Three types of response are illustrated kymographically: (A) the initiation of flight movements; (B) change in the form and frequency of the wing beat; (C) interruption or cessation of flight movements.

Reaction times of about 0.08 and 0.09 second respectively are reported for the initiation of flight movements in *Graphiphora c-nigrum* and *Pseudaletia unipuncta*.

Summation of stimuli, facilitation by previous mechanical stimulation, accommodation, and the masking effect of certain sounds are described and illustrated kymographically. Responses are shown to be dependent upon the integrity of the tympanic organs.

Responses to sound after decapitation have been recorded in some species.

Although excitatory responses to the inaudible components of bat cries have not been obtained, interruption of movement has been observed in moths confronted by a "ticking" bat.

Field observations are given, showing sensitivity to sound in certain day-flying Lepidoptera.

That an important function of the tympanic organs is the detection of the ultrasonic pulses of bats is regarded as probable but not proved.

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A REVIEW OF THE GENUS RALLICOLA (PHILOPTERIDAE, MALLOPHAGA) FOUND ON ARAMIDAE, PSOPHIIDAE AND RALLIDAE

K. C. EMERSON

INTRODUCTION

While attempting to identify a large collection of the genus *Rallicola*, the author realized that the genus was in need of revision. Subsequent correspondence with Miss Clay, Department of Entomology, British Museum (Natural History), established the fact that she had already prepared a revision of the "*Rallicola* complex", but without detailed descriptions of the species. The manuscript of this revision was immediately made available to the author.

The comprehensive generic description and discussion of the variation in the *Rallicola* species parasitizing the Rallidae, contained in Miss Clay's paper has eliminated the necessity of including a discussion of these subjects in the present study. This study is confined to an examination of those species of *Rallicola* found on the avian families Aramidae, Psophiidae, and Rallidae of the order Gruiformes, and is to supplement the information contained in Miss Clay's paper.

In addition to the author's collection, material has been furnished by Mr. M. A. Carriker, Jr.; Mr. C. F. W. Muesebeck, United States National Museum; Miss Theresa Clay, Department of Entomology, British Museum (Natural History); Mr. G. H. E. Hopkins, Zoological Museum, Tring; and Dr. Harry D. Pratt, Communicable Disease Center, U. S. Public Health Service. I am indebted to Miss Theresa Clay and Mr. G. H. E. Hopkins for their assistance and suggestions.

KEY TO THE RALLICOLA FOUND ON ARAMIDAE, PSOPHIIDAE AND RALLIDAE

1. Hyaline margin of forehead absent, or not noticeably expanded 2
   Hyaline margin of forehead broadly expanded 7
2. Abdominal tergites with more than ten medium-length setae on the posterior margins ..... **foedus**
   Abdominal tergites with six, or less, medium-length setae on the posterior margins 3
3. Antennae filiform and similar in both sexes 4
   Antennae of female filiform; of the male, segment I considerably enlarged and segment III prolonged distally beyond the junction with segment IV 5
4. Abdominal sternite V with six or seven medium-length setae on the median portion of the posterior margin ..... **harrisoni**
   Abdominal sternite V with four or five medium-length setae on the median portion of the posterior margin ..... **minutus**

5. Abdominal tergites IV-V[1] of the female transversely continuous ..... **lugens**
   Abdominal tergites IV-V of the female divided medianly 6
6. Sternite IX of the male with a median lobe-like process reaching to, or beyond, the end of the abdomen ..... "**advenus** group"
   Sternite IX of the male without a lobe-like process ..... **fulicae**
7. In the female, three genital setae on the tubercle on each side ..... **gracilis**
   In the female, two genital setae on the tubercle on each side 8
8. Antennae filiform and similar in both sexes. ..... **ortygometrae**
   Antennae of female filiform; of the male, segment I considerably enlarged and segment III usually prolonged distally beyond the junction with segment IV 9
9. Sternite VIII (or IX ?) of the male distinctly bilobed or with lateral lobes 10
   Sternite VIII (or IX ?) of the male not distinctly bilobed or with lateral lobes 11
10. Tergites III–V of the male divided, or partly divided, medianly ..... **carrikeri**
    Tergites III–V of the male transversely continuous ..... **andinus**
11. Mesosome large and extending distally beyond the parameres 12
    Mesosome not extending distally beyond the parameres 13
12. Abdominal tergite III transversely continuous. ..... **mystax**
    Abdominal tergite III divided medianly ..... **zumpti**
13. Penis elongated and recurved ..... **flavescens**
    Penis short and straight 14
14. Abdominal sternites III–VI with six, or fewer, setae on the posterior margins 15
    Abdominal sternites III–VI with more than six setae on the posterior margins ..... **ferrisi**
15. Tergite VII, of the male interrupted medianly. ..... **funebris**
    Tergite VII, of the male transversely continuous 16
16. Tergite V of the female interrupted medianly 17
    Tergite V of the female transversely continuous 18
17. Tergite VII of the female interrupted medianly. ..... **elliotti**
    Tergite VII of the female transversely continuous. ..... **cuspidatus**
18. Mesosome short, broadly rounded ..... **hoogstraali**
    Mesosome elongated and pointed ..... **sarothurae**

Rallicola porzanae has been omitted from the key: it is discussed elsewhere in the paper.

Rallicola foedus (Nitzsch)

Lipeurus foedus Nitzsch, 1866, (*in* Giebel) Z. ges. Nat. Wiss., 28: 387.

Material examined:

1 male, 1 female from *Psophia crepitans crepitans* Linnaeus, (type host) Venezuela.

4 males, 18 females from *Psophia viridis viridis* Spix, Brazil.

3 males, 2 females from *Psophia leucoptera leucoptera* Spix, Peru.

A long slender atypical species. Forehead without extended hyaline margin. Antennae sexually dimorphic, the first antennal segments being enlarged and elongated in the male; each with an appendage. Tergites transversely continuous in both sexes, each with twenty medium-length setae on the posterior margin. Abdominal sternites, in both sexes, each with sixteen medium-length setae on the posterior margin. This is the only species examined in which the abdominal segments are without well-defined paratergal plates. Male genitalia as in figure 3.

Measurements:[2]	*Male*	*Female*
Length of head	0.65 mm	0.70 mm
Width of head	0.52	0.57
Width of prothorax	0.32	0.35
Width of pterothorax	0.45	0.55
Width of abdomen	0.45	0.60
Total length	2.25	2.90

Rallicola fulicae (Denny)

Nirmus fulicae Denny, 1842, Mon. Anopl. Brit., p. 50 and 125, pl. 9, fig. 2.

Material examined:

2 males, 1 female from *Fulica atra atra* Linnaeus, (type host) England.

2 males, 1 female from *Fulica atra atra* Linnaeus, China.

1 male, 1 female from *Fulica atra australis* Gould, Australia.

A short stout species, with a short wide head. Forehead without extended hyaline margin. The antennae are sexually dimorphic, the first antennal segment being enlarged and elongated in the male. Abdominal tergites II-VII in the female, and II-IV in the male, interrupted medianly. Abdominal sternites III-VI in both sexes with seven medium-length setae on the posterior margins. The male genitalia as in figure 1.

Measurements:	*Male*	*Female*
Length of head	0.37 mm	0.45 mm
Width of head	0.35	0.45
Width of prothorax	0.23	0.30
Width of pterothorax	0.31	0.40
Width of abdomen	0.40	0.53
Total length	1.12	1.60

The "**advenus** group"

Except for slight differences in size and abdominal chaetotaxy, there appears to be no satisfactory external morphological characters by which *R. advenus* (Kellogg), *R. wernecki* n. sp., *R. taylori* n. sp., and *R. guimaraesi* n. sp. can be separated. The male genitalia differ greatly and offer the best means of separation for the species of this well-defined group.

Rallicola advenus (Kellogg)

Onchophorus advenus Kellogg, 1896, Proc. Calif. Acad. Sci. (2) 6: 133, pl. II, figs. 1 and 2.
Docophoris minutotrabeculatus Osborn, 1896, Bull. U. S. Bur. Ent. (n. s.) 5: 221.

Material examined: 12 males, 13 females from *Fulica americana americana* Gmelin, (type host) Iowa, Louisiana, New Mexico, Kansas and Costa Rica.

A short stout species, with a short wide head. Hyaline margin of forehead not extended, and

[1]The first apparent tergite is tergite II.

[2]All measurements throughout the paper are of specimens mounted in balsam.

more broadly rounded than in *R. fulicae*. The antennae are sexually dimorphic, the first antennal segment being enlarged and elongated in the male. Abdominal tergites II-VII in the female, and II-IV in the male, interrupted medianly. Abdominal sternites III-VI in both sexes with six or seven medium-length setae on the posterior margins. Male genitalia as in figure 6.

Measurements:	*Male*	*Female*
Length of head	0.33 mm	0.40 mm
Width of head	0.34	0.40
Width of prothorax	0.23	0.26
Width of pterothorax	0.33	0.35
Width of abdomen	0.40	0.47
Total length	1.20	1.40

Rallicola wernecki n. sp.

Material examined:

4 males, 1 female from *Fulica armillata* Vieillot, Chile.

Male: Head as in figure 34. Posterior margin of pterothorax with a pair of long setae in each posterior lateral angle, and with two pairs of median setae. Abdominal tergites II-IV interrupted medianly. Paratergal plates produced anteriorly and each with two long and one short setae in each posterior lateral angle. Abdominal sternites III-VI each with seven medium-length setae on the posterior margin. Male genitalia as in figure 4.

Female: Antennae filiform, abdominal tergites II-VII interrupted medianly. Chaetotaxy, except for the terminal abdominal segments, as in the male.

Measurements:	*Male*	*Female*
Length of head	0.43 mm	0.40 mm
Width of head	0.40	0.40
Width of prothorax	0.23	0.25
Width of pterothorax	0.35	0.35
Width of abdomen	0.40	0.43
Total length	1.23	1.35

This species is named for Dr. F. L. Werneck, the noted Brazilian specialist on Mallophaga. The holotype male and allotype female have been deposited in the U. S. National Museum.

Rallicola taylori n. sp.

Material examined:

2 males, 2 females from *Fulica gigantea* Eydoux and Souleyet, Bolivia.

Male: Head as in figure 33. Abdominal tergites II-IV interrupted medianly. Abdominal sternites III-VI each with eight medium-length setae on the posterior margin. This species differs but little from *R. advenus*, except in the details of the male genitalia (figure 7), and in that the setae of the abdominal chaetotaxy are considerably smaller.

Female: Antennae filiform, abdominal tergites II-VII interrupted medianly. Chaetotaxy, except for the terminal abdominal segments, as in the male.

Measurements:	*Male*	*Female*
Length of head	0.50 mm	0.42 mm
Width of head	0.42	0.47
Width of prothorax	0.27	0.27
Width of pterothorax	0.40	0.40
Width of abdomen	0.50	0.55
Total length	1.40	1.55

This species is named for Dr. Walter P. Taylor, my former teacher, and noted zoologist and ecologist presently residing in California. The holotype male and allotype female have been deposited in the U. S. National Museum.

Rallicola guimaraesi n. sp.

Material examined:

2 males, 2 females from *Fulica rufifrons* Philippi and Landbeck, Chile.

Male: Head as illustrated in figure 32. Abdominal tergites II-IV interrupted medianly. Abdominal sternites III-VI each with seven medium-length setae on the posterior margin. This species differs but little from the other forms found on *Fulica* spp., except for size and in the details of the male genitalia (figure 2). The very large and complicated male genitalia easily distinguishes it from related species.

Females: Antennae filiform, abdominal tergites II-VII interrupted medianly. Chaetotaxy, except for the terminal abdominal segments, as in the male.

Measurements:	*Male*	*Female*
Length of head	0.40 mm	0.43 mm
Width of head	0.38	0.47
Width of prothorax	0.27	0.28
Width of pterothorax	0.37	0.42
Width of abdomen	0.51	0.57
Total length	1.48	1.58

This species is named for Dr. L. R. Guimarães, the noted Brazilian specialist on Mallophaga. The holotype male and allotype female have been deposited in the U. S. National Museum.

Rallicola minutus (Nitzsch)

Nirmus minutus Nitzsch, 1866, (*in* Giebel) Z. ges. Nat-Wiss., 28: 375. (type host, *Gallinula chloropus chloropus* Linnaeus).

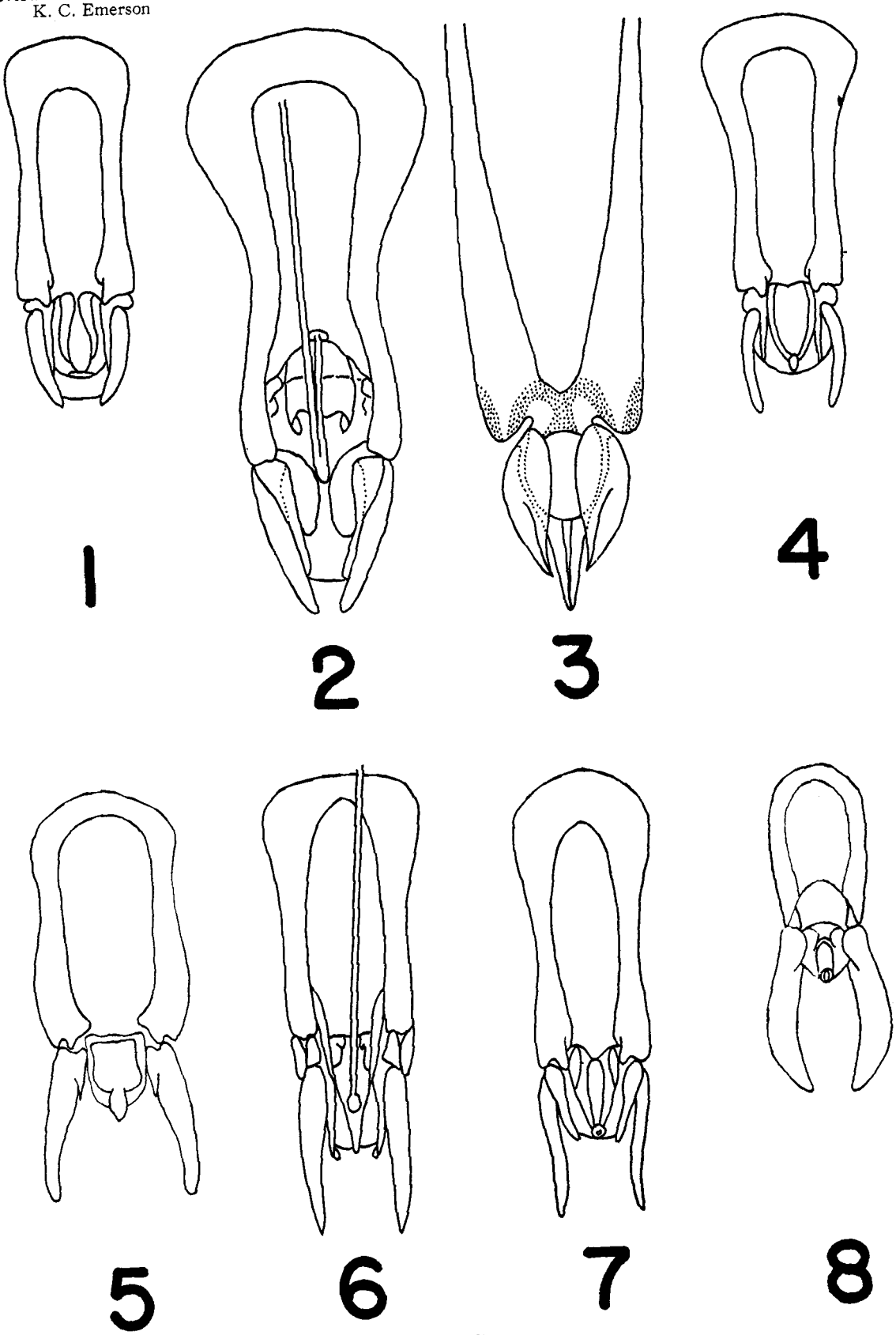
Nirmus parvulus Piaget, 1880, Les Pédiculines, p. 669, pl. 55, fig. 6. (type host, *Gallinula chloropus orientalis* Horsfield).

Rallicola bisetosa var. *microcephala* Uchida, 1948, Jap. Med. Jour., 1: 307. (type host, *Gallinula chloropus indica* Blyth and *Amaurornis phoenicurus chinensis* (Boddaert)).

EXPLANATION OF PLATE I

Rallicola Spp. Male genitalia, drawn to the same scale.

FIG. 1. *R. fulicae* (Denny).
FIG. 2. *R. guimaraesi* n. sp.
FIG. 3. *R. foedus* (Nitzsch).
FIG. 4. *R. wernecki* n. sp.
FIG. 5. *R. andinus* Carriker.
FIG. 6. *R. advenus* (Kellogg).
FIG. 7. *R. taylori* n. sp.
FIG. 8. *R. cuspidatus* (Scopoli).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Material examined:

2 males, 3 females from *Gallinula chloropus chloropus* Linnaeus, Germany and England.

1 female from *Gallinula chloropus galeata* (Lichtenstein), Trinidad.

3 males, 3 females from *Gallinula chloropus cerceris* Bangs, Antigua, British West Indies.

1 male, 1 female from *Gallinula chloropus cachinnans* Bangs, South Carolina.

Head long and slender, hyaline of forehead not extended. Antennae filiform and similar in both sexes. Abdominal tergites II-III in the male, and II-VII in the female, interrupted medianly. Abdominal sternites III-VI in both sexes with four or five medium-length setae on the posterior margins. Male genitalia as in figure 31.

Measurements:	*Male*	*Female*
Length of head	0.41 mm	0.44 mm
Width of head	0.34	0.36
Width of prothorax	0.24	0.23
Width of pterothorax	0.30	0.33
Width of abdomen	0.40	0.44
Total length	1.15	1.35

The description and measurements given by Uchida agree with material from *Gallinula chloropus chloropus* Linnaeus, and not with specimens obtained from *Amaurornis phoenicurus chinensis* (Boddaert).

Rallicola harrisoni n. sp.

Material examined:

5 males, 6 females from *Gallirallus australis australis* (Sparrman), New Zealand.

Male: Head as in figure 29. Abdominal tergites transversely continuous. Abdominal sternites III-VI each with six or seven medium-length setae on the posterior margin. Male genitalia as in figure 30.

Female. Antennae filiform, abdominal tergites II-VII interrupted medianly. Chaetotaxy, except for the terminal abdominal segments, as in the male.

Measurements:	*Male*	*Female*
Length of head	0.51 mm	0.51 mm
Width of head	0.38	0.40
Width of prothorax	0.22	0.24
Width of pterothorax	0.35	0.38
Width of abdomen	0.46	0.48
Total length	1.37	1.68

This species is very closely related to *R. minutus*, but can be distinguished from it by the more numerous setae on the abdominal sternites, and by the fact that the second abdominal tergite in the male is transversely continuous.

This species is named for the late Mr. L. Harrison, who contributed much to our knowledge of the Mallophaga, during his lifetime. The holotype male and allotype female are in Mr. M. A. Carriker's collection.

Rallicola ortygometrae ortygometrae (Schrank)

Pediculus ortygometrae Schrank, 1781, Enum. Ins. Austr. Indig., p. 503.

Nirmus attenuatus Burmeister, 1838, Handb. Ent., 2: 428. *Nomen novum* for *Pediculus ortygometrae* Schrank 1781.

Material examined:

1 male, 2 females from *Crex crex* (Linnaeus), (type host) France.

Head slender, with a wide hyaline margin. Antennae filiform and similar in both sexes. Abdominal tergites II-III in the male, and II-V in the female, interrupted medianly. Abdominal sternites III-VI in both sexes with three or four long setae on the posterior margins. Male genitalia as in figure 14.

Measurements:	*Male*	*Female*
Length of head	0.42 mm	0.45 mm
Width of head	0.30	0.33
Width of prothorax	0.20	0.22
Width of pterothorax	0.27	0.31
Width of abdomen	0.40	0.47
Total length	1.22	1.56

In the past, workers have commented that certain species of *Rallicola* found on the true Rails form a compact and closely related group. From the evidence obtained in this study, it is apparent that the species listed by Clay, in the "*affinis* group" and related species, are very similar and form a well-defined group. The host distribution is apparently limited to the subfamily Rallinae, but without regard to host phylogeny as presently accepted within the subfamily.

The differences in size, external morphology, and male genitalia are so slight that it is the opinion of the author that, for the present, all forms should be treated as subspecies of *R. ortygometrae*.

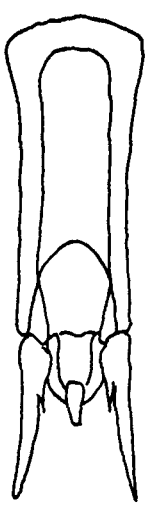
KEY TO THE SUBSPECIES OF RALLICOLA ORTYGOMETRAE

1. Seven long setae on the posterior margins of abdominal sternites III–VI ..... **bedfordi**
   Fewer than seven long setae on the posterior margins of abdominal sternites III–VI 2
2. Tergite VIII in the female divided medianly 3
   Tergite VIII in the female transversely continuous .. 6
3. Tergite V in the male divided medianly .... **bisetosus**
   Tergite V in the male transversely continuous 4
4. Tergite III in the male divided medianly 5
   Tergite III in the male transversely continuous. ..... **clayae**

EXPLANATION OF PLATE II

Rallicola spp.; Male genitalia, drawn to the same scale.

FIG. 9. *R. ortygometrae bedfordi* n. ssp.
FIG. 10. *R. ortygometrae clayae* Tandan.
FIG. 11. *R. ortgometrae californicus* (Kellogg and Chapman).
FIG. 12. *R. ortygometrae pratti* n. ssp.
FIG. 13. *R. ortygometrae bisetosus* (Piaget).
FIG. 14. *R. ortygometrae ortygometrae* (Schrank).
FIG. 15. *R. ortygometrae affinis* (Piaget).
FIG. 16. *R. ortygometrae haydocki* n. ssp.
FIG. 17. *R. ortygometrae ewingi* n. ssp.



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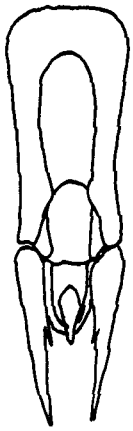

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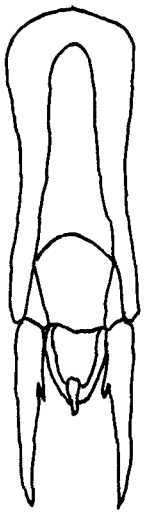

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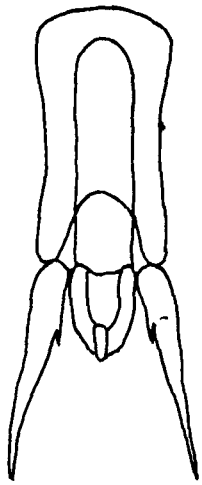

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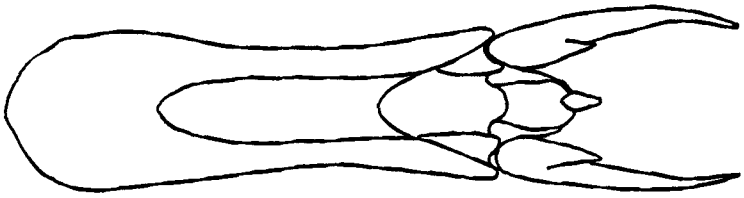

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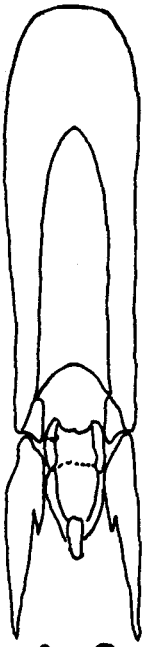

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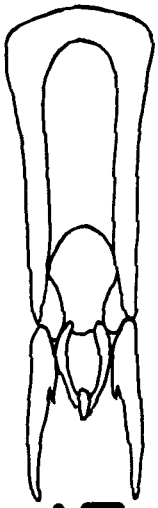

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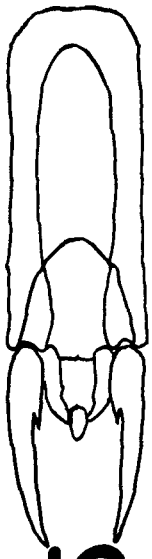

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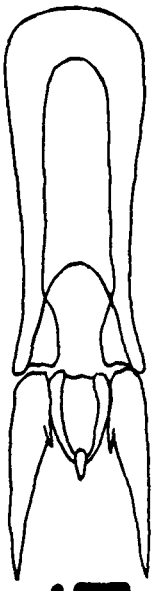

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5. Four long setae on the posterior margin of abdominal sternite V..... **ewingi**
   Five long setae on the posterior margin of abdominal sternite V..... **californicus**
6. Tergite VI in the female divided medianly..... 7
   Tergite VI in the female transversely continuous. ..... **ortygometrae**
7. Six long setae on the posterior margin of abdominal sternite V..... **haydocki**
   Four or five long setae on the posterior margin of abdominal sternite V..... 8
8. Tergite VII in the female divided medianly..... **pratti**
   Tergite VII in the female transversely continuous. ..... **affinis**

Rallicola ortygometrae piageti Clay and *Rallicola ortygometrae guami* Carriker have been omitted from the key. A discussion of these two forms has been included elsewhere in the paper.

Rallicola ortygometrae bedfordi n. ssp.

Material examined:

4 males, 3 females from *Rougetius rougetii* (Guérin-Méneville), Ethiopia.

Male: Head as in figure 35. Abdominal tergites II-IV interrupted medianly. Abdominal sternites III-VI each with seven long setae on the posterior margins. Male genitalia as in figure 9.

Female. Antennae filiform, abdominal tergites II-VII interrupted medianly. Chaetotaxy, except for the terminal abdominal segments, as in the male.

Measurements:	*Male*	*Female*
Length of head	0.50 mm	0.50 mm
Width of head	0.37	0.37
Width of prothorax	0.25	0.27
Width of pterothorax	0.37	0.37
Width of abdomen	0.48	0.50
Total length	1.63	1.67

This species is named for the late Mr. G. A. H. Bedford, who made many contributions to our knowledge of African Mallophaga. Holotype male, slide number 613 and allotype female, slide number 614 deposited in the British Museum (Natural History).

Rallicola ortygometrae bisetosus (Piaget)

Oncophorus bisetosus Piaget, 1880, Les Pédiculines, p. 217, pl. 18, fig. 14.

Material examined:

4 males, 10 females from *Rallina tricolor tricolor* Gray, (type host) Aru Islands.

Abdominal tergites II-V in the male, and II-VIII in the female, interrupted medianly. Abdominal sternites III-VI in both sexes with four long setae on the posterior margins. Male genitalia, the largest of the group, as in figure 13.

Measurements:	*Male*	*Female*
Length of head	0.46 mm	0.48 mm
Width of head	0.38	0.42
Width of prothorax	0.23	0.23
Width of pterothorax	0.33	0.33
Width of abdomen	0.44	0.44
Total length	1.28	1.45

Rallicola ortygometrae californicus (Kellogg and Chapman)

Oncophorus californicus Kellogg and Chapman, 1899, Occ. Pap. Calif. Acad. Sci. 6: 106, pl. 7, fig. 6.

Material examined:

2 males, 3 females from *Rallus longirostris scotti* Sennet, Florida.

3 males, 4 females from *Rallus longirostris caribaeus* Ridgway, Antigua, British West Indies.

5 females from *Rallus longirostris waynei* Brewster, South Carolina.

13 males, 31 females from *Rallus elegans elegans* Audubon, Louisana and Alabama.

3 females from *Rallus elegans ramsdeni* Riley, Cuba.

The original description, based on material collected from *Rallus limicola limicola* Vieillot and *Rallus elegans elegans* Audubon, agrees with all material examined.

Abdominal tergites II-VIII in the female, and II-III in the male; interrupted medianly. Abdominal sternites in both sexes with five medium-length setae on the posterior margins. Male genitalia as in figure 11.

Measurements:	*Male*	*Female*
Length of head	0.52 mm	0.55 mm
Width of head	0.36	0.39
Width of prothorax	0.24	0.25
Width of pterothorax	0.34	0.39
Width of abdomen	0.45	0.50
Total length	1.53	1.80

Rallicola ortygometrae clayae Tandan

Rallicola clayae Tandan, 1951, Ann. Mag. Nat. Hist. (12) 4: 810, figs. 9–13.

Material examined:

1 male, 1 female from *Amaurornis phoenicurus chinensis* (Boddaert), (type host) India.

Abdominal tergites II-VIII in the female, and II in the male, interrupted medianly. Abdominal sternites III-VI in both sexes with five long setae on the posterior margins. Male genitalia as in figure 10.

Measurements:	*Male*	*Female*
Length of head	0.44 mm	0.46 mm
Width of head	0.33	0.35
Width of prothorax	0.21	0.22
Width of pterothorax	0.30	0.32
Width of abdomen	0.41	0.50
Total length	1.40	1.60

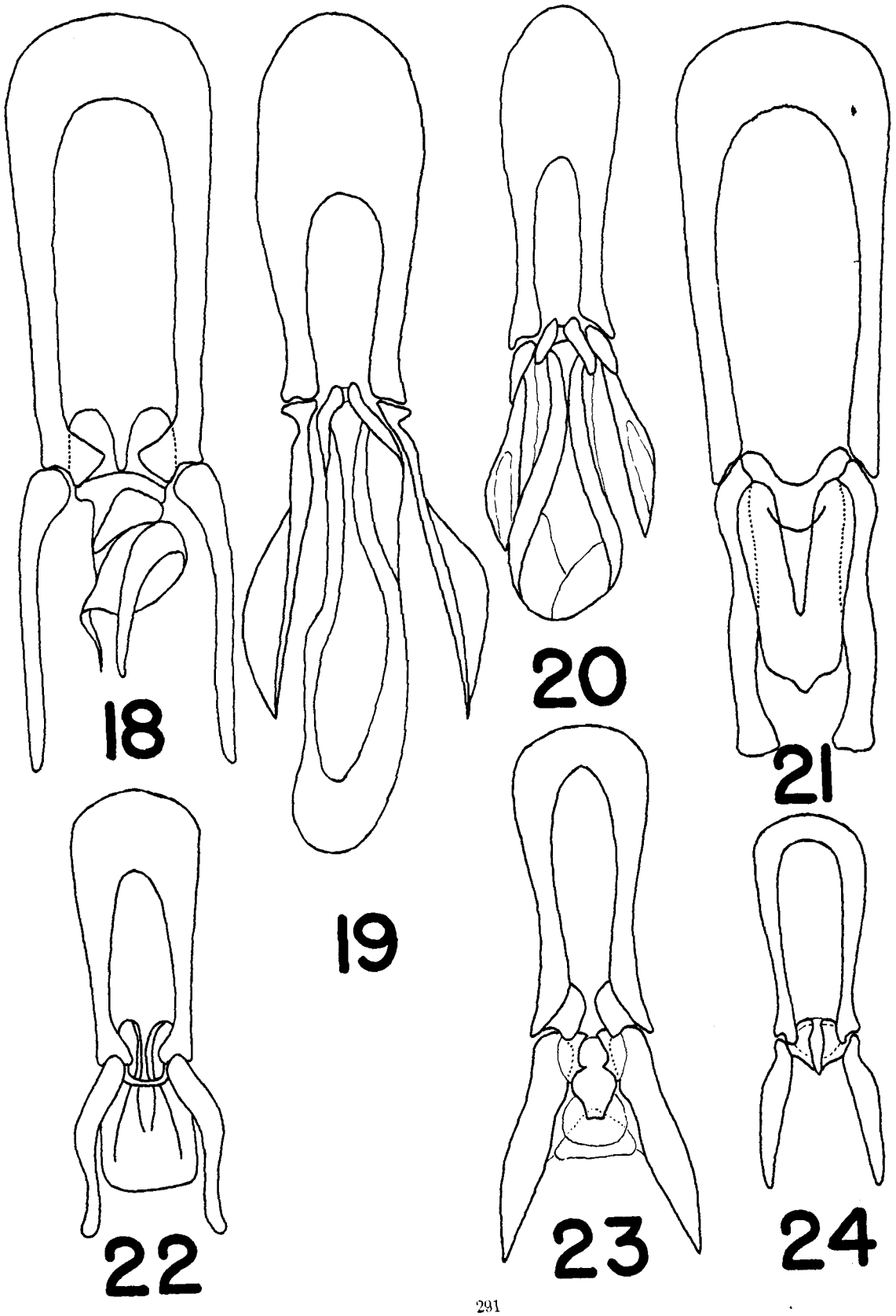
Rallicola ortygometrae affinis (Piaget)

Oncophorus affinis Piaget, 1880, Les Pédiculines, p. 217, pl. 18, fig. 3.

EXPLANATION OF PLATE III

Rallicola spp.; Male genitalia, drawn to the same scale.

FIG. 18. *R. flavescens* (Piaget).
FIG. 19. *R. mystax* (Giebel).
FIG. 20. *R. zumpti* (Keler).
FIG. 21. *R. funebris* (Nitzsch).
FIG. 22. *R. ferrisi* n. sp.
FIG. 23. *R. elliotti* n. sp.
FIG. 24. *R. lugens* (Giebel).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Material examined:
1 male, 1 female from *Dryolimnas cuvieri cuvieri* (Pucheran).

Part of the Piaget Duplicate Collection, with the following notation on the slide label "compared with type—probably part of the original type material".

Abdominal tergites II-III in the male, and II-VI in the female; interrupted medianly. Abdominal sternites III-VI in both sexes, with four or five long setae on the posterior margins. Male genitalia as in figure 15.

Measurements:	*Male*	*Female*
Length of head	0.46 mm	0.51 mm
Width of head	0.36	0.39
Width of prothorax	0.22	0.25
Width of pterothorax	0.32	0.35
Width of abdomen	0.42	0.52
Total length	1.27	1.62

Rallicola ortygometrae pratti n. ssp.

Material examined:
5 males, 14 females from *Ortygonax nigricans nigricans* (Vieillot), Brazil and Colombia.

Male: Head as in figure 37. Abdominal tergites II-III interrupted medianly. Abdominal sternites III-VI each with four medium-length setae on the posterior margins. Male genitalia as in figure 12.

Female: Antennae filiform, abdominal tergites II-VII interrupted medianly. Chaetotaxy, except for the terminal abdominal segments, as in the male.

Measurements:	*Male*	*Female*
Length of head	0.47 mm	0.50 mm
Width of head	0.37	0.37
Width of prothorax	0.23	0.23
Width of pterothorax	0.32	0.32
Width of abdomen	0.43	0.50
Total length	1.50	1.63

This species is named for Dr. Harry D. Pratt, Entomologist with the U. S. Public Health Service. Holotype male, slide number 615 and allotype female, slide number 616 have been deposited in the British Museum (Natural History).

Rallicola ortygometrae haydocki n. ssp.

Material examined:
4 males, 5 females from *Crecopsis egregia* (Peters), Mpata Kafu, N. Rhodesia.

Male: Head as in figure 27. Abdominal tergites II-III interrupted medianly, IV partly divided. Abdominal sternites III-VI each with six long setae on the posterior margin. Male genitalia as in figure 16.

Female: Antennae filiform, abdominal tergites II-VI interrupted medianly. Chaetotaxy, except for the terminal abdominal segments, as in the male.

Measurements:	*Male*	*Female*
Length of head	0.48 mm	0.49 mm
Width of head	0.36	0.38
Width of prothorax	0.23	0.25
Width of pterothorax	0.32	0.36
Width of abdomen	0.45	0.55
Total length	1.68	1.98

This species is named for Major E. L. Haydock of Luanshya, N. Rhodesia, the collector. Holotype male and allotype female, slide number 619, in the British Museum (Natural History).

Rallicola ortygometrae ewingi n. ssp.

Material examined:
4 males, 13 females from *Aramides cajanea cajanea* (P. L. S. Müller), (type host) Colombia.
3 males, 12 females from *Aramides cajanea mexicana* Bangs, Mexico.

Male: Head as in figure 28. Abdominal tergites II-III interrupted medianly. Abdominal sternites III-VI, each with four medium-length setae on the posterior margins. Male genitalia as in figure 17.

Female: Antennae filiform, abdominal tergites II-VIII interrupted medianly. Chaetotaxy, except for the terminal abdominal segments, as in the male.

Measurements:	*Male*	*Female*
Length of head	0.47 mm	0.54 mm
Width of head	0.36	0.42
Width of prothorax	0.20	0.20
Width of pterothorax	0.25	0.28
Width of abdomen	0.39	0.43
Total length	1.51	1.72

This species is named for the late Dr. H. E. Ewing who contributed much to our knowledge of external parasites during his lifetime. Holotype male and allotype female in the collection of Mr. M. A. Carriker.

Rallicola ortygometrae piageti Clay

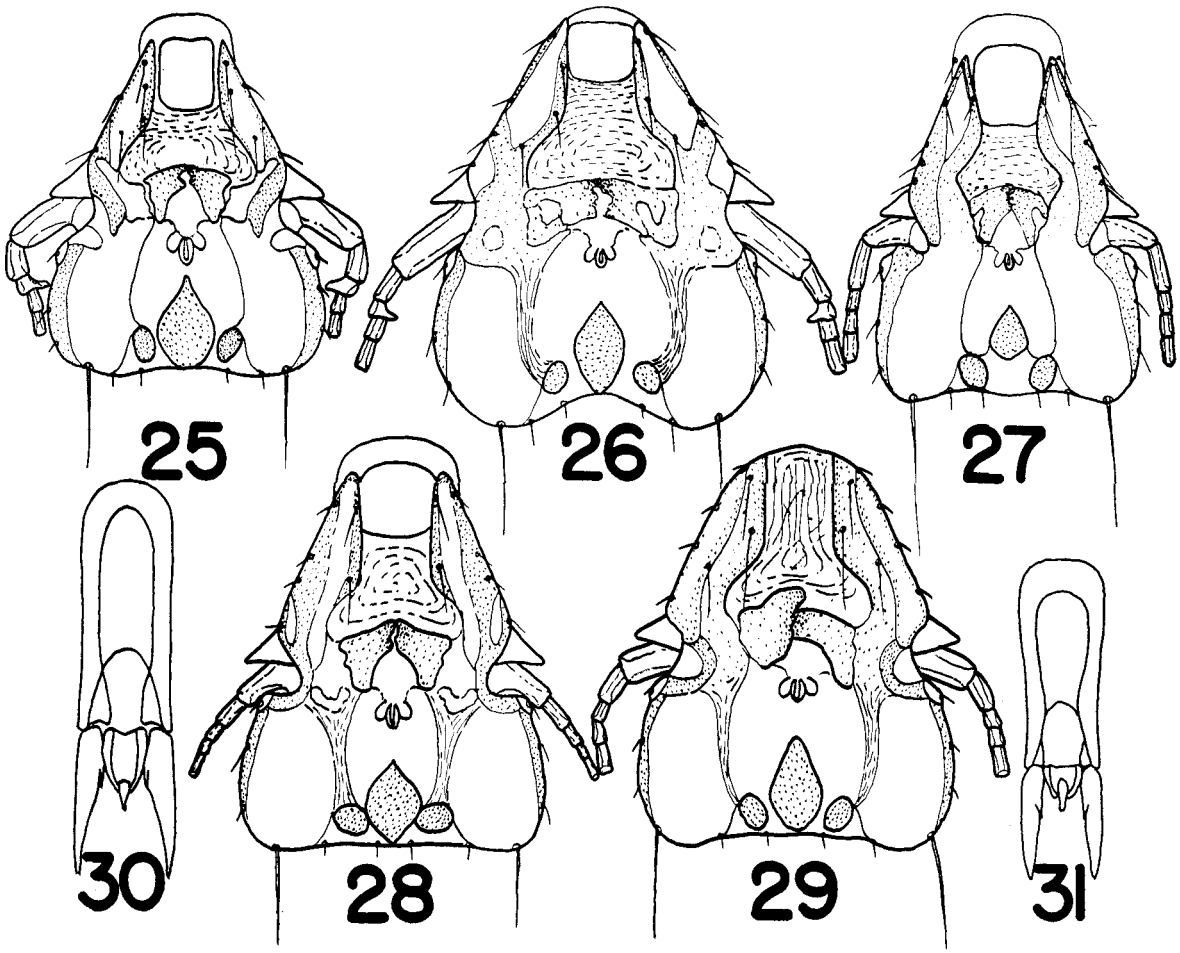
Onchophorus major Piaget, 1888, (*nec. O. major* Piaget, 1885). Tijdschr. Ent. 31: 153, pl. 3, f. 6. (type host: *Tricholimnas lafresnayanus* (J. Verreaux and Des Murs)). *Rallicola piageti* Clay, 1953, Proc. Zool. Soc. London, 123: 584. *Nomen novum* for *Oncophorus major* Piaget, 1888.

No material from this host has been examined. Miss Clay states that the measurements of the type male are as follows: width of head, 0.39 mm; length of head, 0.47 mm (from the anterior margin of the anterior plate as the hyaline margin is damaged). The male genitalia are of the "*ortygometrae* type".

Rallicola ortygometrae guami Carriker

Rallicola guami Carriker, 1949, Proc. U. S. Nat. Mus., 100: 4, fig. 1, e, f. (type host: *Rallus owstoni* (Rothschild)).

Material from this host has not been examined. The description and illustrations clearly show that the form is a subspecies of *R. ortygometrae*,



Rallicola spp.; Ventral view of the head, male, drawn to the same scale.

FIG. 25. *R. elliotti* n. sp.
FIG. 26. *R. ferrisi* n. sp.
FIG. 27. *R. ortygometrae haydocki* n. ssp.
FIG. 28. *R. ortygometrae ewingi* n. ssp.
FIG. 29. *R. harrisoni* n. sp.

Rallicola species, male genitalia, drawn to the same scale.

FIG. 30. *R. harrisoni* n. sp.
FIG. 31. *R. minutus* (Nitzsch).

but there is insufficient information given to satisfactorily place the form within the group.

Rallicola hoogstraali n. sp.

Material examined:

6 males, 6 females from *Rallus madagascariensis* Verreaux collected at Bemangidy, Ft. Dauphin District, Madagascar.

Male: Head as in figure 36. Posterior margin of the pterothorax with four pairs of long setae. Second abdominal tergite interrupted medianly, the remainder transversely continuous. Paratergal plates produced anteriorly, each posterior lateral angle with two long and one short setae. Abdominal sternites III-VI with four medium-length setae on the posterior margins. Male genitalia as in figure 38.

Female: Antennae filiform, abdominal tergites II-III interrupted medianly. Chaetotaxy, except for the terminal abdominal segments, as in the male. Terminal abdominal segments as in figure 43.

Measurements:	*Male*	*Female*
Length of head	0.55 mm	0.55 mm
Width of head	0.42	0.42
Width of prothorax	0.25	0.25
Width of pterothorax	0.37	0.37
Width of abdomen	0.50	0.56
Total length	1.64	1.72

This species is named for Dr. Harry Hoogstraal, the collector. Holotype male and allotype female in the U. S. National Museum.

Rallicola funebris (Nitzsch)

Nirmus funebris Nitzsch, 1866, (in Giebel) Z. ges. Nat-Wiss., 28: 371.

Rallicola bresslaui Pessôa and Guimarães, 1935, Ann. Fac. Med. S. Paulo (2) 11: 3, figs. 1–6.

Material examined:

19 males, 22 females from *Aramus scolopaceus scolopaceus* (Gmelin), (type host) Brazil, Boliva and Colombia.

5 males, 2 females from *Aramus scolopaceus pictus* (F. A. A. Meyer), Florida.

Head slender, with a wide hyaline margin. Antennae sexually dimorphic; first segments of the antennae of the male, enlarged and elongated, each with an appendage. Abdominal tergites II-VIII, in both sexes, interrupted medianly. Abdominal sternites III-VI in both sexes with five or six long setae on the posterior margins. Ventrally, in the female, the lateral margins of the ninth abdominal segment with seven heavy setae. Male genitalia as in figure 21.

Measurements:	*Male*	*Female*
Length of head	0.57 mm	0.65 mm
Width of head	0.45	0.50
Width of prothorax	0.28	0.30
Width of pterothorax	0.44	0.46
Width of abdomen	0.50	0.64
Total length	1.97	2.12

Rallicola ferrisi n. sp.

Material examined:

7 males, 9 females from *Galbicrex cinera* (Gmelin), China and Formosa.

Male: Head as in figure 26. Abdominal tergites II-III interrupted medianly, the remainder being transversely continuous. Paratergal plates produced anteriorly, and each with two long and one short setae in each posterior lateral angle. Abdominal sternites III-VI each with nine long setae on the posterior margin. Male genitalia as in figure 22.

Female: Antennae filiform, abdominal tergites II-VIII interrupted medianly. Chaetotaxy, except for the terminal abdominal segments as in the male. Terminal abdominal segments as in figure 44.

Measurements:	*Male*	*Female*
Length of head	0.54 mm	0.56 mm
Width of head	0.42	0.43
Width of prothorax	0.29	0.29
Width of pterothorax	0.43	0.43
Width of abdomen	0.57	0.57
Total length	1.65	1.71

This species is named for Dr. G. F. Ferris, Stanford University, the well-known authority on Anoplura and Mallophaga. Holotype male and allotype female are in the U. S. National Museum.

Rallicola flavescens (Piaget)

Oncophorus flavescens Piaget, 1885, Les Pédiculines, Supplément, p. 37, pl. 4, fig. 7.

Material examined:

12 males, 29 females from *Himantornis haematopus* Hartlaub, (type host) West Africa.

Head slender, with a wide hyaline margin. Antennae sexually dimorphic, first segments enlarged and elongated in the male, each with an appendage. Abdominal tergite II in the male, and II-VII in the female, interrupted medianly. Abdominal sternites III-VI in both sexes with six long setae on the posterior margins. Ventrally, in the female, the lateral margins of the ninth abdominal segment with eighteen long setae. Male genitalia as in figure 18.

Measurements:	*Male*	*Female*
Length of head	0.52 mm	0.52 mm
Width of head	0.42	0.45
Width of prothorax	0.27	0.27
Width of pterothorax	0.43	0.44
Width of abdomen	0.55	0.56
Total length	1.59	1.62

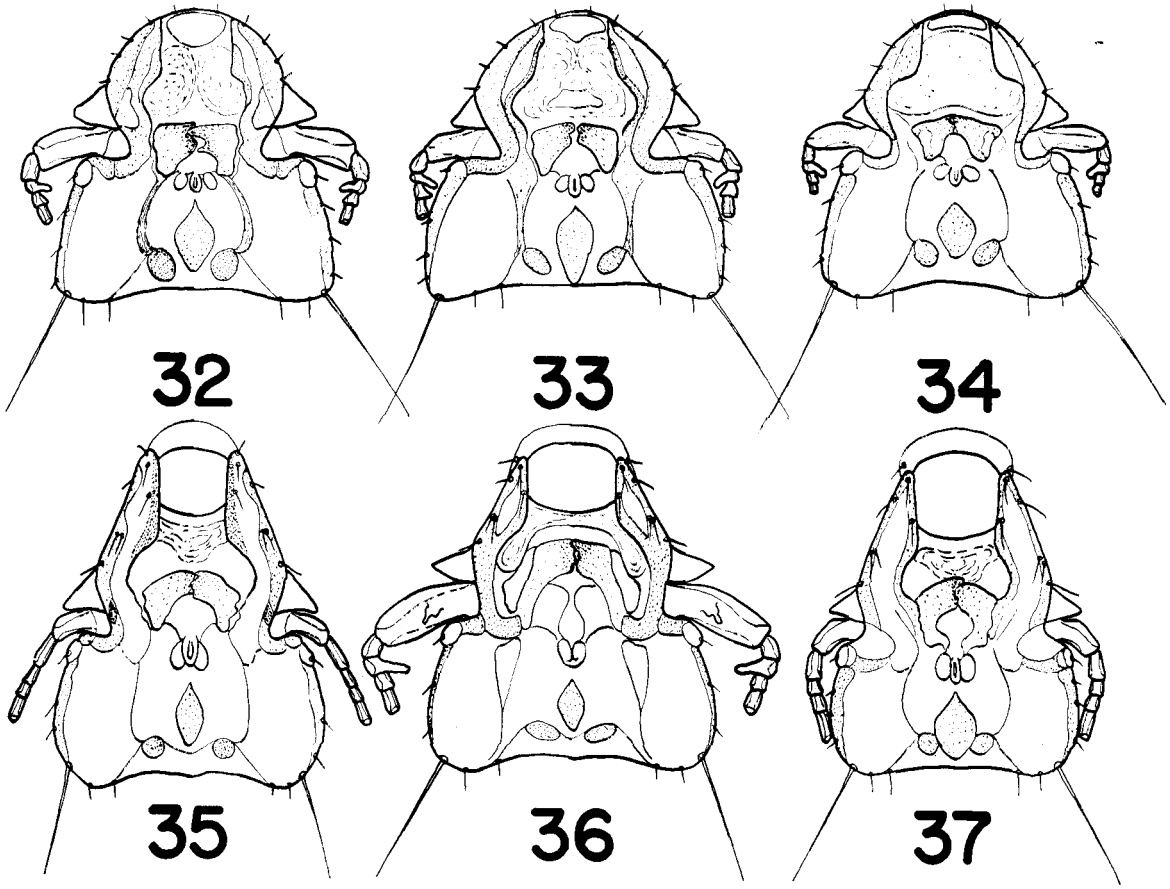
Rallicola andinus Carriker

Rallicola andinus Carriker, 1949, Rev. Brasil Biol., 9: 313, figs. 23–24.

Material examined:

5 males, 3 females from *Ortygonax rytirhynchos tschudii* (Chubb), (type host) Peru.

11 males, 13 females from *Ortygonax rytirhynchos rytirhynchos* Vieillot, Brazil.



Rallicola spp.; Ventral view of the head, male, drawn to the same scale.

FIG. 32. *R. guimaraesi* n. sp.
FIG. 33. *R. taylori* n. sp.
FIG. 34. *R. wernecki* n. sp.
FIG. 35. *R. ortgometrae bedfordi* n. ssp.
FIG. 36. *R. hoogstraali* n. sp.
FIG. 37. *R. ortygometrae pratti* n. ssp.

Head long and wide, with a wide hyaline margin. Antennae sexually dimorphic, first segments of the antennae of the male enlarged and elongated, each with a small appendage. Abdominal tergites II in the male, and II-VII in the female, interrupted medianly. Abdominal sternites III-VI in both sexes with five long setae on the posterior margins. Terminal abdominal segments of the male (fig. 42) not characteristic. Male genitalia as in figure 5.

Measurements:	*Male*	*Female*
Length of head	0.43 mm	0.48 mm
Width of head	0.38	0.39
Width of prothorax	0.22	0.24
Width of pterothorax	0.33	0.36
Width of abdomen	0.42	0.45
Total length	1.19	1.41

Rallicola cuspidatus (Scopoli)

Pediculus cuspidatus Scopoli, 1763, Ent. Carniolica, p. 385

Material examined:

1 male, 3 females from *Rallus aquaticus aquaticus* Linnaeus, (type host) Germany.

1 female from *Rallus aquaticus indicus* Blyth, Japan.

Head slender, with a wide hyaline margin. Antennae sexually dimorphic, first segments of the antennae of the male enlarged and elongated, each with an appendage. Abdominal tergites II-V in the female, and II-III in the male, interrupted medianly. Abdominal sternites III-VI in both sexes with four or five medium-length setae on the posterior margins. Male genitalia as in figure 8.

Measurements:	*Male*	*Female*
Length of head	0.37 mm	0.42 mm
Width of head	0.30	0.35
Width of prothorax	0.19	0.22
Width of pterothorax	0.27	0.30
Width of abdomen	0.35	0.43
Total length	1.11	1.44

Rallicola elliotti n. sp.

Material examined:

12 males, 9 females from *Ionornis martinica* (Linnaeus), Panama, Tristan da Cunha, Maritius Island and Colombia.

Male: Head as in figure 25. Abdominal tergite II interrupted medianly, the remainder being transversely continuous. Paratergal plates produced anteriorly and each with two long and one short setae in each posterior lateral angle. Fifth abdominal sternite with four long setae, the remainder with two long setae, on the posterior margins. Terminal abdominal segment ventrally with eight medium-length setae on each lateral margin. Male genitalia as in figure 23.

Female: Antennae filiform, abdominal tergites II-VI interrupted medianly. Fourth and fifth abdominal sternites with four long setae, the remainder with two long setae on the posterior margins.

Measurements:	*Male*	*Female*
Length of head	0.45 mm	0.47 mm
Width of head	0.33	0.37
Width of prothorax	0.22	0.23
Width of pterothorax	0.33	0.35
Width of abdomen	0.48	0.52
Total length	1.27	1.49

This species is named for one of the collectors, Mr. H. F. I. Elliott. Holotype male and allotype female, from Panama, are in the British Museum (Natural History).

Rallicola lugens (Giebel)

Nirmus lubens Giebel, 1874, Insecta Epizoa, p. 170. (type host, *Porphyrio poliocephalus poliocephalus* (Latham)).
Oncorphorus fallax Piaget, 1880, Lés Pediculines, p. 220, pl. 18, fig. 6. (type host, *Porphyrio poliocephalus melanotus* Temminck).
Onchophorus subfallax Piaget, 1880, Lés Pediculines, p. 221, pl. 18, fig. 7. (type host, *Porphyrio poliocephalus palliatus* Brüggemann).

Material examined:

6 males, 4 females from *Porphyrio poliocephalus poliocephalus* (Latham), India.

3 males, 1 female from *Porphyrio poliocephalus indicus* Horsfield, Borneo.

2 males, 1 female from *Porphyrio poliocephalus melanotus* Temminck, Australia.

1 male, 2 females from *Porphyrio poliocephalus mertoni* Berlepsch, Great Key Island.

Head slender, hyaline margin not extended. Antennae sexually dimorphic, the first antennal segments being enlarged and elongated in the male, each with an appendage. Abdominal tergites II in the male, and II-III in the female, interrupted medianly. Abdominal sternites III-VI in both sexes with twelve long setae on the posterior margins. Male genitalia as in figure 24.

Measurements:	*Male*	*Female*
Length of head	0.47 mm	0.52 mm
Width of head	0.40	0.45
Width of prothorax	0.25	0.27
Width of pterothorax	0.40	0.45
Width of abdomen	0.50	0.63
Total length	1.57	1.80

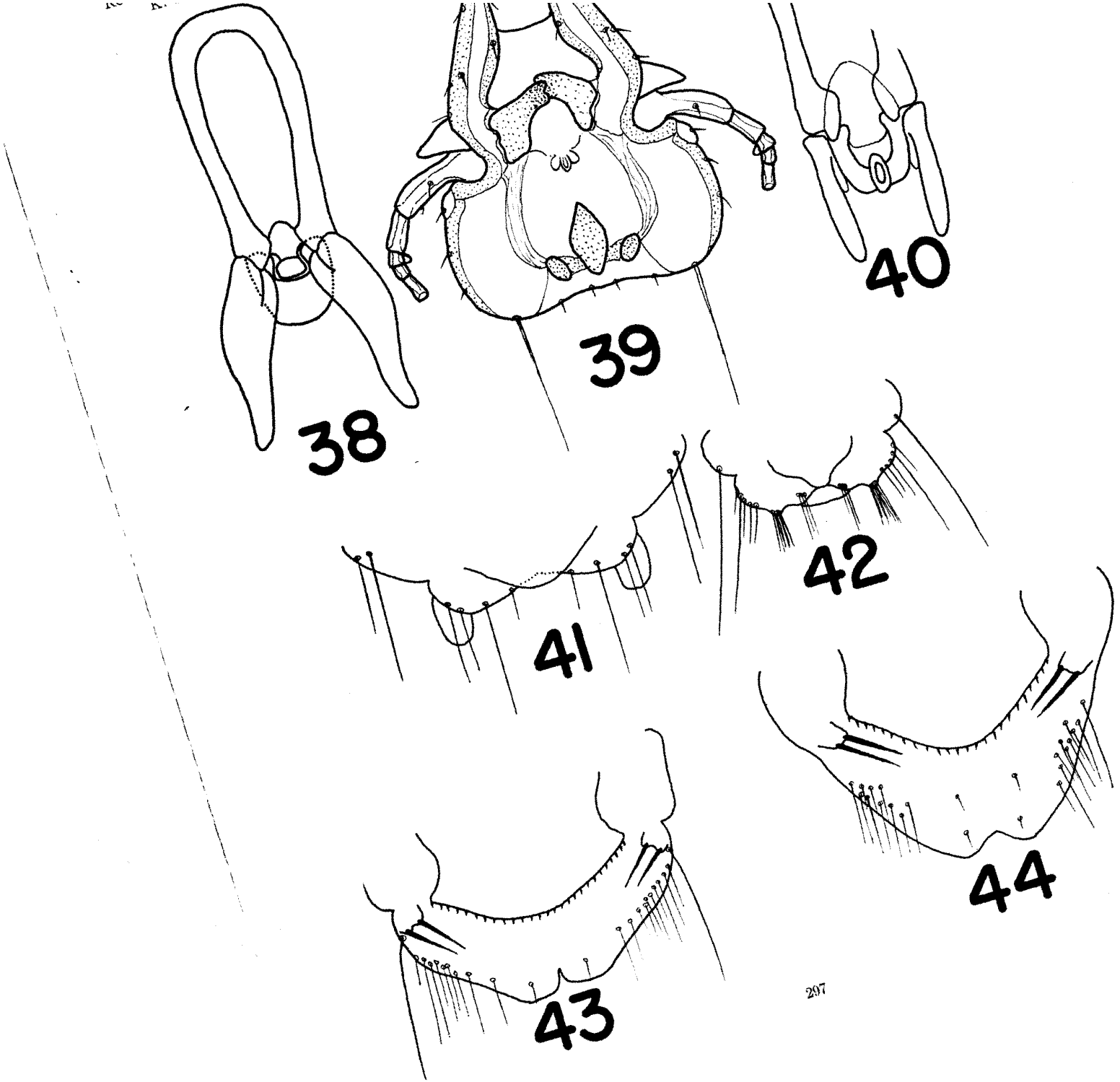
Rallicola mystax (Giebel)

Nirmus intermedius Giebel, 1874, Insecta Epizoa, p. 169.
Nirmus mystax Giebel, 1874, Insecta Epizoa, p. 301.
Nomen novum for *Nirmus intermedius* Giebel, 1874, *nec* Nitzsch 1866.

EXPLANATION OF PLATE VI

Rallicola spp.

FIG. 38. *R. hoogstraali* n. sp., male genitalia.
FIG. 39. *R. carrikeri* n. sp., male, ventral view of head.
FIG. 40. *R. carrikeri* n. sp., male genitalia.
FIG. 41. *R. carrikeri* n. sp., male, ventral view of terminal abdominal segments.
FIG. 42. *R. andinus* Carriker, male, ventral view of terminal abdominal segments.
FIG. 43. *R. hoogstraali* n. sp., female, ventral view of terminal abdominal segments.
FIG. 44. *R. ferrisi* n. sp., female, ventral view of terminal abdominal segments.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Material examined:

1 male, 1 female from *Porzana porzana* (Linnaeus), (type host) Macedonia.

Head long and slender with a wide hyaline margin. Antennae sexually dimorphic, first segments in the antennae of the male enlarged and elongated, each with an appendage. Abdominal tergite II may be divided, remainder transversely continuous in both sexes. Abdominal sternites III-VI with four long setae on the posterior margins. Male genitalia as in figure 19.

Measurements:	*Male*	*Female*
Length of head	0.37 mm	0.40 mm
Width of head	0.32	0.35
Width of prothorax	0.18	0.21
Width of pterothorax	0.27	0.30
Width of abdomen	0.41	0.47
Total length	1.30	1.30

Rallicola zumpti (Kéler)

Parricola zumpti Kéler, 1951, Z. Parasitenk., 15: 47, figs. 7-11.

Material examined:

5 males, 3 females from *Atlantisia rogersi* Lowe, Inaccessible Island.

Head long and slender with a wide hyaline margin. Antennae sexually dimorphic, first segments of the antennae of the male, enlarged and elongated, each with an appendage. Abdominal tergites II-III in both sexes interrupted medianly. Abdominal sternites III-VI in both sexes with four long setae on the posterior margins. Male genitalia as in figure 20.

Measurements:	*Male*	*Female*
Length of head	0.42 mm	0.45 mm
Width of head	0.35	0.37
Width of prothorax	0.21	0.22
Width of pterothorax	0.33	0.33
Width of abdomen	0.50	0.50
Total length	1.27	1.38

Rallicola carrikeri n. sp.

Material examined:

4 males, 5 females from *Laterallus viridis brunnescens* Todd, Colombia.

Male: Head as in figure 39. Abdominal tergites II-III interrupted medianly. Tergites IV-V partly divided. Paratergal plates narrow and heavily chitinized; produced anteriorly. Abdominal sternites III-VI with four long setae on the posterior margins. Terminal abdominal segments as in figure 41. Male genitalia as in figure 40.

Female: Antennae filiform, abdominal tergites II-VIII interrupted medianly. Chaetotaxy, except for the terminal abdominal segments, as in the male.

Measurements:	*Male*	*Female*
Length of head	0.42 mm	0.42 mm
Width of head	0.38	0.38
Width of prothorax	0.22	0.23
Width of pterothorax	0.36	0.36
Width of abdomen	0.46	0.52
Total length	1.78	1.88

This species is named for Mr. M. A. Carriker, the well-known Mallophaga specialist, who collected the series. Holotype male and allotype female are in the collection of Mr. M. A. Carriker.

Rallicola gracilis (Piaget)

Docophorus gracilis Piaget, 1871, Tijdschr. Ent., 14: 120, pl. 6, fig. 5. (host unknown).

Docophorus dubius Piaget, 1880, Les Pédiculines, p. 120, pl. 10, fig. 8. (host unknown).

Miss Clay has furnished the following information concerning the type. *Rallicola gracilis* is probably based on the same specimen, a female, as *Rallicola dubius:* the specimen in the British Museum (Natural History) is labelled with the latter name. The female has three genital setae on the tubercle on each side, which easily separates it from the other known species in the genus. Abdominal sternites III-VI with ten to twelve medium-length setae, the three outer setae on each side are separated from the median group. Abdominal tergites II-VII and probably VIII are interrupted medianly. Length of head, 0.55 mm, and width of head, 0.48 mm.

Rallicola porzanae (Piaget)

Oncophorus porzanae Piaget, 1880, Les Pédiculines, p. 218. (type host: *Coturniceps noveboracensis noveboracensis* Gmelin).

Miss Clay has kindly furnished the following information concerning the type. Abdominal tergites II-VIII interrupted medianly. Abdominal sternites III-VI with four to six medium-length setae. Length of head, 0.55 mm, width of head, 0.43 mm. With only the type, a female, it is impossible to place this species in the key.

Rallicola sarothurae Clay

Rallicola sarothurae Clay, 1953, Proc. Zool. Soc. London, 123: 583, figs. 19, 31-35. (type host: *Sarothurra antonii* Madarasz and Newmann).

This species has been well-illustrated by Miss Clay. The male genitalia do not resemble any other known in the genus.

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PRELIMINARY STUDIES OF THE HYDRACARINA OF MICHIGAN: THE SUBFAMILY FORELIINAE VIETS (ACARINA: PIONIDAE)[1]

DAVID R. COOK
Department of Biology, Wayne University, Detroit, Michigan

This paper[2] is the first of a series dealing with the subfamilies of the Pionidae of Michigan. The present work, although treating primarily the Michigan fauna, includes all the known North American species. The subfamily Foreliinae is small, with only two described genera, both of which are present in Michigan. Members of the genus *Forelia* are mostly holarctic in distribution, but have also been reported from Africa. The genus *Pseudofeltria*, formerly known only from Europe, is now reported from North America for the first time.

Prior to the work of Habeeb (1954a, 1954b) there were only two described species of *Forelia* known from North America. Habeeb erected five species, two of which appear to be synonyms of *F. ovalis* Marshall. Although types were not designated or specimens deposited in museums, the author was able, through the kindness of Dr. Habeeb, to secure the loan of named specimens for comparison.

The strong sexual dimorphism in males belonging to this subfamily produces excellent characters upon which species diagnoses may be based. One of the best of these characters is the highly modified fourth leg. Unfortunately, it is almost impossible to orient the legs in exactly the same way in all specimens which, on casual observation, may lead to apparent differences in both proportions and chaetotaxy. This should be kept in mind when comparisons are made with figures of the fourth leg included in this paper.

[1]Contribution from the Department of Biology, Wayne University and the University of Michigan Biological Station.

[2]Appreciation is expressed to the editor for permission to revise this manuscript (originally submitted in 1953) to avoid the needless creation of synonyms. Data on specimens collected during the Summer of 1954 have also been included.

Subfamily **Foreliinae** Viets

Viets, 1926. Zool. Anz., 69: 198.

Subfamily Diagnosis; Integument thin or with a tendency to form areas of secondary sclerotization; fourth palpal segment with hair tubercles on the ventral side and a small projection at the distal end; legs with or without swimming hairs; median margin of fourth coxae reduced to a median angle; with six to many genital acetabula on each side; IV-Leg-6 of male strongly modified, with two to twelve peg-like setae.

Genus **Forelia** Haller

Haller, 1882. Mitt. Naturf. Ges. Bern, 18: 58.

Generotype: *Forelia liliacea* (Muller)

Generic Diagnosis: Integument thin or with areas of secondary sclerotization; swimming hairs present on second, third and fourth pairs of legs; posterior margins of fourth coxae pointed in females; without a projection on the ventral side of the second palpal segment.

Subgenus **Forelia** Haller

Subgeneric Diagnosis; IV-Leg-4 of males with little, if any, sexual dimorphism; posterior margins of fourth coxae pointed or only slightly rounded in males; projection at distal end of fourth palpal segment small.

Forelia (Forelia) ovalis Marshall

Figs. 33–36, 38–41, 43–45

F. ovalis Marshall, 1929. Univ. Toronto Stud., Biol. Ser., No. 33: 78.
F. scutator Habeeb, 1954. Leaflets Acadian Biol., No. 3: 1. (new synonymy).
F. millburniana Habeeb, 1954. Leaflets Acadian Biol., No. 3: 4 (new synonymy).

Male: Length of body 0.54–0.67 mm.; width of body 0.42–0.48 mm.; body bluntly pointed at