Research Article

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The feather louse genus *Mulcticola* Clay et Meinertzhagen, 1938 (Phthiraptera: Philopteridae) from Brazil, with descriptions of five new species and catalogue for species described in the genus

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Abstract: Five new species of *Mulcticola* Clay et Meinertzhagen, 1938 are described and illustrated from Brazil. These new species and their hosts are: *Mulcticola sicki* sp. n. from the sand-coloured nighthawk, *Chordeiles rupestris rupestris* (Spix), *Mulcticola bacurau* sp. n. from the common pauraque, *Nyctidromus albicollis* (Gmelin), *Mulcticola tendeiroi* sp. n. from the long-trained nightjar, *Macropsalis forcipata* (Nitzsch), *Mulcticola piacentinii* sp. n. from the short-tailed nighthawk, *Lurocalis semitorquatus semitorquatus* (Gmelin) (type-host) and *L. s. nattereri* (Temminck), and *Mulcticola parvulus* sp. n. from the little nightjar, *Setopagis parvula* (Gould). These species were compared primarily with *Mulcticola nacunda* Carriker, 1945 from the nacunda nighthawk, *Chordeiles nacunda nacunda* (Vieillot), which is one of the species of *Mulcticola* previously recorded in the Neotropical region. All the five new species described herein differ from their congeners by exclusive characters such as the shape of anterior dorsal head plate, metasternal plate, subvulvar plates in females and genitalia in males. We increased the number of species in *Mulcticola* to 18 in total, with seven of them now known from the Neotropics. We present the main morphological characters to distinguish *Mulcticola* from other species of the Philopteridae parasitising Caprimulgiformes and also compile a detailed catalogue for species included in this louse genus.

Keywords: taxonomy, Caprimulgidae, chewing lice, nighjars, nighthawks, Neotropical region

The genus *Mulcticola* Clay et Meinertzhagen, 1938 is one of the almost 150 genera of chewing lice of the family Philopteridae Burmeister, 1838 sensu lato and is confined to nighjars and nighthawks, family Caprimulgidae (Aves, Caprimulgiformes). *Mulcticola* includes 13 described species (Hopkins and Clay 1952, Price et al. 2003) distributed around the globe, with five occurring in the Afrotropical region, three occurring in the Indomalayan region, one in the Nearctic and one in Palearctic regions, and three in the Neotropical region.

The original description of Clay and Meinertzhagen (1938) provides no key characters defining *Mulcticola* as most of the characteristics mentioned by those authors are common to many other currently recognised philopterid genera. Thus, the species in *Mulcticola* have been described without a solid morphological generic diagnosis in comparison to other philopterids (Carriker 1945, Emerson and Elbel 1957, Tendeiro 1961, 1962). Ledger (1980), using part of Clay's unpublished key for Philopteridae, was the first to provide some distinctive characters exclusive for species of *Mulcticola*. Here we present a more detailed generic definition to distinguish this louse genus from its

close relatives. Also, we present a detailed and complete catalogue for the known species of the genus *Mulcticola*.

Carriker (1945) described three species of *Mulcticola* occurring in the Neotropical region. One of these species was collected for us, and therefore used as a starting point for the morphological comparison of the new taxa. Although there is a single unidentified record for '*Mulcticola* sp.' in Brazil (Enout et al. 2012), the species treated below are the first record of named species of this louse genus on Brazilian Caprimulgidae.

MATERIALS AND METHODS

All the specimens studied are deposited in the Museu de Zoologia da Universidade de São Paulo (MZUSP), with a number associated as a unique identifier from the SophiA® database for the Phthiraptera collection. Most of host vouchers are held in MZUSP ornithological collection and their unique numbers are also provided after host's name. Other collections with host vouchers studied are Museu Nacional of Universidade Federal do Rio de Janeiro, Rio de Janeiro (MNRJ) and Ornithological collection of Universidade Federal do Rio Grande do Norte, Natal (COUFRN), both in Brazil. Lice were permanently slide-mounted in Canada

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balsam, following the technique in Palma (1978). Terminology of head chaetotaxy follows that employed by Clay (1951) and reinterpreted by Mey (1994), and that used for thoracic setae follows the latter author. The dorsal sensilla present on head are named as proposed by Valim and Silveira (2014). Host common and scientific names follow Dickinson and Remsen (2013).

All measurements are in millimeters and identified by the following abbreviations: ADHPL – anterior dorsal head plate length; ADHPW – anterior dorsal head plate width; AW – abdominal width (at level of segment V); GL – male genitalia length; HL – head length (at midline and including the hyaline margin); PAW – preantennal width (at level of preconal setae); PL – paramera length; PTW – pterothorax width (at its posterior level); PW – prothorax width; TL – total length; TW – temporal width (at level of marginal temporal setae 2).

The extreme morphological homogeneity among the species of *Mulcticola* would make the morphological descriptions of each taxon repetitive. Therefore, only the first species is fully red-described; other species are only compared and their informative and diagnostic characters described. The nymphs were studied and measured based on their head and thorax features due to poor condition of the specimens that did not allow proper study of their abdominal chaetotaxy.

RESULTS

Taxonomy

Phthiraptera Haeckel, 1896

Ischnocera Kellogg, 1896

Philopteridae Burmeister, 1838

Mulcticola Clay et Meinertzhagen, 1938

Type species: *Mulcticola hypoleucus* (Denny, 1842) (syn. *Nirmus hypoleucus* Denny, 1842), by original designation and monotypy.

Mulcticola Clay et Meinertzhagen, 1938. *Entomologist* 71(907): 279 (one species included). Carriker 1945: 173 (four new species); Hopkins and Clay 1952: 227 (world checklist, five valid species); Emerson and Elbel 1957: 420 (two new species); Tendeiro 1961: 129 (one new species); Tendeiro 1962: 345 (six new species); Price et al. 2003: 198 (world checklist, 12 species valid in total).

Distribution. Afrotropical region (Angola, Cameroun, Congo, Kenya, Sierra Leone), Indomalayan region (India, Nepal, Thailand), Nearctic region (Canada, USA), Palaearctic region (Bulgaria, Czech Republic, Finland, Germany, Hungary, Poland, Romania, Spain, Tajikistan, Turkey, UK), Neotropical region (Bolivia, Colombia, Peru).

Diagnosis. This is the only philopterid genus with the following combination of characters: ocular (*os*) and marginal temporal setae (*mts*) 1 and 3 each side long, preantennal seta (*pas*) long surpassing pedicel length (Figs. 1, 2); preocular seta (*pos*), *mts*2, *mts*4–5, as short seta; antenna similar in both sexes (scape 0.05–0.07 long; pedicel 0.07–0.11; flagellomeres: I 0.05–0.06, II 0.03–0.05, III 0.04–0.06); hyaline margin present, rounded to flattened, arising after *as*3 each side; dorsal preantennal region with

marginal carina divided into pre- and post-marginal carinae; dorsal anterior plate with posterior margin rather rounded, never pointed and thickened; dorsal preantennal suture encircling posterolateral margin of dorsal anterior head plate ending on its midline before level of mandibles (Fig. 2). Prothorax on each side with one anteromedian sensillum and one very short post-spiracular seta set on posteromedial margin; pterothorax divided medially, with one pair of anteromedian sensillum and on each side with two pairs of long setae set on posterolateral margin plus one lateral trichoid seta (*tr*, see Fig. 3) and one short and spine-like ventral seta (*s*, see Fig. 3). Coxa I fused ventrally, coxae II and III free and articulated with ventral portion of thorax, coxae III with well sclerotised trochantin (Fig. 3). Tergite II divided medially, tergites III–VII only medially notched but not entirely divided, other tergites entire; internal mid-dorsal projection from each side of abdominal segment II into pterothorax (Fig. 3). Female genitalia composed by one pair of subvulvar plates of distinct shapes depending on species, one small internal genital sclerite associated with internal genital opening, plus one very large and weakly sclerotised calyx of spermatheca (Fig. 22). Male genitalia characteristic, with paramere robust and basally inflated, pointed, with sub-apical seta and one sensillum set above latter seta; whole endomere and its lateral arms distinct, not inflated and of diagnostic shape. This genus is found exclusively on Caprimulgiformes (Caprimulgidae).

Remarks. We will compare primary *Mulcticola* with other genera of lice parasitising Caprimulgiformes and define some generic and phylogenetic informative characters among these parasites, assuming they are closely related and form a generic complex (Clay 1957) parasitising Caprimulgiformes. Table 1 is presented to distinguish imagoes for the genera of the Philopteridae – *Mulcticola*, *Nyctibicola* Cicchino, 1989 and *Podargoeus* Emerson et Price, 1966 – parasitising Caprimulgiformes. The medial division of the pterothorax and the presence of one long anterior seta on each side of tergite II are shared by these three genera. Females share one spine-like seta each side set below the vulvar margin and their vulvar margin is greatly convex medially (see Table 1 for further distinctive characters). There are few other informative characteristics that do not occur exclusively in these philopterid genera.

The isolated comparison between the above-mentioned characters among other philopterid genera could result in a comparison of convergent adaptive characters of homologous structures for the same host body region, ecomorphological specialisation, a phenomenon very well known in feather lice (Clay 1949, 1951, 1957, Johnson et al. 2012). However, some of the key characters found in species of *Mulcticola* and shared with other chewing louse genera will be briefly compared.

The internal mid-dorsal projection from each side of the abdominal segment II into the pterothorax is also present in other unrelated genera, e.g. *Ardeicola* Clay, 1936, *Fulicofula* Clay et Meinertzhagen, 1938, *Pseudophilopterus* Carriker, 1936 and *Pseudolipeurus* Carriker, 1936. Females of these genera are also like *Mulcticola* in having three pairs of spine-like anal setae with the two most proximal pairs

Table 1. Diagnostic features for the imagoes of the genera of Philopteridae (Ischnocera) parasitising Caprimulgiformes (Aves).

Features	<i>Muldicola</i>	<i>Nyctibicola</i>	<i>Podargoeus</i>
	Clay et Meinertzhagen, 1938	Cicchino, 1989	Emerson et Price, 1966
Anterior seta 3 (<i>as</i> 3)	short	medium	short
Dorsal submarginal seta (<i>dsms</i>)	long	medium	very long
Preantennal seta (<i>pas</i>)	very long	very short	very short
Ocular seta (<i>os</i>)	long	short	long
Postnodal seta (<i>pns</i>)	short	medium	short or long
Marginal temporal seta (<i>mts1</i>)	long	short	long
Marginal temporal seta (<i>mts2</i>)	short	short	short
Dorsal anterior plate I	anterior margin straight to slightly concave	anterior margin deeply concave	anterior margin straight to slightly concave
Dorsal anterior plate II	without median posterior projection	without median posterior projection	with median posterior projection
Dorsal anterior plate III	independent of the pre-marginal carina	fused with the pre-marginal carina on its postero-lateral margins	independent of the pre-marginal carina
Conus	reach the midlength of scape	reach the posterior margin of scape	reach the posterior margin of scape
Eye	normal, semicircular in shape	normal, semicircular in shape	pointed and projected posteriorly
Postspiracular prothoracic setae	very short	medium-long	short or very long
Pterothorax chaetotaxy*	2 + 2	3 + 4	6 or 2 + 2
Pterothorax	medially divided	medially divided	medially divided
Coxal acetabula on legs III	present	absent	absent
Postspiracular abdominal setae	IV–VII	IV–VII	III–VII
Tergite II	medio-anteriorly indented into pterothorax	never indented	never indented
Pointed projection on postero-lateral margin of tergal plates II–IV	absent	present	present
Tergal plates on segments III–VIII	medially fused, only anterior indented	medially divided	medially divided
Antero-lateral projections on tergites III–VIII (re-entrant heads)	present	absent	absent
Sternal plates	present	absent	absent
Endomeran arm in male genitalia	distinct, not inflated distally	distinct, very inflated distally	indistinct
Paramere in male genitalia I	somewhat inflated basally and articulated with basal plate	nearly regular in breadth and partially fused with basal plate	somewhat inflated basally and articulated with basal plate
Paramere in male genitalia II	with posterior sensilla developed in seta	with anterior and posterior sensillae developed in setae	with posterior sensilla developed in seta
Body ecotype	wing feathers	head feathers	head feathers
Host family	Caprimulgidae	Nyctibiidae	Podargidae and Aegothelidae
Distribution	worldwide	Neotropical region	Australian region
Number of species	13 + 5 new	1	3

* each side, and excluding the minute plus the long trichoid setae always present.

being modified. However, *Muldicola* is unique when compared with other genera of Philopteridae (excluding Goniodidae and Heptapsogasteridae) because it has very long preantennal seta (*pas*) surpassing the pedicel length, and the internal mid-dorsal projection from segment of the abdomen II into the pterothorax. All species within the four genera cited above (*Ardeicola*, *Fulicoffula*, *Pseudophilopterus* and *Pseudolipeurus*) have the *pas* short.

Muldicola nacunda Carriker, 1945

Figs. 1–5, 9, 10, 21, 22

Imago redescription

Head. Triangular, subtruncated forward, slightly longer than wide, cephalic index of 1.1 in both sexes (Fig. 2). Short clypeal region, narrow hyaline margin, rounded sides and slightly rounded to straight in front. Anterior dorsal and ventral head plates of characteristic shape, with distinct tracks of cibarial muscles on dorsal plate (Fig. 9), ratio of anterior head plate 1.1–1.3. Coni triangular in shape,

shorter reaching at most posterior margin of scapus. Postnodal seta short. Eye small-rounded and prominent. Temples slightly extended, marginal temporal carina narrow. Posterior margin of occipital edge concave, with *pts* and sensilla *s1*–*s5* present on each side (*s5* sometimes indistinct on one side).

Thorax. Whole thorax shorter than head. Prothorax trapezoidal, pterothorax also as a larger trapezoid, about same width of head. Meso- and metasternal plates distinctly sclerotised each with one pair of medium-sized setae; latter plate of diagnostic shape, nearly square-like (Fig. 10).

Abdomen. Elongated, with widest segment at V. Segment II with tergal plate laterally fused with pleura and entirely divided medially, with 4 posterior setae (plus one pair of anterior setae). All other segments entire and laterally fused to pleura. On segments III–VIII with 4 posterior setae (rarely 3 to 6 setae in some segments); anterior margin of tergal plates III–IV with median notch, gradually reducing into posterior segments. Tergite VIII entire

Figs. 1–4. *Multicola nacunda* Carriker, 1945 from *Chordeiles nacunda nacunda* Vieillot. **Fig. 1.** Male habitus in dorsoventral views. **Fig. 2.** Female head in dorsoventral views. **Fig. 3.** Female thorax in dorsoventral views. **Fig. 4.** Female terminalia (VII–XI) in dorsoventral views. **Abbreviations:** *ads* – anterior dorsal seta; *as* – anterior seta; *avs* – anterior ventral seta; *dsms* – dorsal submarginal seta; *mds* – mandibular seta; *mts* – marginal temporal seta; *os* – ocular seta; *pos* – preocular seta; *pas* – preantennal seta; *pcs* – preconal seta; *pms* – marginal pronotal setae; *pns* – postnodal seta; *ppss* – prothoracic postspiracular seta; *pts* – posttemporal seta; *s* – spine-like seta of pterothorax; *s1–s5* – occipital head sensilla; *SVS* – subvulvar sclerite; *tr* – trichoid setae; *vsms* – ventral submarginal seta.

but medially narrower than others. Pleural bands extended into segment precedent forming well defined ‘re-entrant heads’ on III–VIII; pleural chaetotaxy: 0 on II–III; 2 setae on IV–V; 3 setae on VI–VIII. Sternal chaetotaxy: II with 4 (rarely 3 or 5) setae in trapezoidal arrangement; III–VI with 6 setae (rarely 5 to 8). Sternites dimorphic, ovoid and set laterally in each side of abdominal segments in female,

and in roughly rectangular shape and set across each sternite in males.

Male. General habitus as in Fig. 1. Subgenital plate with 4–5 setae. Copulatory apparatus of male (Fig. 21) characterised by broad and flattened basal plate; parameres strong, long, relatively broad; endomerale plate moderately elongate, its lateral arms characteristic as shown in Fig. 21;

Fig. 5. *Multicola nacunda* Carriker, 1945 from *Chordeiles nacunda nacunda* Vieillot – head in dorsoventral views and thorax in dorsal view of nymph III; **a,b** – anterior dorsal and ventral plates of nymph III (two specimens). **Fig. 6.** *Multicola bacurau* sp. n. from *Nyctidromus albicollis* (Gmelin) – anterior dorsal plate of nymph III. **Figs. 7, 8.** *Multicola piacentinii* sp. n. from *Lurocalis semitorquatus semitorquatus* (Gmelin). **Fig. 7.** Head in dorsoventral views and thorax in dorsal view of nymph II; **a** – anterior dorsal and ventral plates of nymph II. **Fig. 8.** Head in dorsoventral views and thorax in dorsal view of nymph I. **Abbreviations:** as – anterior seta; mts – marginal temporal seta; pas – preantennal seta; ppss – prothoracic post-spiracular seta; s – spine-like seta of pterothorax; tr – trichoid setae.

gonopore bearing from prepucis, both unsclerotised and assuming a quadrangular shape, on soft part of endomerale plate. Ventrally one pair of sensilla set on each side of sclerotised part of endomera. Measurements of male ($n = 3$): HL 0.64–0.67; PAW 0.44–0.48; TW 0.56–0.59; ADHPL 0.17–0.18; ADHPW 0.16; PW 0.38–0.41; PTW 0.52–0.56; AW 0.69–0.76; TL 2.80–2.97; GL 0.35–0.36; PL 0.16–0.17.

Female. One pair of female subvulvar sclerites well developed and of characteristic shape, with spine-like seta bearing each plate (Figs. 4, 22), set marginally. Subgenital plate with 2–4 setae each side; vulvar margin with 17–21 thin and 21–26 spine-like setae (Fig. 4). Measurements of female ($n = 4$): HL 0.68–0.71; PAW 0.49–0.52; TW 0.59–0.64; ADHPL 0.19–0.20; ADHPW 0.15–0.17; PW 0.42–0.45; PTW 0.57–0.61; AW 0.72–0.85; TL 2.93–3.21.

Pre-imago description

Nymph III. Head and thorax shape and chaetotaxy as in Fig. 5, cephalic index 1.1–1.2, with marginal carina entire and developed anterior dorsal head plate, still posteriorly fused with head surface. Two variations of anterior

dorsal head plate presented in Figs. 5a and 5b. Tracks of cibarial muscles discernible on anterior dorsal head plate. as3 present and set on hyaline margin; pas, pos, mts1 and mts3 very long; ads set on soft tegument of preantennal suture, posterior to anterior dorsal head plate. Prothorax with post-spiracular setae very short as in imagoes; chaetotaxy of pterothorax exactly as in imagoes. Abdomen still membranous but with distinct tergal and pleural plates moderately sclerotised, roughly square-like in shape, in each segment abdominal II–VIII. Measurements ($n = 3$): HL 0.54–0.56; PAW 0.42–0.44; TW 0.47–0.49; ADHPW 0.12–0.13; PW 0.31; PTW 0.41–0.46.

Type host: *Podager nacunda minor* (Cory) (= *Chordeiles nacunda coryi* Agne et Pacheco) (Aves: Caprimulgidae).

Type locality: Maicao, La Guajira, Colombia.

Material examined: 1♂, 2♀, 1 nymph III (MZUSP No. 6273–6274), Brazil, Pará, Urucurituba (03°32'S; 55°30'W), Rio Tapajós (west), 18 July 1970, not known, ex *Chordeiles nacunda nacunda* (Vieillot) (MZUSP No. 73231); 1♀ (MZUSP No. 6272), Brazil, Pará, Fordlândia (03°40'S; 55°30'W), Rio Tapajós (east), 9 May 1969, A.M. Ollala coll., ex *C. n. nacunda* (MZUSP No. 67943); 2♀, 1 nymph III (MZUSP No.

Fig. 9. *Muldicola nacunda* Carriker, 1945 from *Chordeiles nacunda nacunda* Vieillot – anterior dorsal and ventral head plates (a–c – variation in three specimens). **Fig. 10.** Metasternal plate (a–c – variation in three specimens). **Figs. 11, 12.** *Muldicola sicki* sp. n. from *Chordeiles rupestris rupestris* (Spix). **Fig. 11.** Anterior dorsal and ventral head plates (a–c – three specimens); **Fig. 12.** Metasternal plate (a,b – two specimens). **Figs. 13, 14.** *Muldicola bacurau* sp. n. from *Nyctidromus albicollis* (Gmelin). **Fig. 13** Anterior dorsal and ventral head plates (a–g – seven specimens). **Fig. 14.** Metasternal plate (a–d – four specimens). Abbreviations: *ads* – anterior dorsal seta.

6276–6277), same data except 9 May 1968 ex *C. n. nacunda* (MZUSP No. 66546); 1♀ (MZUSP No. 6275), Brazil, Pará, Santa Maria do Arapenã, Rio Tapará, 10 October 1968, A.M. Ollala coll., ex *C. n. nacunda* (MZUSP No. 70891); 2♂, 1♀, 1 nymph III (MZUSP No. 6270–6271), same data except, 9 October 1968, ex *C. n. nacunda* (MZUSP No. 70890).

Remarks. The only record for this species is based on its original description of specimens from Colombia (see above); as far as we know this is the first record of this species in Brazil. *Muldicola nacunda* is morphologically close to *M. macrocephalus* (Kellogg, 1896) due the dimorphic sternites and the chaetotaxy of tergal and sternal plates. However, they are indeed distinct species based on the shape of the anterior dorsal head plate, metasternal plate, the subvulvar plate in females and by the tips of endomeral arms in male genitalia.

Muldicola sicki sp. n.

Figs. 11, 12, 23, 24

ZooBank number for species:

urn:lsid:zoobank.org:act:B4477712-B2E6-4A7E-A1DF-8A7C2A5F3F05

Imago description

Head. Triangular, subtruncated forward, slightly longer than wide, cephalic index from 1.1 in both sexes. Short clypeal region, anterior dorsal and ventral head plates of characteristic shape, with distinct tracks of cibarial muscles on dorsal head plate (Fig. 11), ratio of anterior head plate 1.1–1.3 in males and 1.2–1.4 in females.

Thorax. Metasternal plate of diagnostic shape, slightly wider than long (Fig. 12).

Abdomen. Chaetotaxy of abdominal tergites: II with one pair of anterior long setae; II–VIII with 4 setae; anterior edge III–IV of tergites with median notch in males, and III–V in females. Pleural chaetotaxy: II–III, 0; IV–V, 2; VI–VIII, 3. Sternal chaetotaxy: II with 2–3 setae; III–VI with 4–6; in females 6 setae more frequent. Sternites monomorphic, in both sexes roughly rectangular and set across each sternite.

Male. Subgenital plate with 4 setae. Copulatory apparatus and mesosomal shape characteristic (Fig. 23). Measurements of male (n = 3): HL 0.66–0.74; PAW 0.47–0.50; TW 0.60–0.64; ADHPL 0.20–0.21; ADHPW 0.16–0.17; PW

0.42–0.45; PTW 0.53–0.61; AW 0.69–0.79; TL 2.82–3.05; GL 0.34–0.36; PL 0.16.

Female. The subvulvar plates as in Fig. 24, with spine-like seta set marginally. Subgenital plate with 3 setae each side (rarely 2 on one side); vulvar margin with 16–19 thin and 16–24 spine-like setae. Measurements of female (n = 4): HL 0.70–0.77; PAW 0.51–0.53; TW 0.65–0.68; ADHPL 0.21–0.23; ADHPW 0.17–0.18; PW 0.45–0.47; PTW 0.60–0.65; AW 0.75–0.84; TL 3.14–3.30.

Type host: *Chordeiles rupestris rupestris* (Spix) – sand-coloured nighthawk (Aves: Caprimulgidae).

Type locality: Alto Xingu (11°12'S; 53°14'W), Diauarum, Mato Grosso, Brazil.

Type material: Holotype 1♂ (MZUSP No. 6278), 3 August 1949, H. Sick coll., ex *Chordeiles rupestris rupestris* (MNRJ No. 35352, A.1380). Paratypes 2♀ (MZUSP No. 6279, 6285), same data as holotype, 1♀ (MZUSP No. 6280), same data as holotype except ex *C. r. rupestris* (MNRJ No. 35351, A.1379); 1♂ and 1♀ (MZUSP No. 6281, 6283), Brazil, Pará, Santana do Araguaia, Fazenda Fartura (9°50'S; 50°29'W), 15 August 2013, L.F. Silveira and M.P. Valim coll., ex *C. r. rupestris* (MZUSP No. 97003); 1♂ and 1♀ (MZUSP No. 6280, 6282), same data except, ex *C. r. rupestris* (MZUSP No. 97004).

Etymology: The species is named after the late Helmut Sick (1910–1991), one of the most important ornithologists in Brazil, for his visionary interest in collecting ectoparasites of birds at the 1950's during the Roncador-Xingu expedition to central Brazil. The epithet is a noun in the genitive case.

Diagnosis. This species is similar to *M. nacunda* in both sexes by the presence of well-marked tracks of cibarial muscles on dorsal anterior head plate, by presence of 6 sternal setae on III–VI, and by the lowest cephalic index (1.1). However, the males of these species can be easily distinguished by the shape of the tips of the endomeral arms of their genitalia (see Figs. 22 and 23). Females also have distinctly shaped subvulvar sclerites (Fig. 24). The shape of metasternal plate (Fig. 12) and occurrence of monomorphic sternites in *M. sicki* sp. n. make it easily distinguishable from any other species described below.

Mulcticola bacurau sp. n. Figs. 13, 14, 25, 26
Mulcticola sp., Enout et al. 2012: 1734.

ZooBank number for species:

urn:lsid:zoobank.org:act:C1AF7081-2F2C-4F68-9024-B8DBED94037C

Imago description

Head. Triangular, subtruncated forward, longer than wide, cephalic index 1.2–1.3. Short clypeal region, anterior dorsal and ventral head plates of characteristic shape, with distinct tracks of cibarial muscles on dorsal one (Fig. 13), ratio of anterior head plate 1.2–1.3.

Thorax. Metasternal plate of diagnostic shape, nearly square-like (Fig. 14).

Abdomen. Chaetotaxy of abdominal tergite: II with one pair of anterior long setae; II–VIII with 4 setae; anterior edge III–V (rarely on III–IV) of tergites with median notch. Pleural chaetotaxy: II–III, 0; IV–V, 2; VI–VIII, 3. Sternal

chaetotaxy: II with 4 setae in trapezoidal arrangement; III–VI with 4 setae. Sternites dimorphic, as in *M. nacunda*.

Male. Subgenital plate with 4 setae. Copulatory apparatus and mesosomal shape characteristic (Fig. 25). Measurements of males (n = 7): HL 0.57–0.64; PAW 0.34–0.38; TW 0.45–0.50; ADHPL 0.16–0.18; ADHPW 0.13–0.15; PW 0.31–0.33; PTW 0.41–0.45; AW 0.52–0.62; TL 2.39–2.60; GL 0.28–0.37; PL 0.13–0.16.

Female. Subvulvar plates as in Fig. 26, spine-like seta set marginally. Subgenital plate with 3 setae each side; vulvar margin with 12–17 thin and 16–24 spine-like setae. Measurements of females (n = 7): HL 0.58–0.63; PAW 0.37–0.42; TW 0.48–0.53; ADHPL 0.17–0.19; ADHPW 0.13–0.16; PW 0.32–0.37; PTW 0.45–0.49; AW 0.60–0.65; TL 2.59–2.75.

Pre-imago description

The immature specimens of *Mulcticola bacurau* sp. n. were in poor condition and thus allowed us to obtain only limited morphometric data. In all measured features nymphs of *M. bacurau* sp. n. are smaller than those of *M. nacunda* (above) and *M. piacentinii* sp. n. (below); except for head shapes, all general structures are similar in immatures of these three species. The anterior dorsal head plate of last nymph (NIII) of *M. bacurau* sp. n. (Fig. 6) is smaller and distinctive than that of *M. nacunda* (Fig. 5). Measurements of *Nymph I* (n = 1): Ratio HL/TW 1.3; HL 0.32; PAW 0.21; TW 0.24; PW 0.16; PTW 0.23. Measurements of *Nymph II* (n = 1): ratio HL/TW 1.2; HL 0.38; PAW 0.25; TW 0.30; ADHPW 0.08; PW 0.19; PTW 0.24. Measurements of *Nymph III* (n = 1): ratio HL/TW 1.2; HL 0.46; PAW 0.33; TW 0.38; ADHPW 0.10; PW 0.24; PTW 0.34.

Type host: *Nyctidromus albicollis* (Gmelin) – common pauraque (Aves: Caprimulgidae).

Type locality: Mata do Olho D'água (05°53'S; 35°23'W), Jundiá, Macaíba, Rio Grande do Norte, Brazil.

Type material: Holotype 1♂ (MZUSP No. 6287), 19 April 2012, H.M. Silva coll., ex *N. albicollis* (COUFRN No. 634). Paratypes 1♂ and 2♀ (MZUSP No. 6288–6290), same data as holotype; 4♂, 1 nymph I, 1 nymph II, 1 nymph III (MZUSP No. 2285, 6291–6293), Brazil, Tocantins, Lageado, Parque Estadual Lageado, Represa (10°10'36"S; 48°12'08"W), 25 June 2008, A.M.J. Enout coll., ex *N. albicollis* (G67750); 1♂ and 5♀ (MZUSP No. 6294–6296), Brazil, São Paulo, Itapeçerica da Serra, Estrada Abias da Silva, 29 October 2013, M. Félix coll., ex *N. albicollis* (MZUSP, ML 1272); 1♀ (MZUSP No. 6297), Brazil, São Paulo, Juquiá (24°19'S; 47°38'W), April 1940, J. Lane and L. Travassos-Filho coll.; ex *N. a. derbyanus* Gould.

Etymology: The name 'bacurau' is derived from *wakura'wa* (Tupi), and is the word for pauraque in Portuguese, it is a noun in apposition.

Diagnosis. The new species is morphologically close to *M. nacunda* by the presence of well-marked tracks of cibarial muscles in dorsal anterior head plate and by heteromorphic sternites. The genitalia in males can be separated by shape of mesosomal complex as whole and the bifurcation in tips of the endomeral arms. In *M. bacurau* sp. n. the tip of the endomeral arm is largely falciform (Fig. 25), whereas in *M. nacunda* the bifurcation is less expressed

Figs. 15, 16. *Multicola tendeiroi* sp. n. from *Macropsalis forcipata* (Nitzsch). **Fig. 15.** Anterior dorsal and ventral head plates (a–c – variation in three specimens); **Fig. 16.** Metasternal plate (a,b – two specimens). **Figs. 17, 18.** *Multicola piacentinii* sp. n. from *Lurocalis semitorquatus* ssp. **Fig. 17.** Anterior dorsal and ventral head plates (a–e five specimens, ‘a,b’ from *L. s. semitorquatus* (Gmelin) and ‘c–e’ from *L. s. nattereri* (Temminck)). **Fig. 18.** Metasternal plate (a–e – five specimens, ‘a,b’ from *L. s. semitorquatus* and ‘c–e’ from *L. s. nattereri*). **Figs. 19, 20.** *Multicola parvulus* sp. n. from *Setopagis parvula* (Gould). **Fig. 19.** Anterior dorsal and ventral head plates (a,b – two specimens); **Fig. 20.** Metasternal plate (a,b – two specimens).

(Fig. 22). Females also have a distinctly shaped subvulvar sclerites (Fig. 26). The shape of the metasternal plate of *M. bacurau* sp. n. (Fig. 14) makes it easily distinguishable from any other species described below.

Remarks. During a parasitological survey of birds in Mato Grosso, Brazil made by Oniki (1999), a single individual of *N. albicollis* was captured and no ectoparasites were found. The specimens found by Enout et al. (2012) in Tocantins State are those also studied herein.

***Multicola tendeiroi* sp. n.** Figs. 15, 16, 27, 28

ZooBank number for species:

urn:lsid:zoobank.org:act:27E19735-BFE5-4190-AA7C-46ED01704A2A

Imago description

Head. Triangular, subtruncated forward, longer than wide, cephalic index 1.2–1.3 in males and 1.3–1.4 in females. Short clypeal region, anterior dorsal and ventral

head plates of characteristic shape, with distinct tracks of cibarial muscles on dorsal one (Fig. 15), ratio of anterior head plate 1.4–1.5 in males and 1.3–1.4 in females.

Thorax. Metasternal plate of diagnostic shape, nearly square-like (Fig. 16).

Abdomen. Chaetotaxy of abdominal tergites: II with 1 pair of anterior long setae; II–VII with 4 setae, and VIII with 4 (less often 2 or 3); anterior edge III–V of tergites with median notch. Pleural chaetotaxy: II–III, 0; IV–V, 2; VI–VIII, 3. Sternal chaetotaxy: II with 4 setae in trapezoidal arrangement; III–VI with 4 setae (less often 5 or 6). Females distinctly with 6 setae on sternite VI. Sternites dimorphic, as in *M. nacunda*.

Male. Subgenital plate with 4 setae. Copulatory apparatus and mesosomal shape characteristic (Fig. 27). Measurements of males (n = 5): HL 0.64–0.72; PAW 0.40–0.43; TW 0.51–0.54; ADHPL 0.20–0.22; ADHPW 0.14–0.16; PW 0.37–0.40; PTW 0.48–0.52; AW 0.64–0.71; TL 2.69–2.90; GL 0.29–0.32; PL 0.12–0.15.

Figs. 21, 22. *Multicola nacunda* Carriker, 1945 from *Chordeiles nacunda nacunda* Vieillot. **Fig. 21.** Male genitalia with mesosome in dorsoventral views (parameres tips broken). **Fig. 22.** Female subvulvar plates, genital opening, spermaducts and claxys of the spermatheca. **Figs. 23, 24.** *Multicola sicki* sp. n. from *Chordeiles rupestris rupestris* (Spix). **Fig. 23.** Male genitalia. **Fig. 24.** Female subvulvar plates (a–c – three specimens). **Figs. 25, 26.** *Multicola bacurau* sp. n. from *Nyctidromus albicollis* (Gmelin). **Fig. 25.** Male genitalia; **Fig. 26.** Female subvulvar plates (a–f – six specimens). **Figs. 27, 28.** *Multicola tendei* sp. n. from *Macropsalis forcipata* (Nitzsch). **Fig. 27.** Male genitalia; **Fig. 28.** Female subvulvar plates. **Figs. 29, 30.** *Multicola piacentinii* sp. n. from *Lurocalis semitorquatus semitorquatus* (Gmelin). **Fig. 29.** Male genitalia; **Fig. 30.** Female subvulvar plates. **Fig. 31.** *Multicola parvulus* sp. n. from *Setopagis parvula* (Gould) – female subvulvar plates (a–d – four plates).

Female. Subvulvar plates as in Fig. 28, spine-like seta set marginally. Subgenital plate with 2 setae each side; vulvar margin with 20–24 thin and 14–26 spine-like setae. Measurements of females ($n = 5$): HL 0.72–0.73; PAW 0.43–0.45; TW 0.52–0.56; ADHPL 0.21–0.22; ADHPW 0.15–0.16; PW 0.40–0.41; PTW 0.52–0.55; AW 0.71–0.74; TL 2.88–2.93.

Type host: *Macropsalis forcipata* (Nitzsch) – long-trained nightjar (Aves: Caprimulgidae).

Type locality: Estação Biológica de Boracéia (23°39'S; 45°54'W, ~850 m), Salesópolis, São Paulo, Brazil.

Type material: Holotype 1♂ (MZUSP No. 6298), 25 July 1949, L. Travassos-Filho coll., ex *Macropsalis forcipata*. Paratypes 10♂, 12♀ and 1 nymph (MZUSP No. 6298–6310), same data as holotype.

Etymology: The species is named after the late João L.S. Tendeiro (1916–1991), an eminent Portuguese phthirapterist, who has described the majority of known species of *Multicola*. The epithet is a noun in the genitive case.

Diagnosis. The new species is morphologically close to *M. bacurau* sp. n. due to the presence of well-marked tracks of cibarial muscles on dorsal anterior head plate, by the head longer than wide (cephalic index 1.2–1.4), and by heteromorphic sternites. The genitalia in males can be separated by shape of mesosomal complex as whole, and the bifurcation on tips of the endomeral arms. In *M. tendeiroi* sp. n. the tip of endomeral arm is grossly rounded, whereas in *M. bacurau* sp. n. the bifurcation is largely fal-ciform. The shapes of anterior dorsal head plate (Fig. 15), metasternal plate (Fig. 16) and subvulvar sclerites (Fig. 28) are distinct from other species of the genus.

***Multicola piacentinii* sp. n.** Figs. 17, 18, 29, 30

ZooBank number for species:

urn:lsid:zoobank.org:act:8A863BDD-2F26-4ADB-A7DD-1685F6FD88D2

Imago description

Head. Triangular, subtruncated forward, longer than wide, cephalic index from 1.2 in both sexes. Short clypeal region, anterior dorsal and ventral head plates of characteristic shape, with very few or indistinct tracks of cibarial muscles on dorsal head plate (Fig. 17), ratio of anterior head plate 1.4 for both sexes.

Thorax. Metasternal plate of diagnostic shape, being longer than wide (Fig. 18).

Abdomen. Chaetotaxy of abdominal tergites: II with 1 pair of anterior long setae; II–VIII with 4 setae; anterior edge III–IV (rarely on V) of tergites with median notch. Pleural chaetotaxy: II–III, 0; IV–V, 2; VI–VIII, 3. Sternal chaetotaxy: II with 4 setae in trapezoidal arrangement; III–VI with 4–6 setae. Sternites dimorphic, as in *M. nacula*.

Male. Subgenital plate with 4 setae. Copulatory apparatus and mesosomal shape characteristic (Fig. 29). Measurements of males ($n = 3$): HL 0.65–0.68; PAW 0.42–0.45; TW 0.53–0.55; ADHPL 0.21–0.24; ADHPW 0.16–0.17;

PW 0.39–0.40; PTW 0.51–0.52; AW 0.64–0.68; TL 2.84–2.96; GL 0.34–0.35; PL 0.14–0.16.

Female. Subvulvar plates as in Fig. 30, with spine-like seta set submarginally. Subgenital plate with 3 setae each side (rarely 2 in one side); vulvar margin with 7–14 thin and 20 spine-like setae. Measurements of females ($n = 2$): HL 0.64–0.68; PAW 0.43–0.44; TW 0.54–0.56; ADHPL 0.22–0.23; ADHPW 0.16; PW 0.39–0.42; PTW 0.50–0.52; AW 0.65–0.69; TL 2.92–2.96.

Pre-imago description

Nymph II. Head and thorax shape and chaetotaxy as in Fig. 7, cephalic ratio 1.2–1.3, with marginal carina entire and developed anterior dorsal head plate posteriorly fused with head surface. One variation of anterior dorsal head plate is presented in Fig. 7a. Tracks of cibarial muscles indistinct, aspect of anterior dorsal head plate smooth. The *as3* present and set on hyaline margin; *pas*, *pos*, *mts1* and *mts3* very long; *ads* set on sclerotised part of head, posterior to anterior dorsal head plate. Each side of prothorax with post-spiracular setae very short as in imagoes; chaetotaxy of pterothorax, each side: 1 spine-like ventral seta, 1 trichoid lateral seta, 1 long posterolateral seta, plus 2 long posterolateral setae. Pterothorax chaetotaxy similar to that in imagoes, less one long seta on posterolateral margin of metathorax. Abdomen still membranous with distinct tergal and pleural plates moderately sclerotised, roughly square-like in shape, in each segment abdominal II–VIII. Measurements ($n = 2$): HL 0.43–0.45; PAW 0.30; TW 0.35; ADHPW 0.09; PW 0.23–0.24; PTW 0.31–0.32.

Nymph I. Head and thorax shape and chaetotaxy as in Fig. 8, cephalic ratio 1.4, with marginal carina entire and smooth, without anterior dorsal head plate, but its region modified as a more sclerotised roof. Tracks of cibarial muscles indistinct as in succeeding nymph. *as3* absent, hyaline margin completely absent; *pas*, *pos*, *mts1* and *mts3* very long; *ads* is set on sclerotised part of head. Prothorax with post-spiracular setae very long; chaetotaxy of pterothorax, each side: one single long posterolateral seta. Abdomen membranous without sclerotised plates. Measurements ($n = 1$): HL 0.39; PAW 0.25; TW 0.28; PW 0.18; PTW 0.19.

Type host: *Lurocalis semitorquatus semitorquatus* (Gmelin) – short-tailed nighthawk (Aves: Caprimulgidae).

Type locality: Fazenda Fartura (9°50'S; 50°29'W), Santana do Araguaia, Pará, Brazil.

Type material: Holotype 1♂ (MZUSP No. 6311), 01 September 2010, V.Q. Piacentini coll., ex *L. s. semitorquatus* (MZUSP No. 89901). Paratypes 3♂ and 1♀ (MZUSP No. 4711, 6312–6313), same data as holotype; 1♂ and 1♀ (MZUSP No. 6314), Brazil, São Paulo, São Vicente, near Centro de Triagem de Animais Silvestre (CETAS), September 2011, CETAS team coll., ex *L. s. nattereri* (Temminck) (MZUSP No. 90319).

Additional material: 1 nymph I, 2 nymph II (MZUSP No. 6315), Brazil, São Paulo, São Vicente, near Centro de Triagem de Animais Silvestre (CETAS), September 2011, CETAS team coll., ex *L. s. nattereri* (MZUSP No. 90319).

Etymology: The species is named after our colleague Vitor

Q. Piacentini, a Brazilian ornithologist for his interest and efforts collecting systematically ectoparasites on birds in Brazil. The epithet is a noun in the genitive case.

Diagnosis. Its head index (1.2) makes it similar to *M. bacurau* sp. n. and *M. parvulus* sp. n. Among these species, *M. piacentinii* sp. n. is unique in shape of the metasternal plate, which is longer than wide (Fig. 18) and the anterior dorsal head plate, much longer than wider (index 1.4) (Fig. 17). In males, the shape of mesosome and tip of endomerar arms are quite distinct from other species, and females are the only taxon with the seta on subvulvar sclerite set submarginally (Fig. 30).

Mulcticola parvulus sp. n. Figs. 19, 20, 31

ZooBank number for species:

urn:lsid:zoobank.org:act:8E82421C-4743-4401-A059-7D78972E84A1

Imago description

Head. Triangular, longer than wide, subtruncated forward, cephalic index from 1.2. Short clypeal region, anterior dorsal and ventral head plates of characteristic shape, with distinct tracks of cibarial muscles on dorsal head plate (Fig. 19), ratio of anterior head plate 1.3–1.4.

Thorax. Metasternal plate of diagnostic shape, slightly wider than long (Fig. 20).

Abdomen. Chaetotaxy of abdominal tergites: II with 1 pair of anterior long setae; II–VIII with 4 posterior setae; anterior edge III–VII of tergites with median notch. Pleural chaetotaxy: II–III, 0; IV–V, 2; VI–VIII, 3. Sternal chaetotaxy: II with 4 setae in trapezoidal arrangement; III–VI with 4 setae. Sternites dimorphic (?), ovoid and set laterally in each side of abdominal segments in female.

Male. Unknown.

Female. Subvulvar plates as in Fig. 31, spine-like seta set marginally. Subgenital plate with 3 setae each side (rarely 2 in one side); vulvar margin with 17 thin and 18–20 spine-like setae. Measurements (n = 2): HL 0.59–0.61; PAW 0.40–0.41; TW 0.50–0.51; ADHPL 0.17–0.19; ADHPW 0.13; PW 0.35–0.36; PTW 0.48–0.50; AW 0.66–0.69; TL 2.61–2.62.

Type host: *Setopagis parvula* (Gould) – little nightjar (Aves: Caprimulgidae).

Type locality: Fazenda Fartura (9°50'S; 50°29'W), Santana do Araguaia, Pará, Brazil.

Type material: Holotype 1♀ (MZUSP No. 6316), 15 August 2013, L.F. Silveira and M.P. Valim coll., ex *S. parvula* (MZUSP No. 97046). Paratypes 3♀ (MZUSP No. 4802, 6317), same data as holotype.

Etymology: The epithet *parvulus* (Latin) is an adjective nominative singular masculine (e.g. little, small, slight). It refers the fact that these females are smaller than other species of *Mulcticola*.

Diagnosis. *Mulcticola parvulus* sp. n. is morphologically close to *M. bacurau* sp. n. and *M. tendeiroi* sp. n. by the presence of well-marked tracks of cibarial muscles on dorsal anterior head plate and by the head being

longer than wide (cephalic index 1.2). Although no male specimen is available for differentiation using its genitalia, structures of female specimens are sufficiently distinct to support the distinctiveness of this newly described taxon. The shapes of the anterior dorsal head plate, metasternal plate and subvulvar sclerites are distinct from any other species of the genus. Furthermore, these females are smaller (2.61–2.62 mm vs >2.75 mm) than any other species of *Mulcticola* described to date (except for two females of *M. bacurau* sp. n., which were 2.59 mm).

Catalogue of the species of *Mulcticola*

The purpose of this catalogue is integrating all host, geographical, taxonomic and morphological information published for species of the worldwide genus *Mulcticola*; comments on some species are also provided.

Mulcticola balati Tendeiro, 1962

Type host: *Caprimulgus clarus* (Reichenow); other hosts *Caprimulgus fossii* (Hartlaub), *Caprimulgus rufigena* A. Smith; type locality Kapenguria, Kenya; photo 5, dorsal habitus of male; photo 6, dorsal habitus of female; photo 7, dorsal view of the male head; photo 8, dorsal view of male genitalia; fig. 2, dorsal head outline and anterior dorsal head plate, from two host species *C. clarus* (left hand) and *C. fossii* (right hand) (Tendeiro 1962 – p. 352).

Type specimens: Male holotype at British Museum of Natural History, UK. Tendeiro (1960): list of morphotypes, their hosts and localities (= '*Mulcticola* sp. 2 and sp. 4', for *C. rufigena* and *C. clarus*, respectively). Ledger (1980): list of species from Africa south of Sahara. Price et al. (2003): world checklist.

Mulcticola deignani Emerson et Elbel, 1957

Type host: *Caprimulgus macrurusbi maculatus* Peale; type locality Lopburi, Thailand; fig. 1, dorsoventral view of the female habitus; fig. 2, dorsoventral view of the male habitus; fig. 3, anterior dorsal head plate outline; fig. 10, dorsal view of the male genitalia (Emerson and Elbel 1957 – p. 420).

Type specimens: Male holotype at United States National Museum, USA. Lakshminarayana (1979): list of species from India. Price et al. (2003): world checklist.

Mulcticola hypoleucus (Denny, 1842)

Type host: *Caprimulgus europaeus* Linnaeus; type locality UK; Plate VI fig. 8, dorsal view of female habitus (Denny 1842 – p. 53, 141).

Type specimens: Male holotype at British Museum of Natural History, UK. Giebel (1874): redescription, Plate VIII fig. 5. Piaget (1885): redescription, Plate VII fig. 3, dorsal view of the female habitus. Harrison (1916): world checklist. Clay and Meinertzhagen (1938): genus description and designation of the type species. Blagoveshtchensky (1951): new host and geographical records, *C. europaeus unwini* (Hume) and Tajikistan, respectively. Hopkins and Clay (1952): world checklist. Balát (1957): list of species from Hungary. Emerson and Elbel (1957): illustrations; fig. 6, anterior dorsal head plate outline; fig. 8, dorsal view of the male genitalia. Tendeiro (1961): measurements and illustrations, fig. 1 (left hand), dorsal head outline and anterior dorsal head plate; fig. 2 (left hand), dorsal view of the male genitalia; photo 3, dorsal

view of male habitus; photo 4, dorsal view of male habitus; photo 6, dorsal view of the male head; photo 8, dorsal view of male genitalia. Tendeiro (1962): photo 23, dorsal view of the male head. Balát (1977): list of species from Czech Republic. Martín-Mateo and Gallego (1977): list of species from Spain. Złotorzycka (1978: 46): illustrations; fig. 138, anterior dorsal and ventral head plates outline; fig. 139, pleurites of middle segments of female; fig. 140, dorsal view of the male genitalia; fig. 142, dorsal habitus of female. Ledger (1980): list of species from Africa south of Sahara; fig. 145a, reproduction of fig. 2 of Tendeiro (1961). Rékási (1993): list of species from Hungary. Hackman (1994): list of species from Finland. Price et al. (2003): world checklist. Mey (2004): list of species from Germany. Adam (2008): list of species from Romania. Dik (2009): geographical record. Ilieva (2009): list of species from Bulgaria. Vas et al. (2012): list of species from Hungary.

Mulcticola macrocephalus (Kellogg, 1896)

Type host: *Chordeiles minor henryi* Cassin; type locality California, USA; Plate LXVIII fig. 3, dorsal view of female habitus (Kellogg 1896 – p. 504).

Type specimens: Female lectotype (EMEC75356) at Essig Museum of Entomology in Berkeley California, USA. Harrison (1916: 137): world checklist. Carriker (1947): combination in *Mulcticola*. Hopkins and Clay (1952): world checklist. Carriker (1957): lectotype designation. Emerson and Elbel (1957): illustrations; fig. 4, anterior dorsal head plate outline; fig. 9, dorsal view of the male genitalia. Price et al. (2003): world checklist. Galloway (2007: 7): biological and parasitological indexes. Synonyms: *Nirmus tyrannus* Osborn, 1896, ex *Tyrannus* sp. (= error) (see Emerson 1960).

Mulcticola minutus Emerson et Elbel, 1957

Type host: *Caprimulgus asiaticus asiaticus* Latham; type locality India; fig. 5, anterior dorsal head plate outline; fig. 7, dorsal view of the male genitalia (Emerson and Elbel 1957 – p. 422).

Type specimens: Male holotype at British Museum of Natural History, UK. Lakshminarayana (1979): list of species from India. Price et al. (2003): world checklist.

Mulcticola nacunda Carriker, 1945

Type host: *Chordeiles nacunda coryi* Agne et Pacheco; type locality Maicao, La Guajira, Colombia; figs.: dorsoventral views of male habitus (from head to abdominal segment IV, plus terminalia from segment VIII); dorsoventral views of female terminalia; dorsal view of the male genitalia (Carriker 1945 – p. 173).

Type specimens: Male holotype (No. 68472) at United States National Museum, USA. Hopkins and Clay (1952): world checklist. Price et al. (2003): world checklist.

Mulcticola orientalis Tendeiro, 1962

Type host: *Caprimulgus affinis monticolus* Franklin; type locality Deccan, India; photo 21, dorsal habitus of female; photo 22, dorsal view of the female head; fig. 6, dorsal head outline and anterior dorsal head plate (Tendeiro 1962 – p. 370).

Type specimens: Female holotype (see remarks below) at British Museum of Natural History, UK. Lakshminarayana (1979): list of species from India. Price et al. (2003): world

checklist. Synonyms: *Mulcticola indicus* Tendeiro, 1962 *nomen nudum* pro fig. 6 of *Mulcticola orientalis* Tendeiro, 1962 (see Lakshminarayana 1979).

Remarks. Herein we would like to point out two little mistakes committed by Tendeiro (1962) on the *M. orientalis* description. First, this species was incorrectly named '*M. indicus*' (an objective synonym of *M. orientalis*) in fig. 6 (Tendeiro 1962; Lakshminarayana 1979), and secondly one male was designated as holotype when only two females were studied by that author (Tendeiro 1962).

Mulcticola peruviana Carriker, 1945

Type host: *Buteo magnirostris occiduus* (Bangs) (= error); type locality Canchamayo, San Juan, Junín, Peru; figs.: dorsoventral views of male habitus (from head to abdominal segment II); dorsal view of the male genitalia (Carriker 1945 – p. 174).

Type specimens: Male holotype (No. 68473) at United States National Museum, USA. Hopkins and Clay (1952): world checklist.

Remarks. This species was wrongly cited in Price et al. (2003) in the last world checklist as having been synonymised with of *M. nacunda* by Hopkins and Clay (1952). However, *M. peruviana* is the fourth species listed by those authors, who considered at that time only five species in *Mulcticola* (Hopkins and Clay, 1952). The narrow anterior portion of the dorsal head plate is distinctively shaped, making *M. peruviana* a good species in our opinion and distinct from all species of the genus.

Mulcticola pectoralis Tendeiro, 1962

Type host: *Caprimulgus pectoralis* Cuvier; type locality Moxico, Angola; photo 17, dorsal habitus of male; photo 18, dorsal habitus of female; photo 19, dorsal view of the male head; photo 20, dorsal view of male genitalia; fig. 5, dorsal head outline and anterior dorsal head plate (Tendeiro 1962 – p. 366).

Type specimens: Male holotype (No. 357) at Centro de Zoologia da Junta de Investigações do Ultramar, Portugal. Ledger (1980): list of species from Africa south of Sahara. Price et al. (2003): world checklist.

Mulcticola scotornis Tendeiro, 1962

Type host: *Caprimulgus climacurus* Vieillot; type locality Obala, Cameroon; photo 9, dorsal habitus of male; photo 10, dorsal habitus of female; photo 11, dorsal view of the male head; photo 12, dorsal view of male genitalia; fig. 3, dorsal head outline and anterior dorsal head plate (Tendeiro 1962 – p. 358).

Type specimens: Male holotype at British Museum of Natural History, UK. Tendeiro (1960): list of morphotypes, their hosts and localities (= '*Mulcticola* sp. 3'). Ledger (1980): list of species from Africa south of Sahara. Price et al. (2003): world checklist.

***Mulcticola tenuiceps* Carriker, 1945**

Type host: *Chordeiles nacunda nacunda* (Vieillot); type locality Todos Santos, Cochabamba, Bolivia; figs.: dorsoventral views of male habitus (from head to abdominal segment IV, plus terminalia from segment IX + X); dorsal view of the male genitalia (Carriker 1945 – p. 177).

Type specimens: male holotype (No. 68477) at United States National Museum, USA. Hopkins and Clay (1952): world checklist. Price et al. (2003): world checklist.

Remarks. Its original description is controversial and thus we believe *M. tenuiceps* is a junior synonym of *M. nacunda*. However, it is prudent to study their types (not studied by us) before is made this taxonomic decision. Here we list our reasons for this assumption: (1) the hyaline margin drawn for *M. tenuiceps* is typically folded on both sides making an acute appearance, which is most probably due to distorted preantennal features; (2) the pleural differences used by Carriker (1945) to distinguish both species are the result of a lateral fold of pleurites caused by overmacerating specimens (resulting from careless slide mounting methods commonly found in Carriker's preparations). The overly macerated specimens cause the illusion that the re-entrant head is inside the cuticular lateral thickness of the preceding pleurite, rather than of normally seated lateral to the lateral thickness of the anterior segment; (3) differences in total size of both species could be an artifact of the over macerating of *M. tenuiceps* and/or a lack of an assessment of variation within species because Carriker (1945) only measured the specimens he designated as holotype; (4) the supposedly presence of the pleural plate on tergite II of *M. tenuiceps* is an artifact as a result of the lateral fold of the segment (see comment No. 2), the pleurite is present in all species and uniformly seen in well prepared specimens; (5) the crenulations on the temporal margin of *M. tenuiceps* could also be explained by the overmacerating of the specimens studied by Carriker (1945); (6) Although the male genitalia for *M. tenuiceps* was relatively well drawn for the drawings of *M. nacunda*, gonopore and prepuc (soft parts) of endomere seem to be shrunken and badly figured (see figures in Carriker 1945) and thus male genitalic differences may not be real; (7) no conspicuous difference in the paramera were found in studied species, thus differences that him (1945) used to distinguish *M. tenuiceps* from *M. nacunda* are obscure even by visual interpretation of drawings made by Carriker (1945); (8) the shape of the anterior dorsal head plates presented by Carriker for both species seems the same. Therefore, we consider the specimens that we collected from skins of *C. n. nacunda* as *M. nacunda* (type host: *C. n. coryi*), rather than of *M. tenuiceps* (type host: *C. n. nacunda*).

***Mulcticola vexillarius* Tendeiro, 1962**

Type host: *Caprimulgus vexillarius* (Gould); type locality Moximo, Angola; photo 1, dorsal habitus of male; photo 2,

dorsal habitus of female; photo 3, dorsal view of the male head; photo 4, dorsal view of male genitalia; fig. 1, dorsal head outline and anterior dorsal head plate (Tendeiro 1962 – p. 348).

Type specimens: male holotype (No. 354) at Centro de Zoologia da Junta de Investigações do Ultramar, Portugal. Tendeiro (1960): parasite-host and host-parasite lists with morphotypes, and localities (= '*Mulcticola* sp. 4 [sic]', fixed into 'sp. 5' at page 215). Ledger (1980): list of species from Africa south of Sahara. Price et al. (2003): world checklist.

***Mulcticola wolffi* Tendeiro, 1961**

Type host: *Caprimulgus inornatus* von Heuglin; type locality Sierra Leone; fig. 1 (right hand), dorsal head outline and anterior dorsal head plate; fig. 2 (right hand), dorsal view of the male genitalia; photo 1, dorsal view of male habitus; photo 2, dorsal view of male habitus; photo 5, dorsal view of the male head; photo 7, dorsal view of male genitalia (Tendeiro 1961 – p. 129).

Type specimens: male holotype at Zoological Museum of Copenhagen, Denmark. Tendeiro (1960): list of morphotypes, their hosts and localities (= '*Mulcticola* sp. 1'). Tendeiro (1962): photo 24, dorsal view of the male head. Ledger (1980): list of species from Africa south of Sahara; fig. 145b, reproduction of fig. 2 of Tendeiro (1961). Price et al. (2003): world checklist.

DISCUSSION

There were only three species of *Mulcticola* recorded for the Neotropics (Carriker 1945), but none known from Brazil. Thus, all six species studied herein are the first records of these chewing louse species in Brazil, which still possess at least 18 more potential host species for which *Mulcticola* have yet to be recorded. Our results increase the number of species in this genus for 18 species in total, of which seven are recorded for the Neotropics (excluding *M. tenuiceps*).

Unfortunately, most of the previously described species were illustrated with photos (Tendeiro 1961, 1962), which does not bring out the morphological details needed to diagnose species. All genera of philopterids parasitic on Caprimulgiiformes, except for *Mulcticola*, have detailed illustrations and precise description of the female genital region (Emerson and Price 1966, Cicchino 1989). Furthermore, only *Nyctibicola* has its nymph II morphologically described (Cicchino 1989). Our line drawings presented in this paper provide additional morphological evidence for the distinctiveness of the genus *Mulcticola* and also show the variability for some structures (e.g. anterior dorsal head plate) used for specific differentiation of species within this genus. In addition, the shapes of metasternal plate and subvulvar sclerites in females are here used for the first time to distinguish species of *Mulcticola*.

This work also constitutes the first morphological analysis of immature specimens of *Mulcticola*. The chaetotaxy of the pterothorax as previously used by Mey (1994), Cicchino and Valim (2008) and Valim and Palma (2012) for other philopterids was also reliable for distinguishing the three nymphal stages of *Mulcticola*, which have the following setae on each side (excluding spine-like and tri-

choid setae): NI with 1 seta; NII with 3 setae; NIII with 4 setae (as in adults). After studying immature specimens of this genus, it was possible to elucidate the ontogenetic progression of some characters of generic value.

The most conservative characters present in all postembryonic stages were: *pas*, *os*, *mts1* and *mts3* very long; prothorax and pterothorax with one small sensillum each side of their posteromedial margins; pterothorax medially divided. Some characters in their most conservative state during the first nymphal stage were: absence of a detached anterior dorsal head plate; absence of the *mts5*; prothorax with long *ppss*; absence of trichoid seta on lateral margin of pterothorax. The characters that appear in second nymph and are preserved until the adult stage include: presence of a well-developed anterior dorsal head plate and hyaline margin; medial dorsal division of the marginal carina; shortening of *ppss* in prothorax; presence of trichoid seta on lateral margin of pterothorax. Lastly, the lateral division of the marginal carina is an exclusive character of adults.

The nymphs of second instar of *Multicola* can be easily distinguished from those of *Nyctibicola* (see Cicchino

1989) by: (1) shape of front head, in both genera very similar in imagoes; (2) *as3* set on marginal carina (*vs* set on hyaline margin); (3) very long (*vs* short) *mts1*; (4) prothorax medially entire (*vs* medially divided); (5) *ppss* very short (*vs* medium-long).

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