

Taxonomy of New World *Columbicola* (Phthiraptera: Philopteridae) from the Columbiformes (Aves), with Descriptions of Five New Species

DALE H. CLAYTON AND ROGER D. PRICE¹

Department of Biology, University of Utah, Salt Lake City, UT 84112-0840 and Department of Entomology, University of Minnesota, St. Paul, MN 55108-6125

Ann. Entomol. Soc. Am. 92(5): 675-685 (1999)

ABSTRACT Twelve previously described species of *Columbicola* are recognized and redescribed. The species *Columbicola extinctus* Malcomson, previously recognized only from the extinct passenger pigeon, *Ectopistes migratorius* (L.), is "brought back" from extinction by showing it to be conspecific with lice from the extant band-tailed pigeon, *Columba fasciata* Say. Five new species are described: *drowni* [type host *Metriopelia melanoptera* (Molina)], *altamimiae* [type host *Metriopelia aymara* (Prevost)], *adamsi* (type host *Columba speciosa* Gmelin), *waggenermani* (type host *Columba squamosa* Bonnaterre), and *waltheri* [type host *Geotrygon linearis* (Prevost)]. *Columbicola triangularis* Eichler and *Columbicola gymnopeliae* Eichler are removed from synonymy and recognized as valid species. *Columbicola pseudolipeurusque* Eichler is considered a junior synonym of *Columbicola passerinae* (Wilson) rather than of *Columbicola macrourae* (Wilson). We remark on informal groupings of the species and provide a key for the identification of the 17 species recognized in this article.

KEY WORDS Ischnocera, *Columbicola*, Columbiformes, New World, taxonomy

THE CHEWING LOUSE genus *Columbicola* Ewing currently includes 82 specific and subspecific names, all from hosts in the avian order Columbiformes. Most of these taxa are from Old World hosts. Tendeiro (1965) published a review of the genus in Portuguese, which is, unfortunately, relatively inaccessible to most workers. The purpose of this article is to review the status of all New World *Columbicola*, including specimens not available to Tendeiro. The material we examined for this study included a large number of museum specimens, as well as fresh material collected in Mexico by D.H.C. Methods used to remove lice from their hosts were described in Clayton (1990). We redescribe 12 species, describe 5 new species, and present a key and illustrations to facilitate the identification of all 17 species. A summary of the distribution of these louse species among the columbiform host taxa is found in Table 1.

Measurements are in millimeters. Abbreviations for measured structures are defined at first use. Host classification follows that of Howard and Moore (1991). For brevity, generic features are not repeated in species descriptions. Characters in the key hold for both sexes unless otherwise stated. Under the *Material* section, we have indicated in parentheses the number of host individuals from which lice were collected. Abbreviations for institutions serving as depository sites for type specimens are as follows: The Natural History

Museum, London (BMNH); Oklahoma State University, Stillwater (OSU); the University of Minnesota, St. Paul (UM); and the National Museum of Natural History, Washington, DC (USNM). Tendeiro (1965) gave a complete listing of junior synonyms, and therefore we have not repeated them here.

Members of *Columbicola* are slender elongate lice. Most species show marked sexual dimorphism of the antennae, with males having a much enlarged scape and distally expanded 3rd segment (Figs. 1 and 4). The head has a distinct bilobed dorsoanterior head plate with associated marginal carina and pair of forward-directed broad medioanterior setae (Fig. 5). Both sexes have the abdomen with divided tergites on II-IX, the first 7 of these with 2 median setae on each side (Figs. 2 and 6). The female ventral terminalia are similar to Fig. 3; the male terminalia are similar to Fig. 7.

The 4 principal characters distinguishing species are as follows: (1) shape and development of the dorsoanterior head plate, (2) chaetotaxy and structure of the female ventral terminalia, (3) shape of components of the male genitalia, and (4) dimensions of major body regions.

Columbicola columbae (L.) (Figs. 1-9)

Pediculus columbae L., 1758: 614. Type host: "Piccion grosso" = *Columba livia* Gmelin.

Description. Male head as in Fig. 4, with long medioposterior pair of setae extending beyond posterior

¹ Current address: 4622 Kinkead Avenue, Fort Smith, AR 72903-1947.

Table 1. Host-parasite list for New World *Columbicola*

Host species ^a	Louse species
<i>Columba</i>	
<i>livia</i> (*)	<i>columbae</i>
<i>leucocephala</i>	<i>waggeneri</i> , n.sp.
<i>squamosa</i> (*)	<i>waggeneri</i> , n.sp.
<i>speciosa</i> (*)	<i>adamsi</i> , n.sp.
<i>picazuro</i> (*)	<i>triangularis</i>
	<i>adamsi</i> , n.sp.
<i>maculosa</i>	<i>triangularis</i>
	<i>adamsi</i> , n.sp.
<i>fasciata</i>	<i>extinctus</i>
<i>cayennensis</i>	<i>adamsi</i> , n.sp.
<i>plumbea</i>	<i>adamsi</i> , n.sp.
	<i>macrourae</i>
<i>subvinacea</i>	<i>macrourae</i>
<i>Streptopelia</i>	
<i>turtur</i> (*) (+)	<i>bacillus</i>
<i>decaocto</i> (+)	<i>bacillus</i>
<i>roseogrisea</i> (= <i>risoria</i>)	<i>bacillus</i>
<i>decipiens</i> (+)	<i>bacillus</i>
<i>semitorquata</i> (+)	<i>bacillus</i>
<i>chinensis</i> (*)	<i>fulmeki</i>
<i>tranquebarica</i> (+)	<i>bacillus</i>
<i>senegalensis</i> (+)	<i>bacillus</i>
<i>Ectopistes</i>	
<i>migratoria</i> (*)	<i>extinctus</i>
<i>Zenaida</i>	
<i>macroura</i> (*)	<i>baculoides</i>
(*)	<i>macrourae</i>
<i>auriculata</i>	<i>baculoides</i>
	<i>macrourae</i>
<i>aurita</i>	<i>macrourae</i>
<i>galapagoensis</i>	<i>macrourae</i>
<i>asiatica</i>	<i>macrourae</i>
<i>Columbina</i>	
<i>passerina</i> (*)	<i>passerinae</i>
<i>minuta</i>	<i>passerinae</i>
<i>talpacoti</i>	<i>passerinae</i>
<i>picui</i>	<i>passerinae</i>
<i>Claravis</i>	
<i>pretiosa</i>	<i>passerinae</i>
<i>mondetoura</i>	<i>passerinae</i>
<i>Metriopelia</i>	
<i>ceciliae</i> (*)	<i>gymnopelidae</i>
<i>melanopectera</i> (*)	<i>drowni</i> , n.sp.
	<i>altamimiae</i> , n.sp.
<i>aymara</i> (*)	<i>altamimiae</i> , n.sp.
<i>Scardafella</i>	
<i>inca</i>	<i>passerinae</i>
<i>Leptotila</i>	
<i>verreauxi</i> (*)	<i>gracilicapitis</i>
	<i>timmermanni</i>
	<i>baculoides</i>
	<i>macrourae</i>
<i>rufaxilla</i> (*)	<i>timmermanni</i>
<i>plumbeiceps</i>	<i>gracilicapitis</i>
	<i>macrourae</i>
<i>jamaicensis</i>	<i>gracilicapitis</i>
<i>cassini</i>	<i>timmermanni</i>
<i>Geotrygon</i>	
<i>linearis</i> (*)	<i>waltheri</i> , n.sp.
	<i>macrourae</i>
<i>mystacea</i>	<i>macrourae</i>
<i>violacea</i>	<i>macrourae</i>
<i>montana</i>	<i>macrourae</i>
<i>Starnoenas</i>	
<i>cianocephala</i> (*)	<i>tendeiroi</i>

(*), Type host. (+), Restricted to Old World (included for completeness even though material was not examined from all of these hosts).

(^a) Host names and sequence from Howard and Moore (1991).

margin; dorsoanterior portion as in Fig. 5; temple width (TW), 0.27–0.31; head length (HL), 0.50–0.55; antennal scape length (SL), 0.12–0.14; anterior plate width (APW), 0.13–0.15; anterior plate median length (APL), 0.05–0.06. Thorax with metanotum having 2 very long setae on each side (Fig. 6); prothorax width (PW), 0.21–0.26; metathorax width (MW), 0.27–0.33. Dorsal abdomen (Fig. 6) with chaetotaxy as shown. Genitalia as in Fig. 8, with genitalia width (GW), 0.09–0.11; inner width of large circular opening in basal apodeme (COW), 0.075–0.085; mesosomal details as in Fig. 9, with small anterior “hole” enclosed in pigmented border, remainder as shown. Total length (TL), 2.17–2.39. Female similar to male except as follows. Head as in Fig. 1, with antennae as shown; HL, 0.53–0.59; SL, 0.05–0.06; APW, 0.14–0.16; APL, 0.06–0.07. Dorsal abdomen as in Fig. 2; ventral terminalia as in Fig. 3, with total of 10–14 short setae aligned along sides of median pigmented area and with small medio-posterior inverted-U (Fig. 3, arrow). TL, 2.57–2.85.

Material. 24 ♂, 29 ♀, ex *C. livia*, Argentina, Costa Rica, Peru, United States: Arkansas, Florida, Kansas, Minnesota, North Carolina, Oklahoma, Pennsylvania (14).

Remarks. *Columbicola columbae* was the 1st species described in the genus *Columbicola*. It is a very common wing louse that is found worldwide on feral pigeons.

Columbicola bacillus (Giebel)

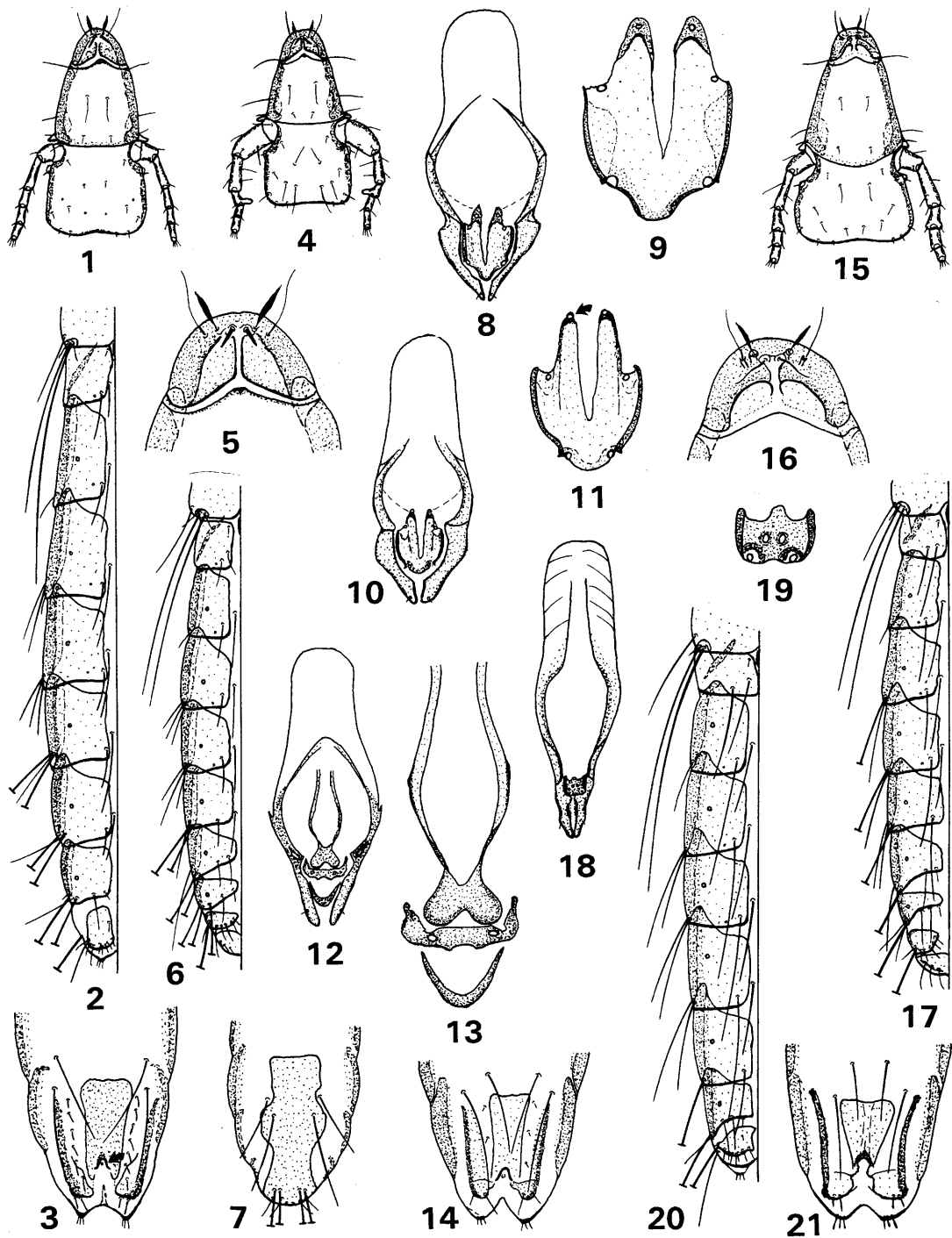
(Figs. 10 and 11)

Lipeurus bacillus Giebel, 1866: 379. Type host: “*Columba turtur*” = *Streptopelia t. turtur* (L.).

Description. Similar to *C. columbae* except as follows. Male head with TW, 0.23–0.27; APW, 0.11–0.13; APL, 0.05–0.06. Thorax with PW, 0.19–0.22, MW 0.24–0.28. Genitalia as in Fig. 10, with GW, 0.08–0.10; COW, 0.060–0.075; mesosomal details as in Fig. 11, with small anterior “hole” not enclosed in pigmented border (Fig. 11, arrow), remainder as shown. Female head with TW, 0.24–0.28; APW, 0.12–0.14. Ventral terminalia with total of 7–12 short setae aligned along sides of median pigmented area.

Material. 5 ♂, 3 ♀, ex *Streptopelia roseogrisea* (Sundevall), South Perth Zoo, W. Australia (1). 24 ♂, 25 ♀, ex *S. turtur*, Egypt, England, India, Palestine, Spain (10). 18 ♂, 15 ♀, ex *Streptopelia decaocto* (Frivaldsky), India, Israel, Palestine (6).

Remarks. This species is very similar to *C. columbae*. It differs from that species in having some dimensions that are smaller, fewer setae on the female subgenital plate, and differences in some details of the male genitalia. On the basis of this similarity, Tendeiro (1965) classified *C. bacillus* as a subspecies of *C. columbae*. However, we believe that the differences between the 2 taxa are sufficient to warrant recognition of *C. bacillus* as a species. *C. bacillus* is found on a number of Old World species and subspecies of *Streptopelia*. Although we have not examined any New World specimens, *C. bacillus* was presumably introduced with the introduction of *Streptopelia risoria*



Figs. 1-21. (1-9) *C. columbae*: (1) female dorsal head, (2) female dorsal metathorax and abdomen, (3) female ventral terminalia [arrow: small medioposterior inverted-U], (4) male dorsal head, (5) male anterior dorsal head, (6) male dorsal metathorax and abdomen, (7) male ventral terminalia, (8) male genitalia, (9) male genitalic mesosome. (10 and 11) *C. bacillus*: (10) male genitalia, (11) male genitalic mesosome [arrow: small anterior "hole"]. (12-14) *C. filmeki*: (12) male genitalia, (13) male genitalic mesosome, (14) female ventral terminalia. (15-21) *C. baculoides*: (15) male dorsal head, (16) male anterior dorsal head, (17) male dorsal metathorax and abdomen, (18) male genitalia, (19) male genitalic mesosome, (20) female dorsal metathorax and abdomen, (21) female ventral terminalia.

(L.), which is the domesticated form of *S. roseogrisea*, its Old World host (Sibley and Monroe 1990).

Columbicola fulmeki Eichler

(Figs. 12-14)

Columbicola fulmeki Eichler, 1942:274. Type host: *Streptopelia chinensis tigrina* (Temminck).

Description. Similar to *C. columbae* except as follows. Male head with HL, 0.54-0.57; APL, 0.07-0.09. Genitalia as in Fig. 12; mesosomal details as in Fig. 13. TL, 2.36-2.50. Female with HL, 0.56-0.62; APW, 0.13-0.15; APL, 0.08-0.09. Ventral terminalia as in Fig. 14, with total of 4-7 minute setae aligned along sides of median pigmented area.

Material. 9 ♂, 9 ♀, ex *Streptopelia chinensis* (Scopoli), Burma, Formosa, North Borneo, Thailand (7).

Remarks. The most distinctive feature of *C. fulmeki* is the markedly different structure of the male genitalic mesosome (Fig. 13). The female is distinguished by possessing a total of no >7 minute setae along the median pigmented area of the ventral terminalia; these setae can be very difficult to discern. Females also differ from closely related species in the dimensions of some characters. *Columbicola fulmeki* is another example of an Old World louse that was presumably introduced into the New World concurrent with the introduction of its Old World host *S. chinensis*.

Columbicola baculoides (Paine)

(Figs. 15-21)

Lipeurus baculoides Paine, 1914:174. Type host: *Zenaidura macroura* (L.).

Description. Male head as in Fig. 15, with short medioposterior pair of setae not extending to posterior margin; antenna without enlarged scape; dorsoanterior portion as in Fig. 16, with dorsal plate having well-defined marginal carina but poorly demarcated posterior margin; TW, 0.31-0.33; HL, 0.53-0.58; SL, 0.06-0.07; APW, 0.12-0.14; APL, 0.03-0.06. Thorax with PW, 0.22-0.24; MW, 0.29-0.32. Chaetotaxy of dorsal abdomen as in Fig. 17, with long median setae. Genitalia as in Fig. 18, with GW, 0.07-0.08; COW, 0.050-0.060; mesosomal details as in Fig. 19. TL, 2.04-2.17. Female similar to male except as follows. Head with TW, 0.32-0.36; HL, 0.55-0.60; APW, 0.13-0.15. Dorsal abdomen as in Fig. 20; ventral terminalia as in Fig. 21, with small medioposterior inverted-U, but no setae evident along sides of median pigmented area. TL, 2.16-2.44.

Material. 28 ♂, 37 ♀, ex *Z. macroura*, United States: Arizona, California, Kansas, Minnesota, Oregon, Utah, Washington (12). 9 ♂, 19 ♀, ex *Zenaidura auriculata* (Des Murs), Argentina, Chile, Ecuador (5). 6 ♂, 4 ♀, ex *Leptotila verreauxi* (Bonaparte), Argentina, S. America (3).

Remarks. The unique genitalia and lack of an enlarged antennal scape readily distinguish males of this species from all other *Columbicola* except *Columbicola triangularis* Eichler, which is described next.

Columbicola triangularis Eichler

Columbicola triangularis Eichler, 1952: 353. Type host: *Columba p. picazuro* Temminck.

Description. Similar to *C. baculoides* except as follows. Male head with TW, 0.36-0.38; HL, 0.59-0.62; SL, 0.08; APW, 0.14-0.15; APL, 0.06. Thorax with PW, 0.28-0.30; MW, 0.37. TL, 2.36-2.39. Female head with TW, 0.37-0.39; HL, 0.61-0.64; APW, 0.15-0.16. TL, 2.49-2.66.

Material. 2 ♂, 6 ♀, ex *Columba maculosa* Temminck, Argentina (1).

Remarks. Because of its consistently larger dimensions, we have removed *C. triangularis* from its placement as a junior synonym of *C. baculoides* by Tendeiro (1965). Although we have seen no material from the type host, *C. picazuro*, the dimensions given by Tendeiro for Eichler's holotype female agree with the dimensions of our material from *C. maculosa*.

Columbicola passerinae (Wilson)

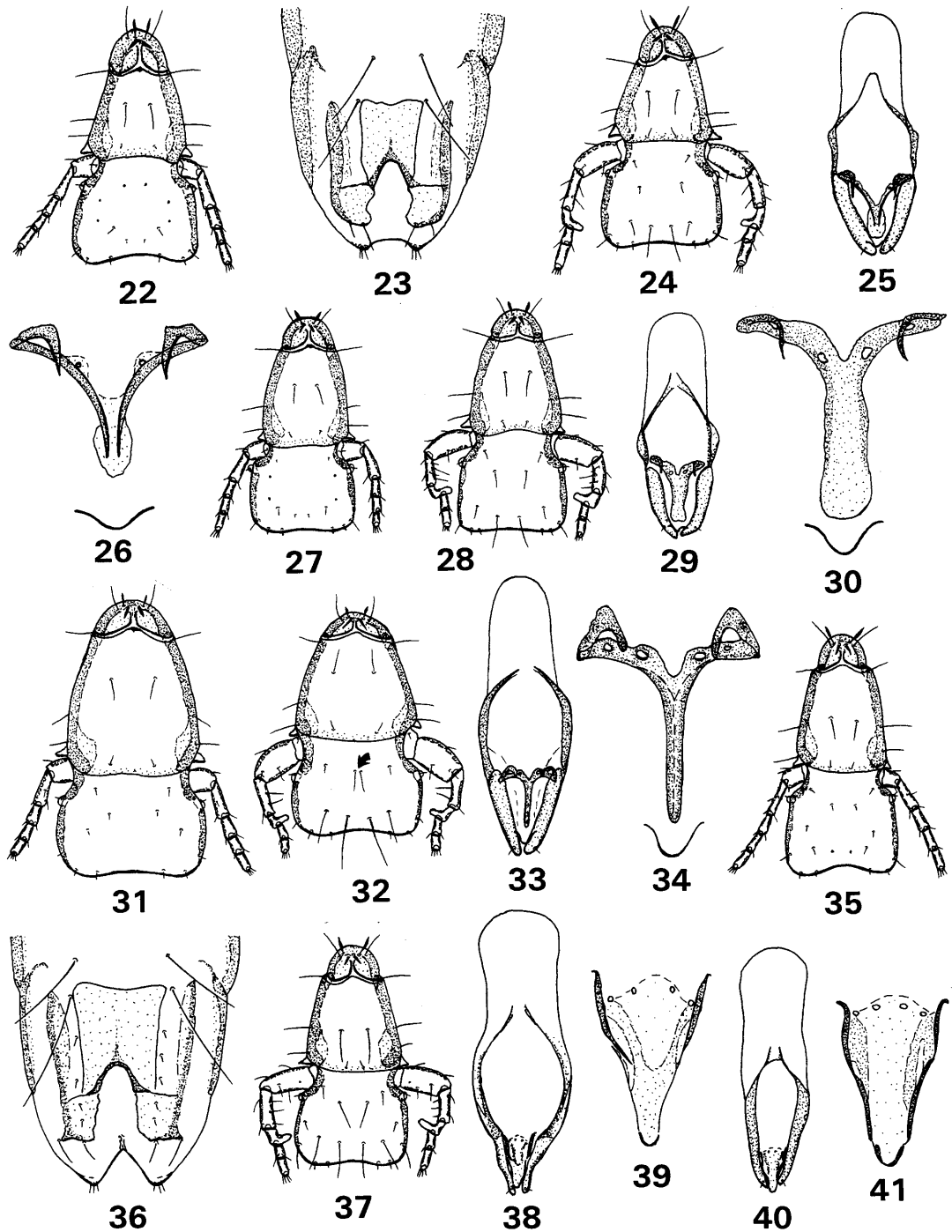
(Figs. 22-26)

Esthiopterum passerinae Wilson, 1941:259. Type host: "*Columbigallina p. passerina*" = *Columbina p. passerina* (L.).

Description. Male head as in Fig. 24, with long medioposterior pair of setae extending beyond posterior margin; TW, 0.22-0.26; HL, 0.44-0.49; SL, 0.09-0.11; APW, 0.10-0.11; APL, 0.06-0.08. Thorax with PW, 0.17-0.21; MW, 0.21-0.26. Dorsal abdomen with chaetotaxy similar to Fig. 6. Genitalia as in Fig. 25, with GW, 0.08-0.09; COW, 0.060-0.070; mesosomal details as in Fig. 26. TL, 1.76-1.96. Female similar to male except as follows. Head as in Fig. 22; TW, 0.23-0.27; HL, 0.46-0.56; SL, 0.04-0.05; APW, 0.10-0.13; APL, 0.07-0.09. Dorsal abdomen near to Fig. 2; ventral terminalia as in Fig. 23, with wide medioposterior inverted-U, but no setae evident along sides of median pigmented area. TL, 2.09-2.54.

Material. 31 ♂, 30 ♀ (including 3 ♂ paratypes of *C. passerinae*), ex *C. passerina*, British West Indies, Colombia, Cuba, Mexico, Venezuela, Virgin Islands, United States: Alabama, Texas (19). 17 ♂, 14 ♀, ex *Columbina talpacoti* (Temminck), Colombia, Mexico, Trinidad (12). 3 ♂, 5 ♀, ex *Columbina minuta* (L.), British Guiana, Trinidad (3). 1 ♂, 2 ♀, ex *Columbina picui* (Temminck), Argentina, Bolivia (3). 1 ♂, 1 ♀, ex *Scardafella inca* (L.), United States: Texas (1). 4 ♂, 6 ♀, ex *Claravis pretiosa* (Ferrari-Perez), Colombia, Mexico, Venezuela (4). 2 ♂, 2 ♀, ex *Claravis montourra* (Bonaparte), Colombia, Costa Rica (2).

Remarks. Males of *C. passerinae* are distinguished by the unique genitalic mesosomal structure and females by the wide inverted-U structure of the subgenital plate in conjunction with the absence of small setae on this plate. The species is further distinguished by the small dimensions of both sexes. *C. passerinae* and the next 3 species (see below) are more similar to 1 another than any of them is to the other species in this article.



Figs. 22-41. (22-26) *C. passerinae*: (22) female dorsal head, (23) female ventral terminalia, (24) male dorsal head, (25) male genitalia, (26) male genitalic mesosome. (27-30) *C. gymnopeliae*: (27) female dorsal head, (28) male dorsal head, (29) male genitalia, (30) male genitalic mesosome. (31-34) *C. altamimiae*: (31) female dorsal head, (32) male dorsal head [arrow: pair of close-set median dorsal setae], (33) male genitalia, (34) male genitalic mesosome. (35-39) *C. extinctus*: (35) female dorsal head, (36) female ventral terminalia, (37) male dorsal head, (38) male genitalia, (39) male genitalic mesosome. (40 and 41) *C. macrouae*: (40) male genitalia, (41) male genitalic mesosome.

Tendeiro (1965) had placed *Columbicola pseudolipeurusque* Eichler as a junior synonym of *Columbicola macrourae* (Wilson). After study of limited material from the type host of Eichler's species and appreciating the difficulty Tendeiro had in placing this name, we feel that it more likely represents a junior synonym of *C. passerinae*. Whatever the case may be, it most certainly is a junior synonym of 1 of these taxa.

Columbicola gymnopeliae Eichler
(Figs. 27-30)

Columbicola gymnopeliae Eichler, 1953: 277. Type host: "Gymnopelia ceciliae" = *Metriopelia ceciliae* (Lesson).

Description. As for *C. passerinae* except as follows. Male head as in Fig. 28; TW, 0.24-0.27; HL, 0.47-0.50; SL, 0.10-0.12; APW, 0.11-0.13; APL, 0.05-0.06. Thorax with PW, 0.19-0.21; MW, 0.24-0.28. Genitalia as in Fig. 29; mesosomal details as in Fig. 30, with broad medioposterior portion and other details as shown. TL, 1.92-2.06. Female head as in Fig. 27; TW, 0.27-0.28; HL, 0.51-0.55; SL, 0.05-0.06; APW, 0.12-0.14; APL, 0.06-0.07. TL, 2.45-2.68.

Material. 5 ♂, 20 ♀, ex *M. ceciliae*, Bolivia, Peru (4).

Remarks. The male of *C. gymnopeliae* is readily distinguished by the details of its genitalic mesosome (Fig. 30). However, the female is only tenuously distinguished on the basis of certain dimensions.

For all material that we studied, someone, perhaps Tendeiro, had inserted "*passerinae* Wilson 1941" in place of M. A. Carriker, Jr.'s earlier identification of the specimens as "*gymnopeliae* Eichler." Our reasoning for suspecting Tendeiro in this action is that Tendeiro (1965) placed *C. gymnopeliae* as a junior synonym of *C. passerinae*. We disagree with this classification and consider *C. gymnopeliae* to be a valid species.

Columbicola drowni Clayton & Price,
new species

Type host: *Metriopelia melanoptera* (Molina).

Description. Similar to *C. passerinae* except as follows. Male head as in Fig. 28; TW, 0.28-0.29; HL, 0.52-0.55; APW, 0.13-0.14; APL, 0.05-0.06. Thorax with PW, 0.21-0.23; MW, 0.30-0.31. Genitalia as in Fig. 29; mesosomal details as in Fig. 30. TL, 2.03-2.12. Female head as in Fig. 27; TW, 0.30-0.31; HL, 0.60-0.64; APW, 0.14-0.16; APL, 0.07. TL, 2.56-2.70.

Type Material. HOLOTYPE: ♂, ex *M. melanoptera*, Chile: Santiago, Coastal Range, 7 November 1981, O. Ramcaqua and M. A. Marin (OSU). Paratypes, ex *M. melanoptera*: 3 ♂, 4 ♀, same data as holotype; 1 ♂, Ecuador: Prov. Colopaxi, 24 km W Latacunga (3,800 m), 21 August 1990, M-794 (OSU, UM).

Remarks. This species is closest to *C. gymnopeliae*, differing from it by its consistently larger size and wider anterior head plate.

Etymology. This species is named for Devin Drown, University of Utah, in recognition of his work on the evolutionary ecology of bird lice.

Columbicola altamimiae Clayton & Price,
new species
(Figs. 31-34)

Type host: *Metriopelia aymara* (Prevost).

Description. Similar to *C. passerinae* except as follows. Male head as in Fig. 32, with pair of close-set median dorsal setae between antenna bases (Fig. 32, arrow); TW, 0.29-0.31; HL, 0.48-0.54; SL, 0.12-0.13; APW, 0.14-0.16; APL, 0.04-0.05. Thorax with PW, 0.20-0.24; MW, 0.28-0.33. Genitalia as in Fig. 33, with CW, 0.08; COW, 0.055-0.065; mesosomal details as in Fig. 34, with narrow, well-defined medioposterior portion. TL, 1.88-2.07. Female head as in Fig. 31; TW, 0.31-0.34; HL, 0.58-0.65; SL, 0.05-0.06; APW, 0.16-0.18; APL, 0.05-0.06. TL, 2.44-2.66.

Type Material. HOLOTYPE: ♂, ex *M. aymara*, Chile: L. Miniques, 14 February 1971, S. E. Chapman (BMNH). Paratypes, ex *M. aymara*: 3 ♂, 3 ♀, same data as holotype; 3 ♂, 5 ♀, Bolivia: Chocaya, 14 June 1936, M. A. Carriker, Jr. #11681; 2 ♀, Peru: Lake Junin, 14 April 1930, M. A. Carriker, Jr. #1605; 1 ♀, Peru: Pampa de Arrizrus, 19 April 1931, M. A. Carriker, Jr. #2624; 2 ♂, 2 ♀, Peru: Sta. Lucia, 25 April 1931, M. A. Carriker, Jr. #2733; 1 ♀, same except #2734 (BMNH, USNM).

Other Material. 1 ♂, 3 ♀, ex *M. melanoptera*, Bolivia (1).

Remarks. This species, on the basis of its large dimensions, is closest morphologically to *C. drowni*. However, both sexes of *C. altamimiae* are readily separated from the preceding 3 species by the unique shape of the dorsal head plate; the male is readily separated by the pair of close-set dorsal setae on the posterior area of its head, in addition to its distinctive genitalic mesosome.

Etymology. This species is named for Sarah Altamimi, University of Utah, in recognition of her work on behavioral interactions between birds and lice.

Columbicola extinctus Malcomson
(Figs. 35-39)

Columbicola extinctus Malcomson, 1937: 55. Type host: *Ectopistes migratorius* (L.).

Description. Male head as in Fig. 37, with long medioposterior pair of setae extending beyond posterior margin; with broadening of head into slight "shoulder" at point of attachment to anterior plate; TW, 0.26-0.30; HL, 0.52-0.59; SL, 0.12-0.14; APW, 0.11-0.14; APL, 0.07-0.09. Thorax with metanotum having 2 very long setae on each side (Fig. 6); PW, 0.20-0.26; MW, 0.26-0.31. Dorsal abdomen with chaetotaxy as in Fig. 6. Genitalia as in Fig. 38, with GW, 0.08-0.10; COW, 0.060-0.070; mesosomal details as in Fig. 39, with thickened margin only on anterior half, remainder as shown; length of mesosome, 0.050-0.060. TL, 2.15-2.47. Female similar to male except as follows. Head as in Fig. 35, with antennae as shown; HL, 0.53-0.64; SL, 0.05-0.06; APW, 0.12-0.16; APL, 0.06-0.09. Dorsal abdomen similar to Fig. 2; ventral terminalia as in Fig. 36, with total of 7-12 short setae aligned along sides of median pigmented area

and with wide medioposterior inverted-U. TL, 2.45–2.95.

Material. 5 ♂, 9 ♀ (including 3 ♂, 1 ♀ paratypes of *C. extinctus*), ex *E. migratorius*, United States: Illinois, New Hampshire + 3 with no specific locality (5). 28 ♂, 28 ♀, ex *Columba fasciata* Say, Bolivia, Colombia, Costa Rica, Mexico, Peru, Salvador, United States: California (14).

Remarks. Malcomson (1937) described this louse species from the extinct passenger pigeon, *E. migratorius*, after comparing its dimensions and male genitalia only to those of *C. columbae*, the feral pigeon louse. He noted that specimens of his new species did not have any of the heavier posteriorly directed setae near the base of the unique anteriorly directed pair, although the setal pits were present. Our examination of additional specimens reveals these setae to be present, suggesting that they were merely broken off of Malcomson's specimens. Furthermore, our study reveals no consistent differences between *Columbicola* specimens from the extinct passenger pigeon and those from the extant band-tailed pigeon, *C. fasciata*. Thus, there is no longer grounds for considering this species of louse extinct (cf., Stork and Lyl 1993), despite its unfortunate specific epithet.

Columbicola macrourae (Wilson)
(Figs. 40 and 41)

Esthiopterum macrourae Wilson, 1941: 262. Type host: *Zenaida macroura carolinensis* (L.).

Description. Similar to *C. extinctus* except as follows. Male with genitalia as in Fig. 40, with GW, 0.07–0.09; COW, 0.040–0.055; mesosomal details as in Fig. 41, with thickened pieces of margin extending full length, remainder as shown; length of mesosome, 0.040–0.055. TL, 1.97–2.38. Female inseparable from *C. extinctus*.

Material. 17 ♂, 24 ♀ (including 3 ♂, 4 ♀ paratypes of *C. macrourae*), ex *Z. macroura*, Cuba, United States: California, Florida, Georgia, Kansas, Louisiana, Minnesota, Missouri, (15). 27 ♂, 24 ♀, ex *Zenaida asiatica* (L.), Mexico, Peru, United States: California, Texas (10). 2 ♂, 3 ♀, ex *Z. auriculata*, British Guiana, Chile (2). 5 ♂, 2 ♀, ex *Zenaida aurita* (Temminck), British West Indies, Porto Rico (2). 25 ♂, 25 ♀, ex *Zenaida galapagoensis* Gould, Galapagos Is. (4). 19 ♂, 17 ♀, ex *Columba plumbea* Vieillot, Colombia, Guyana (4). 11 ♂, 8 ♀, ex *Columba subvinacea* (Lawrence), Colombia, Costa Rica, Peru (3). 1 ♂, ex *Geotrygon linearis* (Prevost), Venezuela. 23 ♂, 21 ♀, ex *Geotrygon montana* (L.), Colombia, Jamaica, Mexico, Peru (18). 1 ♂, 1 ♀, ex *Geotrygon mystacea* (Temminck), British West Indies (1). 1 ♂, ex *Geotrygon violacea* (Temminck), Costa Rica. 4 ♂, 3 ♀, ex *Leptotila plumbeiceps* (Sclater and Salvin), Mexico (4). 15 ♂, 17 ♀, ex *L. verreauxi*, Bolivia, British Guiana, Mexico, Peru, Salvador (11).

Remarks. Although *C. macrourae* is very similar to *C. extinctus*, and females are indeed inseparable, males of the 2 species have consistently different genitalic features as illustrated in Figs. 38–41. These differences are further apparent when comparing the dimensions

associated with the length of the genitalic mesosome and width of the opening in the genitalic basal apodeme.

Columbicola adamsi Clayton & Price,
new species
(Figs. 42 and 43)

Type host: *Columba speciosa* Gmelin.

Description. Similar to *C. extinctus* except as follows. Male with TW, 0.28–0.32; HL, 0.53–0.61; APW, 0.13–0.15. Thorax with MW, 0.27–0.33. Genitalia as in Fig. 42, with COW, 0.055–0.070; mesosomal details as in Fig. 43, with thickened, separated lateral marginal pieces and broad semicircular distal margin, remainder as shown; length of mesosome, 0.060–0.075. TL, 2.26–2.64. Female inseparable from *C. extinctus*.

Type Material. HOLOTYPE: ♂, ex *C. speciosa*, Mexico: Campeche, 13 March 1998, D. H. Clayton, GES-349 (OSU). Paratypes, ex *C. speciosa*: 7 ♂, 8 ♀, same data as holotype; 4 ♂, 6 ♀, same except 14 March 1998, MBR-4506; 1 ♂, Mexico: Oaxaca, 26 March 1961, LSUMZ-24272; 1 ♂, Mexico: Quintana Roo, 5 June 1969, LSUMZ-43642 (BMNH, UM, OSU).

Other Material. 4 ♂, 3 ♀, ex *Columba cayennensis* Bonnaterra, Bolivia, Colombia (4). 1 ♂, ex *C. maculosa*, Argentina. 8 ♂, 5 ♀, ex *C. picazuro*, Argentina (1). 11 ♂, 6 ♀, ex *C. plumbea*, Brazil, Guyana, Peru (5).

Remarks. This new species is separated from the preceding 2 species only by differences in the male genitalia, these involving primarily the shape and size of the mesosome (Fig. 43) and overall genitalic shape (Fig. 42).

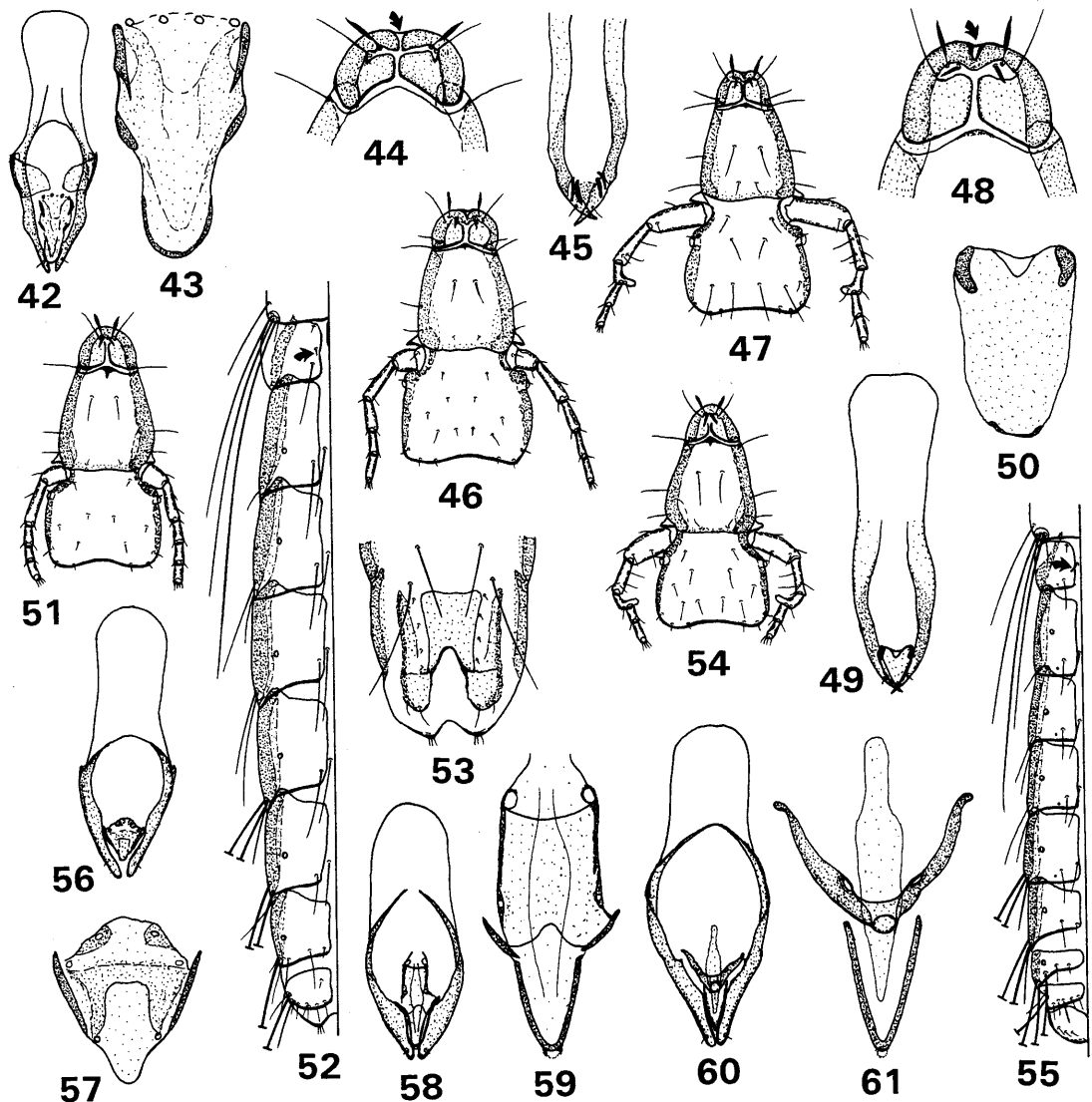
Etymology. This species is named for Richard Adams, University of Utah, in recognition of his interest in the systematics of bird lice.

Columbicola tendeiroi Mey
(Figs. 44 and 45)

Columbicola tendeiroi Mey, 1984: 158. Type host: *Star-noenas cyanocephala* (L.).

Description. Male head with long medioposterior pair of setae extending beyond posterior margin; dorsoanterior portion with distinct medioanterior division of marginal carina (Fig. 44, arrow); TW, 0.32; HL, 0.49. Thorax with metanotum having 3 very long setae on each side (as in Fig. 55); PW, 0.23; MW, 0.31. Genitalia as in Fig. 45; mesosome consisting of 2 slender thickenings on each side associated with small spinous sac. TL, 1.89. Female unknown.

Remarks. Mey (1984) based his description of *C. tendeiroi* on a single male specimen. Although we have seen no material of this species, Mey's illustrations of the entire dorsum, dorsal anterior head, and genitalia are sufficient to assure us that this is indeed a valid species. Data in the above description are from Mey (1984) and Figs. 44 and 45 are adaptations of his figures to make recognition of *C. tendeiroi* possible. Distinguishing features of this species are the complete medioanterior division of the marginal head carina, the



Figs. 42-61. (42 and 43) *C. adamsi*: (42) male genitalia, (43) male genitalic mesosome. (44 and 45) *C. tendeiroi*: (44) male anterior dorsal head [arrow: complete medioanterior division of marginal carina], (45) male genitalia. (46-50) *C. waggermani*: (46) female dorsal head, (47) male dorsal head, (48) male anterior dorsal head [arrow: partial medioanterior division of marginal carina], (49) male genitalia, (50) male genitalic mesosome. (51-57) *C. waltheri*: (51) female dorsal head, (52) female dorsal metathorax and abdomen [arrow: short median seta on tergum II], (53) female ventral terminalia, (54) male dorsal head, (55) male dorsal metathorax and abdomen [arrow: short median seta on tergum II], (56) male genitalia, (57) male genitalic mesosome. (58 and 59) *C. gracilicapitis*: (58) male genitalia, (59) male genitalic mesosome. (60 and 61) *C. timmermanni*: (60) male genitalia, (61) male genitalic mesosome.

presence of 3 very long marginal metanotal setae on each side, and the structure of the male genitalia.

Columbicola waggermani Clayton & Price,
new species
(Figs. 46-50)

Type host: *Columba squamosa* Bonnaterra.

Description. Male head as in Fig. 47, with long medioposterior pair of setae extending beyond pos-

terior margin; with marginal carina only partially divided medioanteriorly (Fig. 48, arrow); TW, 0.30; HL, 0.55; SL, 0.14; APW, 0.13; APL, 0.08. Thorax with metanotum having only 2 very long setae on each side; PW, 0.24; MW, 0.30. Dorsal abdomen with chaetotaxy as in Fig. 6. Genitalia as in Fig. 49, with GW, 0.09; COW, 0.050; mesosomal details as in Fig. 50, with single thickened piece anteriorly on each side of lightly spiculate sac. TL, 2.35. Female similar to male except as follows. Head as in Fig. 46; TW, 0.31-0.33;

HL, 0.54–0.58; SL, 0.05–0.06; APW, 0.14–0.15; APL, 0.07. Dorsal abdomen similar to Fig. 2; ventral terminalia much as in Fig. 36, with total of 8–10 short setae aligned along sides of median pigmented area and with wide medioposterior inverted-U. TL, 2.72–2.86.

Type Material. HOLOTYPE: ♂, ex *C. squamosa*, Virgin Is.: St. Croix, 1937, H. A. Beatty (OSU). Paratype: 1 ♀, same data as holotype (OSU).

Other Material. 2 ♀, ex *Columba leucocephala* L., United States: Florida (1).

Remarks. This new species is quite similar to *C. tendeiroi*, with grossly similar genitalia. However, *C. waggermani* can be distinguished from *C. tendeiroi* because it has only 2 very long marginal setae on each side of the metanotum, a partially divided anterior head carina, and a male genital sac with 2 heavy thickenings instead of 4 slender ones.

Etymology. This species is named for Gary Wagerman, Texas Parks and Wildlife, Austin, TX, in recognition of his expertise on doves and his assistance collecting some of the lice for this study.

***Columbicola waltheri* Clayton & Price,
new species
(Figs. 51–57)**

Type host: *Geotrygon linearis* (Prevost).

Description. Male head as in Fig. 54, with short medioposterior pair of setae not extending to posterior margin; TW, 0.27–0.30; HL, 0.53–0.58; SL, 0.12–0.14; APW, 0.13–0.15; APL, 0.08–0.09. Thorax with metanotum having 3 very long setae on each side (Fig. 55); PW, 0.21–0.23; MW, 0.26–0.28. Dorsal abdomen with chaetotaxy as in Fig. 55, with very short median seta on 1 or both sides of tergum II (Fig. 55, arrow). Genitalia as in Fig. 56, with GW, 0.08–0.10; COW, 0.060–0.075; mesosomal details as in Fig. 57. TL, 2.19–2.41. Female similar to male except as follows. Head as in Fig. 51; TW, 0.29–0.31; HL, 0.59–0.63; SL, 0.05; APW, 0.15–0.16; APL, 0.09–0.10. Dorsal abdomen as in Fig. 52; ventral terminalia as in Fig. 53, with total of 4–9 short setae along sides of median pigmented area and with wide medioposterior inverted-U. TL, 2.76–2.99.

Type Material. HOLOTYPE: ♂, ex *G. linearis*, Colombia: Sierra Perija, Monte Elias, 30 July 1941, M. A. Carriker, Jr., #1753 (USNM). Paratypes ex *G. linearis*, Colombia, M. A. Carriker, Jr.: 3 ♂, 5 ♀, same data as holotype; 4 ♂, 13 ♀, Magdalena, San Lorenzo, September 1945; 2 ♂, 2 ♀, same except 3 February 1913, #11150; 2 ♀, same except Los Gorros, 8 May 1946, #5993; 3 ♀, Sierra Nevada S. M., Pueblo Viejo, 13 March 1914, #14356; 1 ♀, same except Los Gorros, 27 April 1945, #5837 (USNM).

Remarks. *Columbicola waltheri*, along with *Columbicola gracilicapitis* Carriker and *Columbicola timmermanni* Tendeiro (see below), are distinguished from all other species in this article by the 3 very long marginal metanotal setae on each side, in conjunction with the medially complete marginal head carina. The very short median seta on tergum II (Figs. 52, arrow and 55, arrow), longer female head, and details of the

male genitalia distinguish *C. waltheri* from the other 2 species.

Etymology. This species is named for Bruno Walther, Konrad-Lorenz-Institut für Vergleichende Verhaltensforschung, Vienna, Austria, in recognition of his work on comparative biology of birds and lice.

***Columbicola gracilicapitis* Carriker
(Figs. 58 and 59)**

Columbicola gracilicapitis Carriker, 1955: 50. Type host: *Leptotila v. verreauxi* (Bonaparte).

Description. Similar to *C. waltheri* except as follows. Male head with HL, 0.52–0.55; SL, 0.11–0.12. Dorsal abdomen with chaetotaxy similar to Fig. 55, except with longer median seta on tergum II (as in Fig. 6). Genitalia as in Fig. 58, with COW, 0.080–0.090; mesosomal details as in Fig. 59. TL, 2.36–2.50. Female head with HL, 0.55–0.59. Dorsal abdomen as in Fig. 52, except longer median seta on tergum II (as in Fig. 2); ventral terminalia with total of 4–6 minute setae along sides of median pigmented area. TL, 2.61–2.82.

Material. 5 ♂, 4 ♀ (including holotype ♂ of *C. gracilicapitis*), ex *L. verreauxi*, Colombia, Peru, Venezuela (3). 1 ♂, 2 ♀, ex *L. plumbeiceps*, Mexico (2). 7 ♂, 5 ♀, ex *Leptotila jamaicensis* (L.), Jamaica, Mexico (2).

Remarks. Both sexes of *C. gracilicapitis* can be distinguished from *C. waltheri* by their longer median seta on tergum II. Additionally, the male genitalia are distinctively different and the female tends to have a shorter head.

***Columbicola timmermanni* Tendeiro
(Figs. 60 and 61)**

Columbicola timmermanni Tendeiro, 1965: 288. Type host: *Leptotila r. rufaxilla* (Richard & Bernard).

Description. Similar to *C. waltheri* except as follows. Male head with HL, 0.51–0.56; SL, 0.10–0.12. Thorax with MW, 0.24–0.30. Dorsal abdomen with chaetotaxy as in Fig. 55, except with longer median seta on tergum II (as in Fig. 6). Genitalia as in Fig. 60, with COW, 0.070–0.080; mesosomal details as in Fig. 61, with most prominent feature being semicircular transverse median sclerite. Female head with HL, 0.54–0.58. Dorsal abdomen as in Fig. 52, except with longer median seta on tergum II (as in Fig. 2); ventral terminalia as in Fig. 53, with total of 4–7 minute setae along sides of median pigmented area. TL, 2.57–2.76.

Material. 9 ♂, 6 ♀ (including 5 ♂, 4 ♀ paratypes of *C. timmermanni*), ex *L. rufaxilla*, British Guiana, Colombia, Venezuela (3). 8 ♂, 8 ♀, ex *Leptotila cassini* (Lawrence), Colombia (2). 3 ♂, 3 ♀, ex *L. verreauxi*, Bolivia, British Guiana (2).

Remarks. Females of this species are inseparable from those of *C. gracilicapitis*. Males are recognized by their unique genitalic structures.

Key to New World Species of *Columbicola*

1. Margin of metanotum with 3 very long setae on each side (Figs. 52 and 55) 2
Margin of metanotum with only 2 very long setae on each side (Figs. 2 and 6) 5
2. Marginal head carina medially divided (Fig. 44). *tendeiroi* Mey
Marginal head carina medially complete (Fig. 5). 3
3. Very short median seta on 1 or both sides of tergum II (Figs. 52 and 55). Male genitalia as in Figs. 56 and 57. Female head length > 0.58. *waltheri* n. sp.
Longer median seta on both sides of tergum II (Figs. 2 and 6). Male genitalia as in Figs. 58–61. Female head length < 0.60 4
4. Male genitalia as in Figs. 58 and 59. Female inseparable *gracilicapitis* Carriker
Male genitalia as in Figs. 60 and 61 *timmermanni* Tendeiro
5. Marginal head carina deeply indented medioanteriorly (Fig. 48) *waggermani* n. sp.
Marginal head carina without such deep indentation (Fig. 5) 6
6. Male temple width > 0.35; antenna without enlarged scape (Fig. 15). Female temple width > 0.36 *triangularis* Eichler
Male temple width < 0.36; antenna variable, often with enlarged scape (Fig. 4). Female temple width < 0.37 7
7. Male genitalia as in Figs. 8, 10, 12, or 18. Female subgenital plate with narrow inverted-U structure (Figs. 3, 14, or 21) 8
Male genitalia as in Figs. 25, 29, 33, 38, 40, or 42. Female subgenital plate with wide inverted-U structure (Figs. 23 or 36) 11
8. Male genitalia as in Fig. 18; scape not enlarged (Fig. 15). Female subgenital plate without minute to short setae laterad of median pigmented area (Fig. 21); temple width > 0.31 *baculoides* (Paine)
Male genitalia as in Figs. 8, 10, or 12; scape enlarged (Fig. 4). Female with total of 4–14 minute to short setae laterad of median pigmented area (Figs. 3 or 14); temple width < 0.32 9
9. Male genitalia as in Fig. 12. Female subgenital plate with total of only 4–7 minute setae laterad of median pigmented area, difficult to discern (Fig. 14) *fulmeki* Eichler
Male genitalia as in Figs. 8 or 10. Female subgenital plate with total of 7–14 readily discernable setae laterad of median pigmented area (Fig. 3) 10
10. Male genitalic mesosomal structures as in Fig. 11, with anterior “hole” not surrounded by dark pigmentation (Fig. 11) and posterior margin thin, evenly rounded; width of basal apodeme opening 0.060–0.075. Female head with anterior plate 0.12–0.14 wide *bacillus* (Giebel).
Male genitalic mesosomal structures as in Fig. 9, with anterior “hole” surrounded by dark pigmentation and posterior margin thick, protruding; width of basal apodeme opening 0.075–0.085. Female head with anterior plate 0.14–0.16 wide *columbae* (L.)
11. Head shape as in Figs. 31 or 32, with broad preantennal portion and short wide anterior plate. Male genitalia as in Fig. 33; posterior head region with pair of close-set median dorsal setae (Fig. 32) *altamimiae* n. sp.
Head shape as in Figs. 22, 24, 27, 28, 35, or 37, with narrower preantennal portion and longer narrower anterior plate. Male genitalia as in Figs. 25, 29, 38, 40, or 42; posterior head region without pair of close-set median dorsal setae 12
12. Male genitalia as in Figs. 25 or 29. Female subgenital plate without setae laterad of median pigmented area (Fig. 23) 13
Male genitalia as in Figs. 38, 40, or 42. Female subgenital plate with total of 5–12 short setae laterad of median pigmented area (Fig. 36). 15
13. Male temple width > 0.27, head length > 0.51; genitalia as in Fig. 29. Female temple width > 0.29, head length > 0.58 *drowni* n. sp.
Male temple width < 0.28, head length < 0.51; genitalia as in Figs. 25 or 29. Female temple width < 0.29, head length < 0.58 14
14. Male genitalia as in Fig. 25. Female temple width < 0.28 *passerinae* (Wilson)
Male genitalia as in Fig. 29. Female temple width > 0.26 *gymnopelidae* Eichler
15. Male genitalia as in Fig. 42, with mesosome length at least 0.060. Female inseparable *adamsi* n. sp.
Male genitalia as in Figs. 38 or 40, with mesosome length not > 0.060 16
16. Male genitalia as in Fig. 40, with mesosome as in Fig. 41; width of basal apodeme opening only up to 0.055. Female inseparable *macrourae* (Wilson)
Male genitalia as in Fig. 38, with mesosome as in Fig. 39; width of basal apodeme opening at least 0.060 *extinctus* Malcomson.

Acknowledgments

We thank N. Adams (National Museum of Natural History, Washington, DC), J. Beard (The Natural History Museum, London), R. C. Dalglish (University of Missouri, St. Louis), R. E. Elbel (University of Utah, Salt Lake City), and R. L. Palma (Museum of New Zealand, Wellington) for the loan of many valuable specimens. We also thank D. M. Drown for library assistance and R. J. Adams for testing the accuracy of the key. Finally, we are grateful to S. Aquino, R. Cuamatzi, R. Faucett, A. Navarro, T. Peterson, M. Robbins, O. Rojas, and G. Escalona-Segura for invaluable field assistance. Financial support was provided by National Science Foundation award DEB-9703003 to D.H.C.

References Cited

- Carriker, M. A., Jr. 1955. A corrected list of the Venezuelan Mallophaga published by E. W. Stafford, 1943. *Bol. Entomol. Venezuelana* 11: 31-54.
- Clayton, D. H. 1990. Host specificity of *Strigiphilus* owl lice (Ischnocera: Philopteridae), with the description of new species and host associations. *J. Med. Entomol.* 27: 257-265.
- Eichler, W. 1942. Die Mallophagengattung *Columbicola* Ewing. I. Teil: Die Arten der Gattung *Columbicola*. *Sitz. Gesell. Naturforsch. Freunde zu Berlin* 1941: 270-288.
- Eichler, W. 1952. Mallophagen-Synopsis. XXI. Genus *Columbicola*. *Zool. Anz.* 148: 346-356.
- Eichler, W. 1953. Mallophagen. In G. Niethammer, Zur Vogelwelt Boliviens. *Bonn. Zool. Beitr.* 4: 195-303.
- Giebel, C. 1866. Die im zoologischen Museum der Universität Halle aufgestellten Epizoen nebst Beobachtungen über dieselben. *Z. Gesamm. Naturwiss.* 28: 353-397.
- Howard, R., and A. Moore. 1991. A complete checklist of the birds of the world, 2nd ed. Academic, San Diego.
- Linnaeus, C. 1758. *Systema naturae*, Editio Decima, Reformata. Impensis Direct, L. Salvii, Holmiae, I.
- Malcomson, R. O. 1937. Two new species of Mallophaga. *Ann. Entomol. Soc. Am.* 30: 53-56.
- Mey, E. 1984. Kubanische Mallophagen I. (Ergebnisse der 1. Kubanische-Deutschen "Alexander von Humboldt"-Expedition 1967/68:Nr.34). *Reichenbachia* 22: 151-161.
- Paine, J. H. 1914. Mallophaga from birds at Laguna Beach, California. *Ann. Rep. Laguna Marine Lab.* 1: 174-176.
- Sibley, C. G., and B. L. Monroe, Jr. 1990. Distribution and taxonomy of birds of the world. Yale University Press, New Haven, CT.
- Stork, N. E., and C.H.C. Lyal. 1993. Extinction or 'co-extinction' rates? *Nature (Lond.)* 366: 307.
- Tendeiro, J. 1965. Estudos sobre Malofagos. Revisao monografica do genero *Columbicola* Ewing (Ischnocera, Philopteridae). *Mem. Junta Invest. Ultramar* 32(1962): 1-460.
- Wilson, F. H. 1941. The slender lice of American pigeons and doves with descriptions of two new species. *J. Parasitol.* 27: 259-264.

Received for publication 4 January 1999; accepted 14 April 1999.