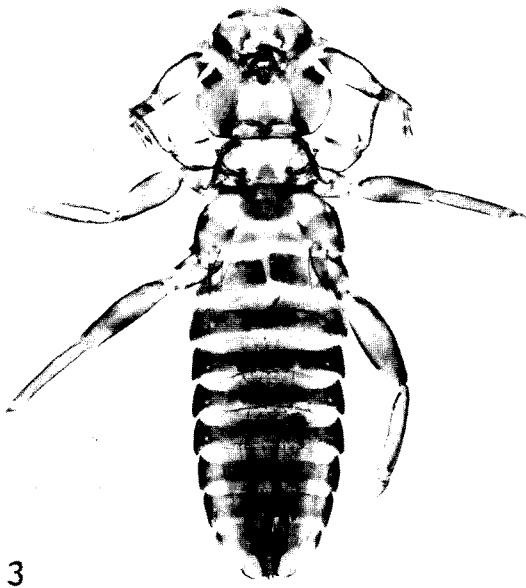
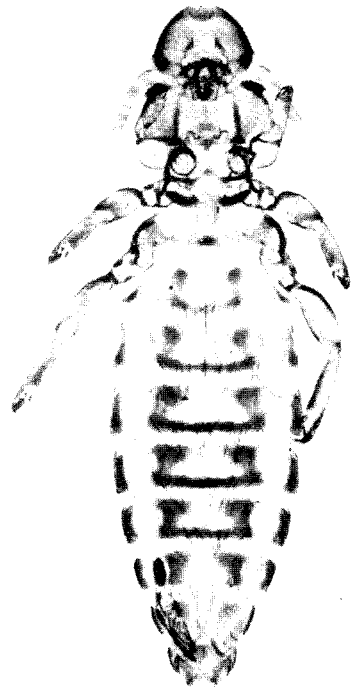
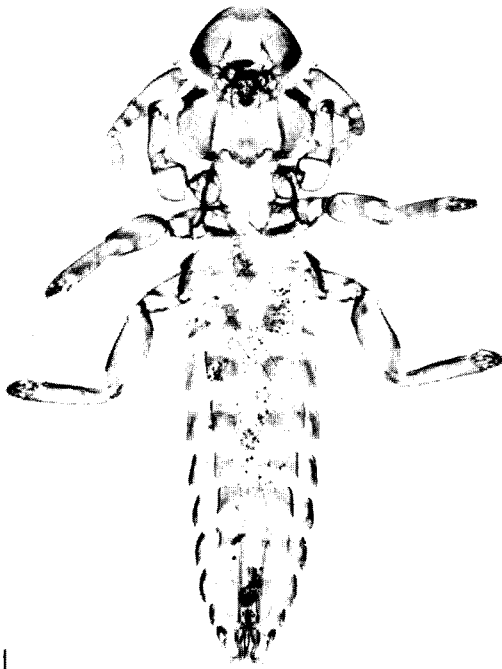


FIG. 1. *Colilipurus r. radiatus* (Neumann) . . . . . 40.  
FIG. 2. *Colilipurus r. radiatus* (Neumann) . . . . . 40.  
FIG. 3. *Falcolinus jordani* sp. n. . . . . 40.  
FIG. 4. *Falcolinus jordani* sp. n. . . . . 40.

T. Chay.

Photographs by M. G. Sawyers.

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