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Three new species of *Formicaphagus* Carriker, 1957 (Phthiraptera, Ischnocera, Philopteridae), parasitic on Thamnophilidae and Conopophagidae (Aves, Passeriformes)

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Abstract

Three new species of *Formicaphagus* Carriker, 1957 parasitic on the avian families Thamnophilidae and Conopophagidae are described and illustrated. They and their type hosts are: *F. mariae* **n. sp.** from *Conopophaga lineata* (Wied-Neuwied, 1831); *F. thamnophili* **n.sp.** from *Thamnophilus r. ruficapillus* Vieillot, 1816; and *F. severus* **n.sp.** from *Mackenziaena severa* (Lichtenstein, 1823). These chewing lice are the first lice described from these host species. These new species are distinguished from the previously described 11 species chiefly by having postspiracular setae from tergite III (from II in some individuals of the former species), the shape of the head and dorsal anterior plate, chaetotaxy and body measurements.

Key words: Chewing lice, *Formicaphagus*, Argentina, Brazil

Introduction

Formicaphagus Carriker, 1957 as reviewed by Price & Clayton (1996) contains 11 species, six of which are parasitic on Antbirds (Thamnophilidae), three on Ant-thrushes (Formicariidae), and two on Gnateaters (Conopophagidae). An additional species was added by Sychra [in Sychra *et al.* (2006)], parasitic on Dusky Antbird (*Cercomacra tyrannina* (P. L. Sclater, 1855), Thamnophilidae). Three additional new species are here proposed, collected from the Rufous Gnateater (*Conopophaga lineata* (Wied-Neuwied, 1831), Conopophagidae) from Brazil, the Rufous-capped Antshrike (*Thamnophilus r. ruficapillus* Vieillot, 1816, Thamnophilidae) from Argentina, and the Tufted Antshrike (*Mackenziaena severa* (Lichtenstein, 1823), Thamnophilidae) from Argentina. These lice are the first described from these host species.

Material and methods

Birds were captured with mist-nets. Each netted bird was euthanized and immediately wrapped with absorbent paper, put in individual plastic bags containing *ca*. 2 cm ethyl acetate to kill lice *in situ*, and then frozen using dry ice. In the laboratory each thawed bird was carefully searched for lice feather-by-feather.Lice were mounted on slides following conventional procedures, staining some of them with Yellowish Eosin to reveal

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the sclerites more clearly, as proposed by Cicchino & Castro (1978). Drawings were made using a *camera lucida* attached to a Wild M-20 microscope. All measurements, expressed in millimeters, were taken from mounted specimens using a calibrated eyepiece, and identified by the following abbreviations: HL head length, ANW anterior notch width, POW preantennal width, OW maximum width of the head, ADPL anterior dorsal plate length, ADPW anterior dorsal plate width, PL prothorax length, PW prothorax width, PTL pterothorax length, PTW pterothorax width, AL abdominal length, AW maximum width of the abdomen, TL total body length, GLT total male genitalia length, GLM male genitalia length from basal apodema to mesomeral plate, GW maximum width of the male genitalia. Measurements include ranges and means, with standard deviations within parentheses. Setal counts include the range and modal value within parentheses. The preantennal region is defined as the portion of the head anterior from a horizontal line between the bases of the coni, to the front margin of the head.

Nymphal instars are distinguished by the pattern of marginal posterior pterothoracic setae. This pattern is identical to that of nymphal instars of *Brueelia* Kéler, 1936 species infesting Cowbirds (Cicchino 2004). The first instar (N I) with one very long seta, second instar (N II) with four (two very long alternating with two medium long setae), and the third one (N III) with six (three very long alternating with three medium long setae). In addition, N I lacks tergal and paratergal plates, which are present in N II and N III. Body measurements also aid in the recognition of instars.

To facilitate descriptions, the following fixed abdominal setae are named and characterized. a) ***Postspiracular seta*****:** as defined in Clay (1954), present on both sexes on tergites III–VIII (rarely on II) or IV–VIII, depending on the species. Usually they are medium long to very long. The postspiracular accessory seta is absent. b) ***Innermost tergoposterior seta*****:** present in both sexes, placed near the postero-internal angle of each tergite, on the tergite or on the adjacent integument. Usually they are medium long to very long and present on II–VIII. c) ***Tergoposterior setae*** ("seta/setae mediad of spiracle" of Price & Clayton (1996))**:** medium long to long, on VI–VII in males (may be present also in females on VI–VII), placed between the postspiracular and innermost tergoposterior setae. d) ***Sutural seta*****:** present on males only (Fig. 16). It is a small to short seta on the inner margin of tergites VI–VIII, less frequently also on V. This seta may or may not be flanked internally by a small to minute *sutural accessory seta*.

Holotypes and paratypes are deposited in the collections of Museo de La Plata (MLP), La Plata, Buenos Aires Province, Argentina and at Entomological Collection of Instituto Oswaldo Cruz (ECIOC), Fundação Oswaldo Cruz, Rio de Janeiro, Rio de Janeiro, Brazil.

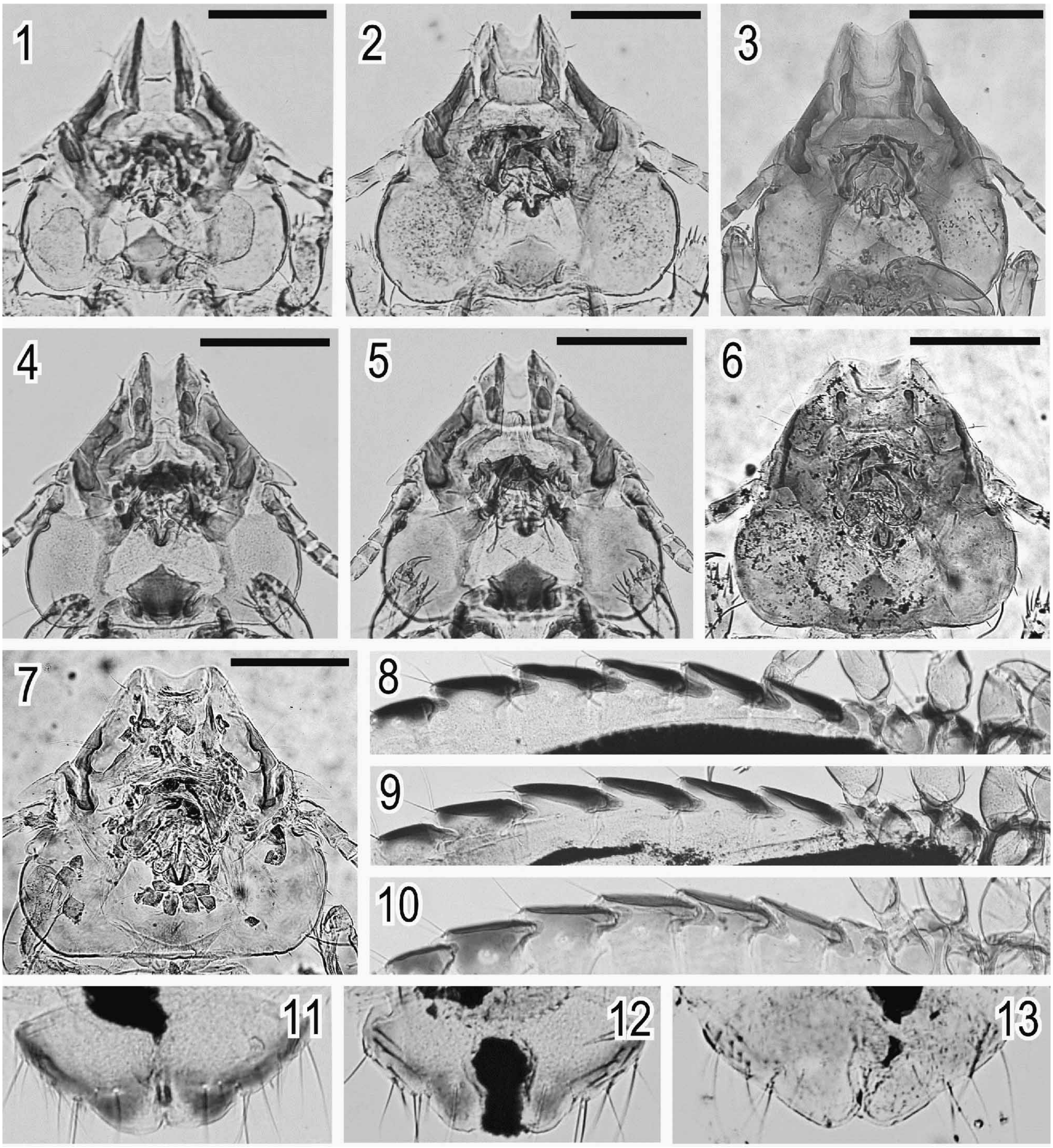
Nomenclature and distributional data of bird hosts follows Dickinson (2003).

Results

The three species described herein belong to two well defined species groups. The first, *F. mariae* **n. sp.**, aligns with *F. arnoldi* Price & Clayton, 1996, and *F. donpetersi* Price & Clayton, 1996 (all parasitic on gnateaters, Conopophagidae). This group is defined as: a) preantennal region longer than wide (Figs. 1–3); b) ANW 0.05–0.08; c) lateral preantenal margin concave (Figs. 1–3); d) pleurites little pigmented (Fig. 10); e) lacking of pigmentation on the posterior margin of the tergite IX+X in females (Fig. 13); f) postspiracular seta present from tergite IV in both sexes (Figs. 14–15); and g) one (less frequently two) tergoposterior setae on VIII.

The remaining new species, *F. thamnophili* **n. sp.** and *F. severus* **n. sp.**, are defined by the following combination of characters: a) head almost as long as wide (Figs. 6–7); b) ANW 0.059–0.120 width; c) lateral preantenal margin almost straight (Figs. 6–7); d) pleurites little pigmented (close to Fig. 10); e) lacking of pigmentation on the posterior margin of the tergite IX+X in females (close to Fig. 13); f) postspiracular seta present from tergite III (even from II in one individual of the former species) in both sexes (Figs. 16–17, 21–

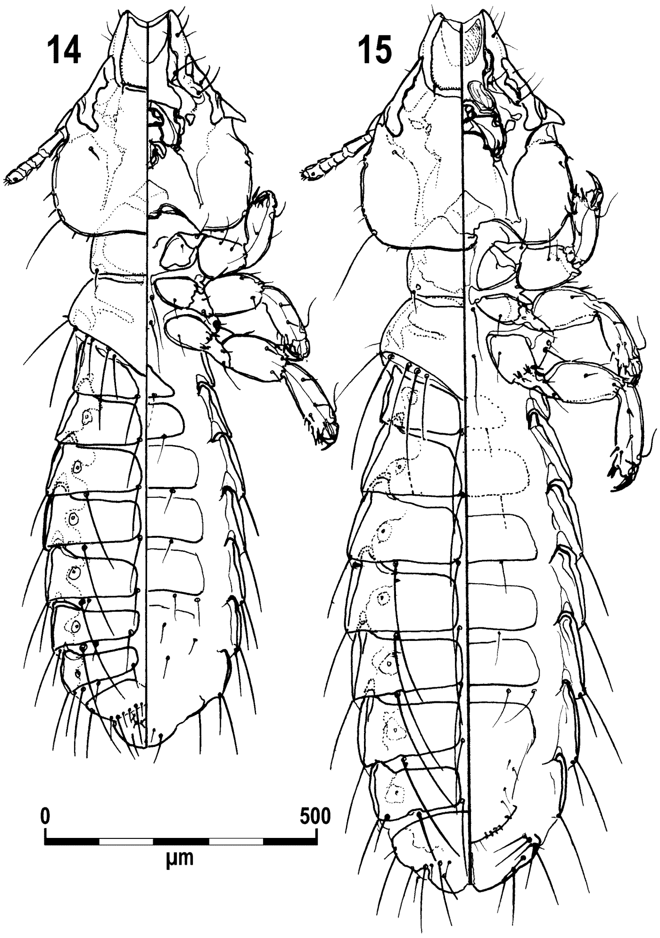
22); g) tergite VIII with one or two tergoposterior setae; and h) presence of one sutural seta on each side of VI–VIII, in *F. thamnophili* **n. sp.** on V–VIII; one sutural accessory seta occassionally may be present on VII–VIII (in *F. severus* **n. sp.**) or VI–VIII (in *F. thamnophili* **n. sp.**). The other species found in Thamnophilidae, including *F. tyrannina* Sychra, 2006 (see discussion below) are characterized by: a) head shape (Figs. 4–5); b) pleurites deeply pigmented (Figs. 8–9); and c) tergite IX+X with its posterior margin pigmented band (Figs. 11–12).The three new species are described below.



FIGURES 1–13. Male heads of: (1) *F. arnoldi* (holotype); (2) *F. donpetersi* (paratype); (3) *F. mariae* n.sp.; (4) *F. tyrannina* (holotype); (5) *F. picturatus*; (6) *F. thamnophili* n.sp.; (7) *F. severus* n.sp. Pleural plates in females of: (8) *F. picturatus*; (9) *F. tyrannina* (holotype); (10) *F. arnoldi* (paratype). Dorsal view of female tergite IX+X of: (11) *F. picturatus*; (12) *F. tyrannina* (holotype); (13) *F. arnoldi* (paratype). Photos 1–2, 4–5, 8–13 by Oldřich Sychra in 2006.

Formicaphagus mariae **Cicchino and Valim, n. sp.**
(Figs. 3, 14–15, 27–29, 30, 33)

Diagnosis: Both sexes more slender than the remaining two species of this group (two from Conopophagidae), having the narrowest temporal, prothoracic, pterothoracic, and abdominal widths. Male genitalia distinctive, differing in the shape of endomeral complex, and Y-shaped (instead T shaped) penial sclerite. Female without posterior tergal setae VII–VIII and fewer setae on gonapophysis (6 on each side).



FIGURES 14–15. *Formicaphagus mariae* **n. sp.**: (14) male; (15) female.

Male (Figs. 3, 14, 28)**:** general habitus as in Fig. 14. Head longer than wide (Fig. 3), wider than abdominal width. Preantennal region elongated, with lateral preantennal margins concave and apical portion noticeably produced (as in Fig. 27); ANW deeply emarginate. Dorsal anterior plate slightly longer than wide. Temples little expanded. Tergoposterior setae present on VI, 1, VII, 1–3 setae, and VIII, 1 seta on each side. Genitalia: mesosomal complex with margin slightly rounded at posterior margin and convergent in its sides, bearing two marginal sensilla on each side; penial sclerite Y-shaped, and paramera globular (Fig. 28). Measurements (n=1): HL 0.410, ANW 0.071, POW 0.276, OW 0.371, ADPL 0.139, ADPW 0.115, PL 0.152, PW 0.219, PTL 0.162, PTW 0.286, AL 0.762, AW 0.390, GLT 0.212, GLM 0.195, GW 0.068, TL 1.362.

Female (Figs. 15, 27, 29–30,33)**:** habitus as in Fig. 15. Head (Fig. 27) and thoracic features much as for male. Tergoposterior setae on each abdominal hemitergites VI, 0–1, and VII, 0. Vulvar margin with 20 spinose and 9 slender setae (Fig. 29), subgenital plate with 12 setae, and gonapophysis with 6 setae on each side. Measurements (n=1): HL 0.438, ANW 0.071, POW 0.276, OW 0.419, ADPL 0.146, ADPW 0.122, PL 0.171, PW

0.248, PTL 0.190, PTW 0.343, AL 0.990, AW 0.467, TL 1.638.

Prevalence: the prevalence of *F. mariae* **n. sp.** is very low, 1.694 % (1 out of 59 individuals examined).

***Etymology*:** this species is dedicated in honour of Maria Ogrzewalska (Ph.D. student Departamento de Medicina Veterinária Preventiva e Saúde Animal of Faculdade de Medicina Veterinária e Zootecnia, Universidade de São Paulo, Brazil), in recognition of her interest in collecting and making this material available.

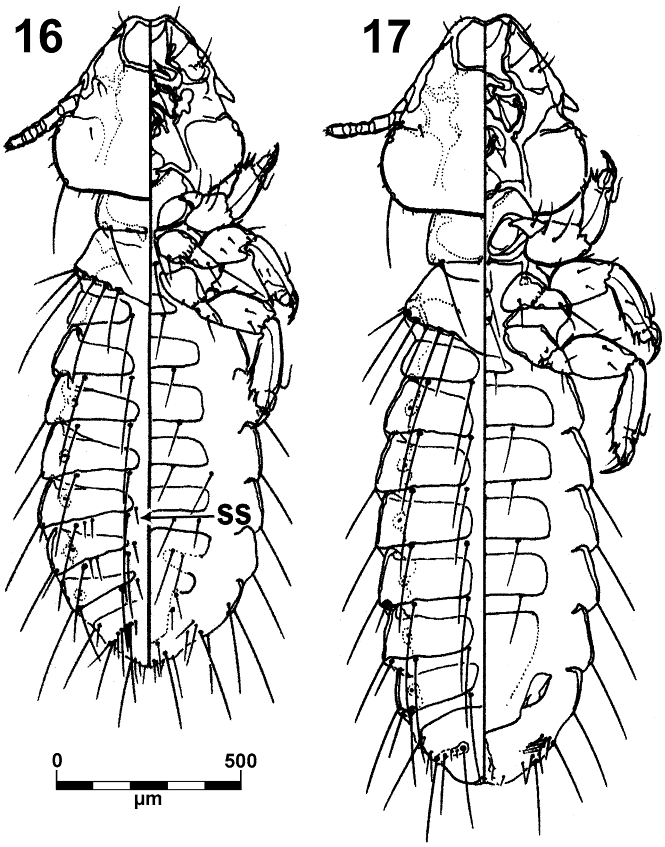
Specimens examined: male holotype and female paratype deposited in ECIOC, **BRAZIL**: São Paulo; Pontal do Paranapanema, 03-II-2006, M. Ogrzewalska col.

Type host: Rufous Gnateater, *Conopophaga lineata*. Usually found close to the ground, in the undergrowth of humid Atlantic Forest in southeastern Brazil, northeast Argentina and Paraguay.

Formicaphagus thamnophili **Cicchino and Valim, n. sp.**
(Figs. 6, 16–20, 23–24, 31–32)

Formicaphagus **n. sp.** Cicchino & Castro 1998:121–122.

Diagnosis: Body silhouette more elongated, dorsal anterior plate slightly wider than long, ANW narrower and tendency to be shorter than *F. severus* n.sp. in both sexes. Male differing in shape of parameres, shape, structure and number of marginal sensilla (three) of endomeral complex, shape and proportions of the penial sclerite, and lesser in most of the body measurements. Female usually lacking posterior tergal setae on VI–VII, lesser number setae on gonapophysis (5–6 vs 6–10 on each side), and noticeably lesser in most of body measurements.



FIGURES 16–17. *Formicaphagus thamnophili* **n. sp.**: (16) male; (17) female. SS - sutural seta.

Male (Figs. 6, 16, 23)**:** general habitus as in Fig. 16. Head slightly wider than long (Fig. 6), narrow than abdominal width. Lateral preantennal margins straight, convergent in a medium width and shallowly emarginated apex. Dorsal anterior plate slightly wider than long. Temples moderately expanded. Tergoposterior setae present on each abdominal hemitergites V 0–1 (1);VI, 2–3 (3); VII 2–5 (2); VIII, 0–2 (0). Sutural accessory seta present in tergites VI (a pair in only 1 specimen), VII (right side of 2 specimens), and VIII (left side of 2 specimens). Genitalia: mesosomal complex with margin slightly sinuated at sides, bearing three marginal sensilla on each side; penial sclerite with slender lateral arms, and parameres somewhat slender and angulated medially (Fig. 23). Measurements (n=4): HL 0.420–0.443 (0.432 ± 0.010), ANW 0.064–0.078 (0.069 ± 0.005), POW 0.303–0.420 (0.344 ± 0.043), OW 0.443–0.467 (0.461 ± 0.009), ADPL 0.111–0.118 (0.114 ± 0.002), ADPW 0.134–0.141 (0.138 ± 0.003), PL 0.163–0.210 (0.187 ± 0.015), PW 0.233–0.257 (0.245 ± 0.010), PTL 0.163–0.373 (0.315 ± 0.079), PTW 0.163–0.373 (0.228 ± 0.077), AL 0.817–0.910 (0.875 ± 0.031), AW 0.513–0.537 (0.525 ± 0.010), GLT 0.172–0.179 (0.175 ± 0.003), GLM 0.158–0.165 (0.161 ± 0.003), GW 0.082–0.087 (0.085 ± 0.001), TL 1.447–1.633 (1.552 ± 0.060).

Female (Figs. 17, 24, 32)**:** as in Fig. 17. Head and thoracic features much as for male, being somewhat larger. Hemitergites VI–VII without tergoposterior setae (with one in VI in a signle specimens and in one side only). Vulvar margin with 16–25 (20) spinose and 4–9 (7) slender setae (Fig. 24), subgenital plate with 11–16 (13) setae, and gonapophysis with 5–6 (6) setae on each side. Measurements (n=20): HL 0.438–0.476 (0.464 ± 0.012), ANW 0.059–0.075 (0.069 ± 0.005), POW 0.327–0.400 (0.368 ± 0.020), OW 0.467–0.514 (0.496 ± 0.011), ADPL 0.111–0.134 (0.122 ± 0.005), ADPW 0.141–0.153 (0.147 ± 0.003), PL 0.181–0.219 (0.195 ± 0.010), PW 0.257–0.286 (0.278 ± 0.009), PTL 0.162–0.219 (0.191 ± 0.017), PTW 0.280–0.420 (0.400 ± 0.031), AL 0.895–1.162 (1.040 ± 0.072), AW 0.513–0.629 (0.570 ± 0.029), TL 1.587–1.933 (1.765 ± 0.088).

Nymph I (Figs. 18, 31)**:** head longer than wide, temples not expanded, and anterior dorsal plate wider than long. Measurements (n=5): HL 0.295–0.314, ANW 0.045–0.056, POW 0.171–0.248, OW 0.267–0.286, ADPL 0.066–0.078, ADPW 0.078–0.094, PL 0.095–0.114, PW 0.171–0.181, PTL 0.086–0.105, PTW 0.229–0.257, AL 0.362–0.448, AW 0.267–0.305, TL 0.790–0.867.

Nymph II (Fig. 19)**:** head slightly longer than wide, temples more expanded, and anterior dorsal plate wider than long. Measurements (n=2): HL 0.343–0.352, ANW 0.049–0.052, POW 0.248–0.286, OW 0.333–0.343, ADPL 0.089–0.092, ADPW 0.106–0.111, PL 0.124–0.143, PW 0.200, PTL 0.105, PTW 0.286–0.295, AL 0.552–0.619, AW 0.381–0.448, TL 1.086–1.114.

Sites of oviposition (n=2)**:** eggs are glued to the basal half of the barbs of the feather vanes by means of a moderate amount of spumaline. In moderate infestations eggs are laid on feathers of pteryla of the crown, throat, neck, chest and lateral edges of the abdomen. In heavier infestation, most of the pteryla of the crown, upper portion of the face, chin, throat, chest and lateral edges of the abdomen are used (Fig. 20).

Prevalence: two individuals examined, both infested with this species. One of them with light infestation (one male, 2 females and 4 nymphs recovered), other heavily infested (3 males, 18 females and 3 nymphs recovered) by fluffing plumage.

Specimens examined: male holotype, 1 male and 18 female paratypes deposited at MLP; 1 male and 2 female paratypes at ECIOC; from the type host, **ARGENTINA**: Buenos Aires Province; Partido Punta Indio, Punta Piedras, 6-X-1984, A. C. Cicchino col. Other specimens: 5 N I and 2 N II, same data and collector as holotype. All these specimens were recovered from two individual hosts collected at the same time.

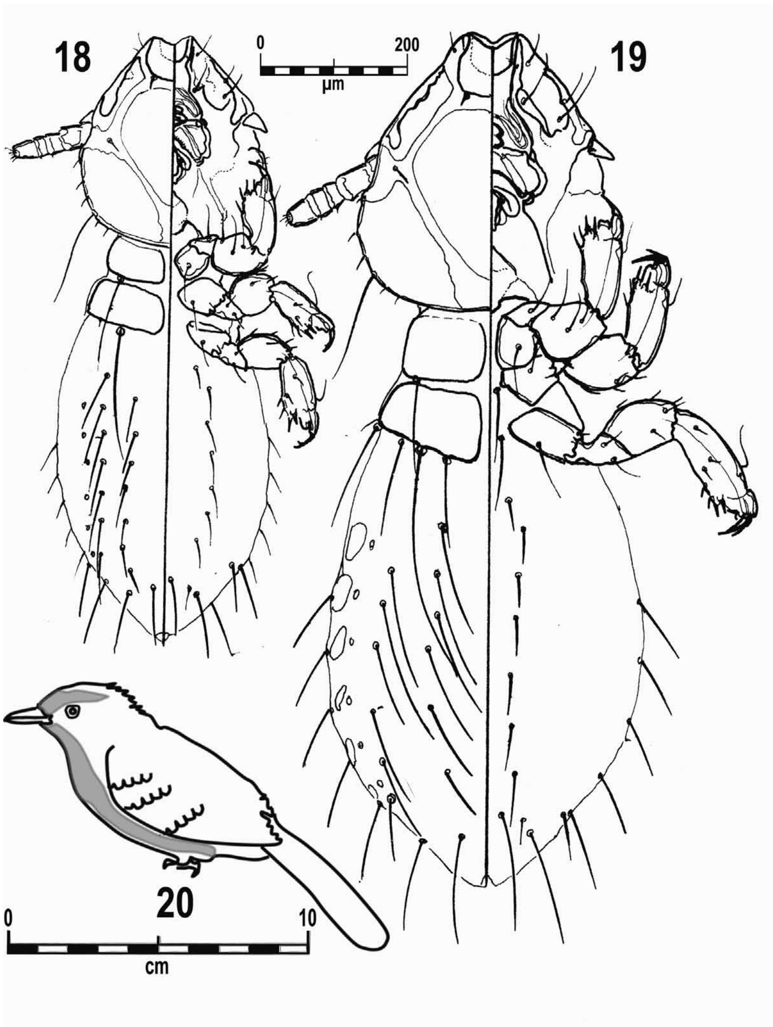
Type host: Rufous-capped Antshrike, *Thamnophilus r. ruficapillus*. Found in forest edges from east slope of the Andes in Peru, Bolivia, and northwest Argentina to southeastern Brazil, eastern Paraguay, Uruguay and northeastern Argentina.

Formicaphagus severus **Cicchino and Valim, n. sp.**

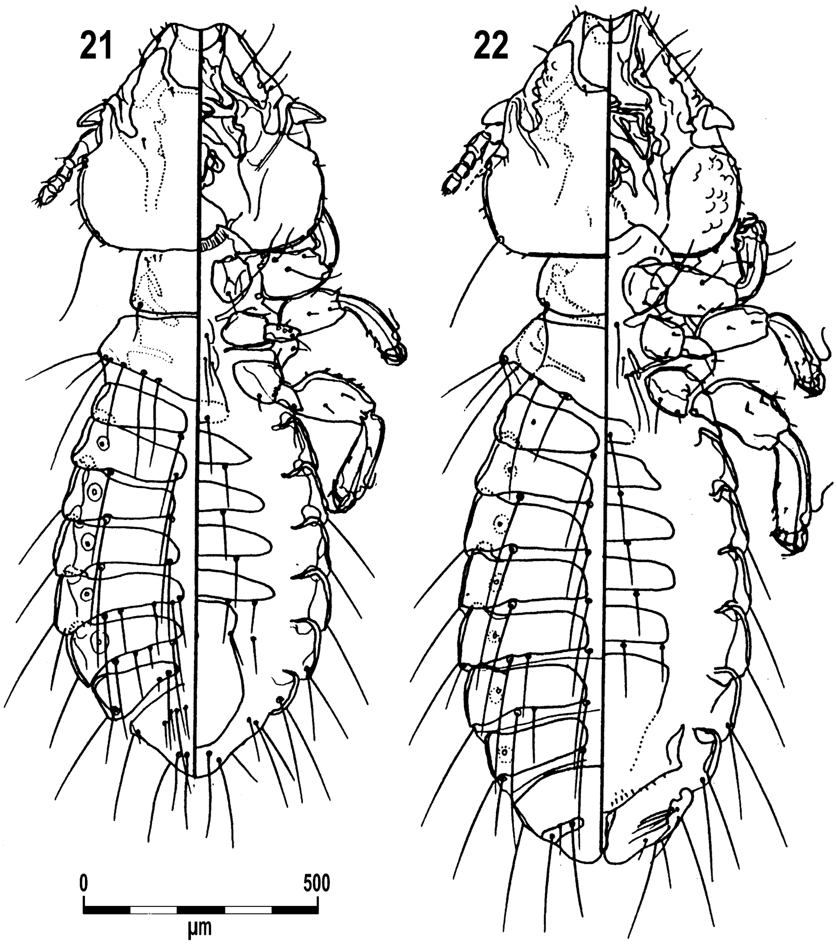
(Figs. 7, 21–22, 25–26)

Formicaphagus **n. sp.** Cicchino & Castro 1998:121.

Diagnosis: Body silhouette more stout, ANW wider and tendency to be longer than *F. thamnophili* n.sp. in both sexes. Male differing in shape of paramera, shape, structure and number of marginal sensilla (four) of endomeral complex, shape and proportions of the penial sclerite, and most of the body measurements. Female with 0–2 posterior (frequently one) tergal setae on VI–VII each side, greater number setae on gonapophysis (6–10 vs 5–6), and most of the body measurements.



FIGURES 18–20. *Formicaphagus thamnophili* **n. sp.**: (18) first nymphal stage; (19) second nymphal stage; (20) sites of oviposition in a heavily infested individual of *Thamnophilus r. ruficapillus* collected at Buenos Aires Province.



FIGURES 21–22. *Formicaphagus severus* **n. sp.**: (21) male; (22) female.

Male (Figs. 7, 21, 25)**:** general habitus as in Fig. 21. Head slightly longer than wide (Fig.7), narrow than abdominal width. Lateral peantennal margins straight, convergent in a medium width and shallowly emarginated apex. Dorsal anterior plate slightly longer than wide. Temples moderately expanded. Tergoposterior setae present on each abdominal hemitergites VI, 2–3 (2); VII, 2–4 (3); and on VIII 0–1 (0). A pair of sutural accessory seta present only in two specimens on VII and VIII. Genitalia: reminiscent of that of *F. pittasomae* Carriker, 1957, differing in size, shape of the parameres and proportions of the dorsal arms of the penial sclerite, bearing four marginal sensilla on each side (Fig. 25). Measurements (n=5): HL 0.527– 0.541 (0.533 ± 0.007), ANW 0.110–0.115 (0.112 ± 0.002), POW 0.405–0.424 (0.414 ± 0.011), OW 0.554–0.568 (0.562 ± 0.008), ADPL 0.157–0.169 (0.165±0.004), ADPW 0.141–0.145 (0.143 ± 0.002), PL 0.189–0.203 (0.200 ± 0.006), PW 0.297–0.330 (0.306 ± 0.017), PTL 0.208–0.235 (0.215 ± 0.013), PTW 0.424–0.451 (0.442 ± 0.011), AL 0.865–0.946 (0.900 ± 0.038), AW 0.608–0.649 (0.620 ± 0.017), GLT 0.262–0.283 (0.275 ± 0.009), GLM 0.242–0.271 (0.258 ± 0.012), GW 0.108–0.115 (0.110 ± 0.003), TL 1.716–1.824 (1.759 ± 0.044).

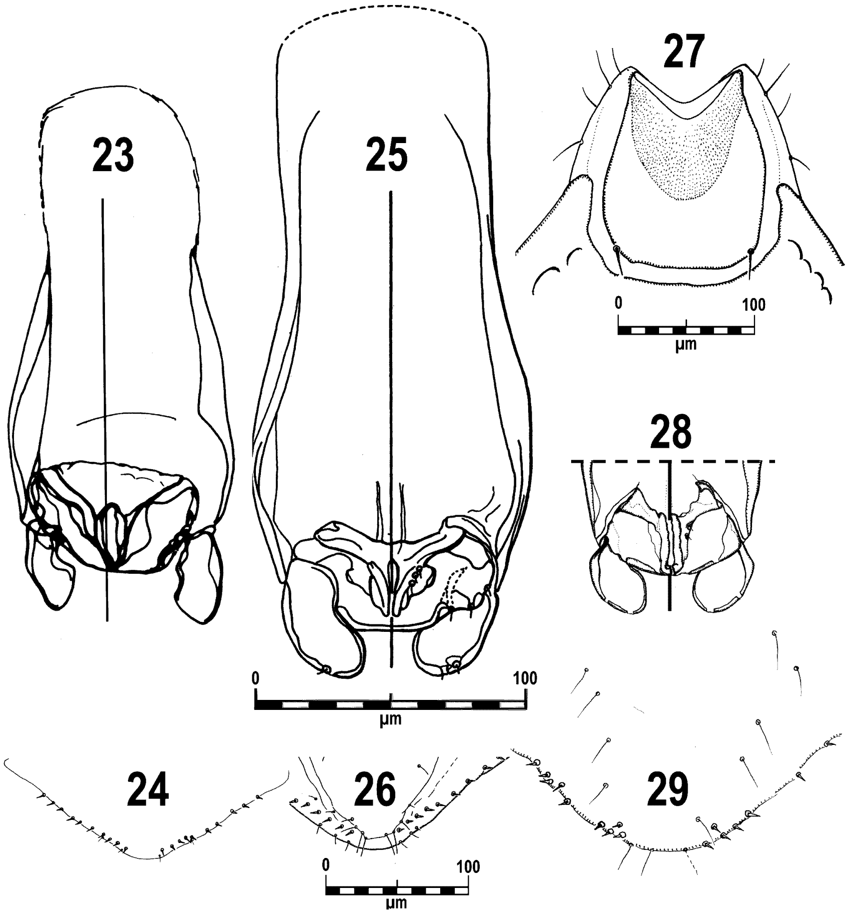
Female (Figs. 22, 26)**:** general habitus as in Fig. 22. Head and thoracic features much as for male, but somewhat larger. Tergoposterior setae present on each abdominal hemitergites VI, 0–1, and VII, 0–2, more often 1 on each side. Vulvar margin with 16–26 (20) spinose and 3–9 (7) slender setae (Fig. 26), subgenital plate with 12–19 (16) setae, and gonapophysis with 6–10 (7 and 8) setae on each side. Measurements (n=15): HL 0.519–0.568 (0.547 ± 0.017), ANW 0.094–0.120 (0.107 ± 0.006), POW 0.419–0.459 (0.436 ± 0.018), OW 0.559–0.595 (0.577 ± 0.014), ADPL 0.155–0.180 (0.171 ± 0.007), ADPW 0.141–0.159 (0.148 ± 0.005), PL 0.195–0.235 (0.209 ± 0.013), PH 0.283–0.351 (0.314 ± 0.024), PTL 0.203–0.249 (0.220 ± 0.019), PTW

0.432–0.486 (0.460 ± 0.019), AL 0.865–1.135 (1.019 ± 0.097), AW 0.595–0.654 (0.639 ± 0.024), TL 1.797–2.000 (1.890 ± 0.080).

Prevalence: the prevalence of this species cannot be calculated, because the only individual host was parasitized.

Specimens examined: male holotype, 3 male and 13 female paratypes at MLP; 1 male and 2 female paratypes at ECIOC; all from the type host, **ARGENTINA**: Misiones Province; Frontera, Urugua-í,11-IX-1952, W. Partridge col.

Type host: Tufted Antshrike, *Mackenziaena severa*. Inhabits dense forest understory of Atlantic Forest region of southeastern Brazil, eastern Paraguay, and northeastern Argentina, particularly where bamboo is present.

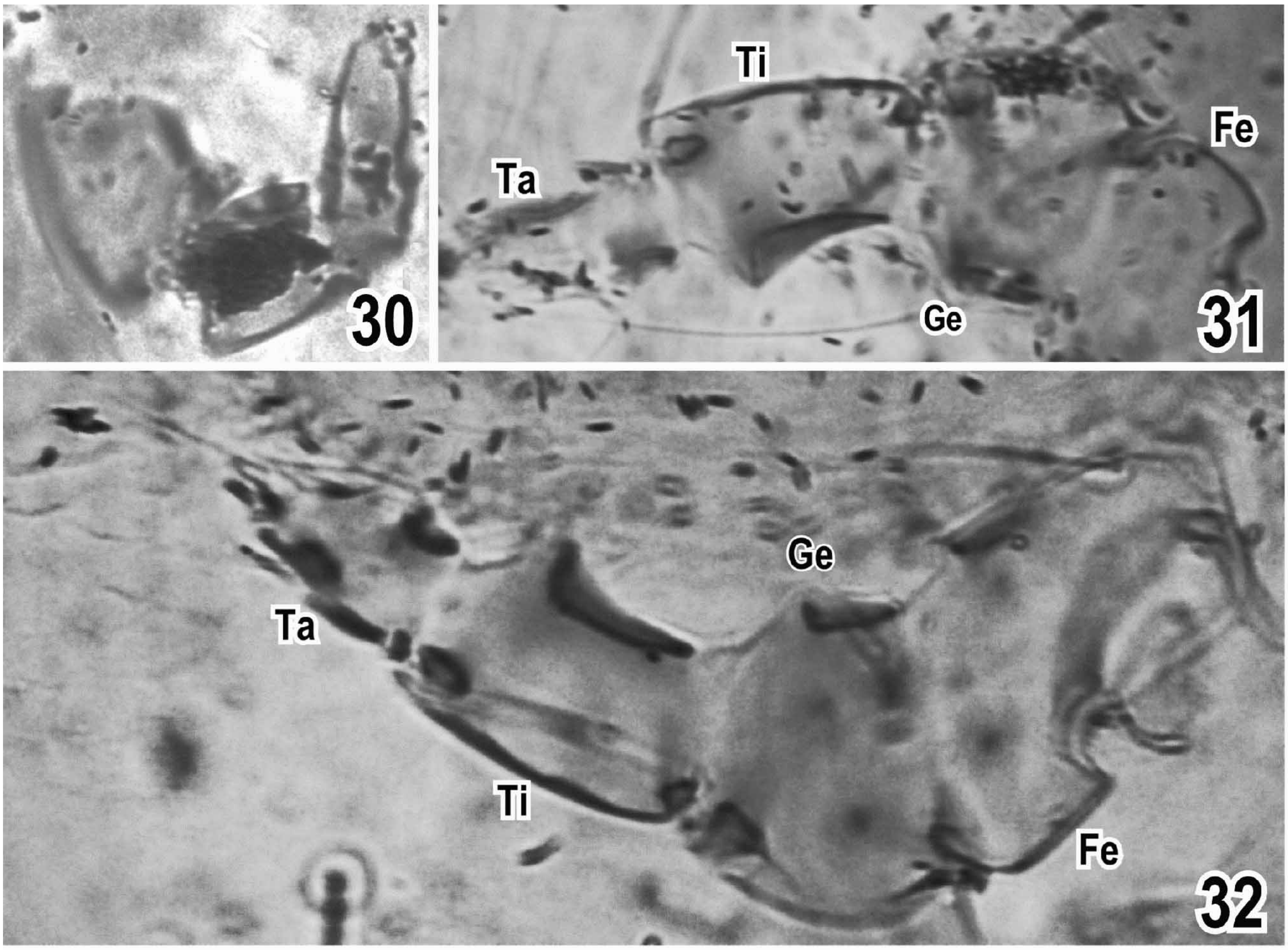


FIGURES 23–29. *Formicaphagus thamnophili* **n. sp.**: (23) male genitalia, (24) vulvae of female. *F. severus* **n. sp.**: (25) male genitalia, (26) vulvae of female. *F. mariae* **n. sp.**: (27) anterior portion of the female forehead, (28) male genitalia, (29) vulvae of female.

Discussion

Price & Clayton (1996: 354) separated in the key to male species a group of two species found on Conopophagidae by the presence of 1–2 tergoposterior seta/setae on VIII. Later, Sychra [in Sychra *et al.* (2006)] described an additional species alleged to belong to this group, although parasitic on a member of the Thamnophilidae, based mostly on the setae character cited above. In this paper, the three new species described share this character, even if two of them (*F. thamnophili* **n. sp.** and *F. severus* **n. sp.**) are unrelated to any other known species by presence of postspiracular setae from III and wide ANW, both parasitic on members of the

Thamnophilidae. This fact suggests that this character alone does not define a close relationship among the species that share it, but it probably developed independently in disparate species-groups. In addition, this character may be so variable even within individuals of the same host population that a single species, e.g. *F. thamnophili* sp. n. (with 1–3 on VIII), may key to Conopophagidae infesting species or to Thamnophilidae/ Formicariidae infesting species, depending on the individual under examination.



FIGURES 30–32. Feather mites legs (Astigmata: Analgoidea) in the digestive tract: (30) female of *F. mariae* **n. sp.**; (31) N II of *F. thamnophili* **n. sp.**; (32) female of *Formicaphagus thamnophili* **n. sp.** Fe—femur, Ge— genua, Ti —tibia, Ta—tarsus.

Price & Clayton (1996: 348) synonymized, based on the absence of significant characters to separate them, under *F. picturatus* four species and under *F. minutus* three others, all formerly described by Carriker (1957) from different host species. Most of these Carriker's species were described from small samples and in a number of cases composed of individuals of one sex, frequently females. This fact impedes a reliable comparison of morphometric and chaetotactic characters among the different "host" populations. If we assume that Price & Clayton's synonymy of four species into *F. picturatus* proves true, and the geographical range of the four hosts overlap in the sites of collection of each louse species (NW of Colombia and North Peru), then we can speculate that factors other than host speciation are involved in structuring *Formicaphagus* species (e.g. Page *et al.* 1996; Paterson *et al.* 1999; Clayton & Walther 2001; Clayton & Johnson 2003; Paterson *et al.* 2003; Clayton *et al.* 2004).

Carriker (1957: 417) stated that the male genitalia of all the species in which males are known are decidedly different. Price & Clayton (1996: 347) rejected this statement, arguing that they have little evidence to support it. The three new species here described show significant differences among them, involving shape of parameres, shape of the mesosomal complex, associated sensilla, and morphology of the penial sclerite. A number of differences remain to be discovered in male genitalia among those species described only from females.

Taking into account the variation in somatic measurements and number and position of setae of abdominal tergites showed in this study, it is highly desirable to stabilize the identities of all the species in *Formicaphagus* known from very low number of individuals. Thus, in *Formicaphagus* this task may be achieved using male and female features based in a larger number of individuals, establishing the extent of individual and/or populational variation of each character.

Species infesting Conopophagidae, two previously known plus *F. mariae* **n. sp.** described herein, form a reasonably well-defined group based on morphology as well as by host taxonomy, being allopatric. The distinctive features and very low prevalence exhibited by *F. mariae* **n. sp.** justify, to our knowledge, the description based on the single pair available to us. Another species described by Sychra [in Sychra *et al.* (2006)] and alleged to be close to Conopophagidae-infesting species on the basis of a single character following Price & Clayton's (1996) key, do not fit well within this group, being collected from a Thamnophilidae (*Cercomacra*).

Philopterids have a diet consisting of fragments of the feathers (mainly barbs and barbules or fragments of them), a fact well documented in the literature (Rothschild & Clay 1952). However, the phenomenon of mites in the gut has been observed repeatedly by several authors (e.g. Rothschild & Clay 1952; Oniki & Butler 1989; Mey 1990; Valim 2006; Cicchino & Mey 2007). Within the specimens examined by us, eight females of *Formicaphagus thamnophili* n.sp. showed unidentifiable fragments of feather mites legs in their digestive tract. In addition, one female presented two propodosomal legs (with femur to tarsus, Fig. 32) probably belonging to a *Mesalgoides* species (Analgoidea, Psoroptoididae, Pandalurinae). One male of *F. thamnophili* n.sp. also showed unidentifiable fragments of legs, and one N II (Fig. 31) three fragments of feather mites propodosomal legs (all with femur to tarsus) belonging to a member of superfamily Analgoidea. In *Formicaphagus mariae* **n. sp.** many leg fragments of unidentified feather mites were found in the digestive tract of the female (Fig. 30). It is important to stress that after molting the exuivae of feather mites remain attached to feathers, typically at the junctions of barbs and rachis (Proctor 2003). Thus it is probable that fragments of feather mite exuviae are ingested along with feather parts during the feeding process of the chewing lice.

Check-list of the chewing lice species known to occur on Typical antbirds and Gnateater. Asterisk (*) indicates type host, taken at species level. Citations includes all localities cited in the current literature and indicated in each case. Avian taxonomy as per Dickinson (2003).

Thamnophilidae — Typical antbirds

Mackenziaena **Chubb, 1918**

M. severa (Lichtenstein, 1823) — **Tufted Antshrike**

Formicaphagus severus **n. sp. Urugua-í, Misiones Province, Argentina** (**Present paper**)

Thamnophilus **Vieillot, 1816**

T. doliatus **(Linnaeus, 1764) — Barred Antshrike**

Machaerilaemus laticorpus **(Carriker, 1903)* Juan Vinas, Costa Rica (Carriker 1903)**

T. ruficapillus **Vieillot, 1816 — Rufous-capped Antshrike**

Formicaphagus thamnophili **n. sp. Punta Indio, Buenos Aires Province, Argentina (Present paper)**

Myrmotherula **P. L., Sclater, 1858**

M. gutturalis **P. L., Sclater & Salvin, 1881 — Brown-bellied Antwren**

M. laticorpus **(Carriker, 1903) no locality, Guyana (Price *et al.* 2002)**

M. axillaris **(Vieillot, 1817) — White-flanked Antwren**

Formicaphagus minutus **Carriker, 1957 Santa Ana, Coroico River, Colombia (Carriker 1957)**

M. schisticolor **(Lawrence, 1865) — Slaty Antwren**

Formicaphagus picturatus **Carriker, 1957 Eneñas, Peru (Carriker 1957)**

Herpsilochmus **Cabanis, 1847**

H. rufimarginatus **(Temminck, 1822) — Rufous-winged Antwren**

Formicaphagus minutus **Carriker, 1957* Upata, Venezuela (Carriker 1957)**

Cercomacra **P. L., Sclater, 1858**

C. nigricans **P. L., Sclater, 1858 — Jet Antbird**

Formicaphagus picturatus **Carriker, 1957 Río Vieja, Bolívar, Colombia (Carriker 1957)**

Machaerilaemus laticorpus **(Carriker, 1903) Tierra Alta, Sinu River, Colombia (Carriker 1956)**

C. tyrannina **(P. L., Sclater, 1855) — Dusky Antbird**

Formicaphagus picturatus **Carriker, 1957 Santa Rosa, Bolívar, Colombia (Carriker 1957)**

Formicaphagus tyrannina **Sychra, 2006* Hitoy Cerere BR, Limon Province, Costa Rica (Sychra *et al.* 2006)**

Pyriglena **Cabanis, 1847**

P. leucoptera **(Vieillot, 1818) — White-shouldered Fire-eye**

Formicaphagus brevifrons **Carriker, 1957* Serra de Angra dos Reis, Rio de Janeiro State, Brazil (Carriker 1957)**

Gymnocichla **P. L., Sclater, 1858**

G. nudiceps **(Cassin, 1850) — Bare-crowned Antbird**

Rallicola heterocephala **(Carriker, 1944)* Jimenez, Costa Rica (Carriker 1944)**

Formicaphagus picturatus **Carriker, 1957 Hitoy Cerere BR, Limón Province, Costa Rica (Sychra *et al.* 2006)**

Schistocichla **Todd, 1927**

S. leucostigma **Pelzeln, 1868 — Spot-winged Antbird**

Formicaphagus clypeatus **Carriker, 1957* La Pampa, Peru (Carriker 1957)**

Myrmeciza **G. R., Gray, 1841**

M. longipes **(Swainson, 1825) — White-bellied Antbird**

Formicaphagus angustifrons **Carriker, 1957 La Plata, Huila, Colombia (Carriker 1957)**

M. laemosticta Salvin, 1865 — **Dull-mantled Antbird**

Formicaphagus magnus **Carriker, 1957* La Palmita, Santander, Colombia (Carriker 1957)**

Formicaphagus picturatus **Carriker, 1957 Puerto Valdivia, Antioquía, Colombia (Carriker 1957)**

M. hemimelaena **P. L., Sclater, 1857 — Southern Chestnut-tailed Antbird**

Formicaphagus angustifrons **Carriker, 1957* Santa Ana, Corioco River, Bolivia (Carriker 1957)**

M. immaculata **(Lafresnaye, 1845) — Immaculate Antbird**

Formicaphagus picturatus **Carriker, 1957* Bellavista, Santander, Colombia (Carriker 1957)**

Gymnopithys **Bonaparte, 1857**

G. leucaspis (**P. L., Sclater, 1855) — White-cheeked Antbird**

Formicaphagus minutus **Carriker, 1957 Quibdó, El Chocó, Colombia (Carriker 1957)**

M. laticorpus (Carriker, 1903) Hitoy Cerere BR, Limón Province, Costa Rica (Sychra *et al.* 2006)

Phaenostictus **Ridgway, 1909**

P. mcleannani **(Lawrence, 1860) — Ocellated Antbird**

Myrsidea mcleannani **Sychra, 2006* Hitoy Cerere BR, Limón Province, Costa Rica (Sychra *et al.* 2006)**

Conopophagidae — Gnateaters

Conopophaga **Vieillot, 1816**

C. peruviana **Des Murs, 1856 — Ash-throated Gnateater**

Formicaphagus donpetersi **Price & Clayton, 1996* Cerro Pantiacolla, Madre de Dios Department, Peru (Price & Clayton 1996)**

C. ardesiaca **d´Orbigny & Lafresnaye, 1837 — Slaty Gnateater**

Formicaphagus arnoldi **Price & Clayton, 1996* Cerro Pantiacolla, Madre de Dios Department, Peru (Price & Clayton 1996)**

C. lineata **(Wied-Neuwied, 1831) — Rufous Gnateater**

Formicaphagus mariae **n. sp. Pontal do Paranapanema, São Paulo State, Brazil (Present paper)**

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