A drop in the bucket of the megadiverse chewing louse genus *Myrsidea* (Phthiraptera, Amblycera, Menoponidae): ten new species from Amazonian Brazil

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Abstract: Ten new species of *Myrsidea* Waterston, 1915 parasitic on members of the avian families Formicariidae, Thraupidae, Tyrannidae, Troglodytidae and Icteridae are described herein. They and their type hosts are *M. isacantha* sp. n. ex *Chamaeza nobilis* Gould, *M. circumsternata* sp. n. ex *Formicarius colma* Boddaert (Formicariidae); *M. cacioppoi* sp. n. ex *Lanio fulvus* (Boddaert), *M. brasiliensis* sp. n. ex *Tangara chilensis* (Vigors), *M. saviti* sp. n. ex *Tangara schrankii* (Spix) (Thraupidae), *M. rodriguesae* sp. n. ex *Cnipodectes subbrunneus* (Sclater), *M. cnemotriccola* sp. n. ex *Cnemotriccus fuscatus* (Wied-Neuwied), *M. lathrotriccola* sp. n. ex *Lathrotriccus euleri* (Cabanis) (Tyrannidae), *M. faccioae* sp. n. ex *Cyphorhinus arada transfluvialis* (Todd) (Troglodytidae), and *M. lampropsaricola* sp. n. ex *Lampropsar tanagrinus* (Spix) (Icteridae). Among these are two new *Myrsidea* species described from the avian family Formicariidae, which previously had only a single described *Myrsidea* species, and a new host record for *M. cinnamomei* Dalgleish et Price, 2005 ex *Attila citriniventris* Sclater. Analysis of mitochondrial cytochrome oxidase I sequences for these and other neotropical *Myrsidea* species provides an assessment of their phylogenetic relationships and indicates that all of these newly described species are genetically distinct. We also put these descriptions into context by estimating the potential number of unnamed *Myrsidea* species in Brazil, given the known diversity of potential hosts and typical levels of host specificity for *Myrsidea* species. Our estimate indicates that Brazilian *Myrsidea* species diversity is likely more than an order of magnitude greater than the number of described *Myrsidea* species known from Brazil, highlighting the need for future work on this megadiverse ectoparasite genus.

Keywords: taxonomy, morphology, species diversity, phylogenetic relationships, passerines, Aves, Neotropical region, COI

Parasites can have important impacts on the health, demography, behaviour and evolution of their hosts (Combes 1996, Combes et al. 1996, Parker et al. 2006, Atkinson et al. 2008) and 30–70% of all named life forms on earth are parasitic (Price 1980, Timm and Clauson 1987, de Meeûs et al. 1998, Windsor 1998, de Meeûs and Renaud 2002), yet we know very little about this important segment of life. Thus, an incredibly high proportion of life that has important consequences to humans, human commensals and wildlife is essentially unknown. The first critical step at understanding this biodiversity is still taxonomic description.

The avian order Passeriformes is the most diverse order of birds. Thus, the extremely host specific (Bueter et al. 2009) chewing louse genus *Myrsidea* Waterston, 1915 (Amblycera, Menoponidae), which is found almost exclusively parasitizing members of the Passeriformes (Price et al. 2003), is perhaps one of the poster children of parasite diversity. With more than 350 species of *Myrsidea* described thus far (Sychra et al. 2006, Sychra 2010, Valim

et al. 2011), this genus is the most speciose of all genera in the parasitic insect order Phthiraptera and many more remain to be described.

The Brazilian Phthiraptera fauna provides an excellent example. Although the country of Brazil is home to an extremely large diversity of birds (*ca* 1 750 species), including approximately 900 Passeriformes (Dickinson 2003, Lepage 2013), it almost certainly harbours a huge diversity of *Myrsidea*. However, there are only a few published records of this louse genus for the country (e.g. Guimarães 1944, Oniki 1990, 1999, Valim and Serra-Freire 2003, Valim et al. 2005, 2009, Enout et al. 2009, Sychra et al. 2009). Some of these records are simply identified at the generic level due to a lack of knowledge about which species occur, even on common bird species (Guimarães 1944, Valim et al. 2009, Enout et al. 2009, 2012).

Hyperdiverse yet undocumented parasite groups, such as *Myrsidea*, are in need of taxonomic description and phylogenetic systematic analysis. Thus, this paper is the beginning of an attempt to reduce the large gap

of knowledge about the species of *Myrsidea* found on Brazilian birds. In this paper we describe ten new *Myrsidea* species and a scheme for this and future taxonomic descriptions of *Myrsidea*, to ensure that the diagnostic characters used in the descriptions of *Myrsidea* species are both taxonomically and phylogenetically informative.

Lastly, based on an analysis of published chewing louse host association records (see references below) from potential avian host species found in Brazil, we estimate the potential remaining numbers of undescribed *Myrsidea* species that are still awaiting description in Brazil. *Myrsidea* in general are thought to be extremely host specific (e.g. Clay 1966, 1968, Dalgleish and Price 2003, Price et al. 2003, 2004, 2005, 2008a–c, Price and Dalgleish 2006, Bueter et al. 2009, Price and Johnson 2009, Sychra et al. 2009, Valim et al. 2011), and thus it is likely that even these ten new species are only a drop in the bucket of *Myrsidea* species diversity in Brazil and on the planet.

MATERIALS AND METHODS

We collected the specimens for this study using the ethyl acetate fumigation technique as described in Clayton and Drown (2001) and modified by Bueter et al. (2009). For all ten of the *Myrsidea* species described here as new we used the modified technique as described by Valim and Weckstein (2011) to extract DNA and then amplified and sequenced a 379 base pair (bp) fragment of the mitochondrial cytochrome oxidase I (COI) gene. The DNA extracts remaining from these sequences are held at Field Museum of Natural History (FMNH), under the code provided for each DNA voucher code listed in the 'examined specimens'.

In the phylogenetic analysis we also included several previously unpublished COI sequences from named *Myrsidea* taxa found in Brazil and from all of the Neotropical *Myrsidea* species previously published in the literature and deposited in GenBank (AF545694, AF545732, EU289211–14, EU650228–29, FJ171267, FJ171272, FJ171278, FJ171281–82, FJ171286–88, FJ171290–91, GQ454448–50, JN638820–22; Johnson et al. 2003, Price et al. 2008a–c, Bueter et al. 2009, Price and Johnson 2009, Valim et al. 2011). All newly generated DNA sequence data and associated voucher numbers and locality data are deposited in GenBank (KF048103-28).

We used PAUP* (version 4.0b10; Swofford 2003) to calculate uncorrected *p*-distances between the COI sequences of all 50 *Myrsidea* species. To reconstruct the phylogenetic relationships among available COI sequences of Neotropical *Myrsidea* species and those sequenced for this study, we conducted a maximum likelihood (ML) search and bootstrap analysis of 379 bp of COI from all species plus the outgroup *Dennyus hirundinis* (Linnaeus, 1761). For the ML search we determined the best fit model for the analysis using jModelTest (Guindon and Gascuel 2003, Posada 2008) and conducted the ML search and bootstrap analysis using Garli v2.0 (Zwickl 2006; see also http://garli.googlecode.com).

We ran five independent search replicates, each beginning at a different starting point, using the model TPM1uf+I+G, which includes three classes of nucleotide substitution rates. After the analyses were complete we considered the tree with the best likelihood score to be the best phylogenetic hypothesis. We estimated all model parameters that best fit the data as part of the Garli analysis. We also performed 100 bootstrap replicates with the same model to assess statistical support for nodes in the phylogeny.

We calculated the total known and potential known *Myrsidea* species and used these figures to estimate the number of undescribed *Myrsidea* species in Brazil based on an index of host specificity (index of specificity (IS) = *Myrsidea* species/ host species of *Myrsidea*). We calculated the index of host specificity from the list of avian hosts found in Brazil from orders and families known to be parasitised by some *Myrsidea* species, including perching birds (Passeriformes), hummingbirds (Trochilidae) and toucans (Ramphastidae). Dubious records present in literature, e.g. *Myrsidea funerea* (Kellogg et Chapman, 1899) on *Picoides pubescens turati* (Malherbe) (Picidae), were not included in the analysis to conservatively avoid overestimating *Myrsidea* diversity.

We used the Howard and Moore (Dickinson 2003) checklist of birds from Brazil reported by Avibase (Lepage 2013) and the host parasite association data reported in Price et al. (2003) and subsequent papers recently published on this genus (Dalgleish and Price 2003, Price et al. 2004, 2005, 2008a–c, Price and Dalgleish 2006, Price and Johnson 2009, Sychra et al. 2006, 2009, Kounek et al. 2011a,b, Valim et al. 2011). Nineteen bird species listed as *incertae sedis* in Avibase were not included in the calculations because they were not known to be parasitised by *Myrsidea*.

All specimens, including the DNA vouchers, were slide-mounted using Palma's (1978) Canada balsam method. In the following descriptions, all measurements are in millimetres. Host names are from Dickinson (2003), morphological names for chewing louse structures strictly follow those applied by Clay (1966, 1968, 1969, 1970).

Abbreviations are: ANW, female anus width; AWIV, abdomen width at segment IV; *dhs*, dorsal head setae (*sensu* Clay 1969) (Fig. 12); GL, male genitalia length; GSL, male genital sclerite length; HL, head length at midline; *ls5*, labial seta 5 (*sensu* Clay 1966) (Fig. 11); MSPL, metasternal plate length; MW, metathorax width; POW, preocular width; PSPL, prosternal plate length; PW, prothorax width; TL, total length; TW, temple width. The ratio of the length of *dhs10/dhs11* (rounded to two decimals) was calculated for each individual specimen examined, thus we did not simply use the final minimum and maximum values of the raw setal measurements of all individuals examined to calculate these final ratios.

Measurements of the body features were taken as follows: ANW, from the bases of the most lateral anal seta on each side of the anal fringe; AWIV, from the widest part of plurites IV; GL, at midline, from the most distal part of the mesomere to the visible apices of basal apodeme; GSL, from the distal part of the sclerite to the visible end of its membraneous portion; HL, at midlevel, from the anterior to posterior margins of the head; MW, from the widest part of metanotum at its posterior part; MSPL and PSPL, at their midlevel; POW, at level of *dhs11*; PW, from the widest part of pronotum; TW, at level of *dhs29*; TL, at midline, in females considering the posterior margin of the dorsal anal fringe, but not including the setae.

Throughout, we are providing detailed descriptions of characters with the intention that these descriptions would be useful for coding characters for morphological phylogenetic reconstruction for *Myrsidea* species. Thus in describing characters we have considered their homologies, instead of providing only setal counts and morphometric data and leaving the diagnostic and descriptive features based exclusively on continuous characters.

To avoid incompatibility between our descriptions and the most recent publications describing new *Myrsidea* species (e.g. Price et al. 2005, 2008a–c, Price and Dalgleish 2006, Johnson and Price 2009, Sychra et al. 2009, Kounek et al. 2011a,b), we present a detailed scheme including a suite of characters that we, and hopefully others, will analyse and describe in future *Myrsidea* species descriptions. We emphasize and consider the 20 morphological features used in this paper as the minimum that should be given in a *Myrsidea* description (Clay 1966).

We also use setal counts as they were employed by Clay (1966) because her system avoids counting setae with constant counts and allows us to better compare characters based on their primary homology rather than solely using characters for differentiating taxa. Thus, the metanotal setal account does not include the most posterolateral setae, which are always constant, and only includes the counts of setae between the most posterolateral setae. In the same way, the tergal setal counts are based only on the variable setae between the postspiracular complex set in tergal plates, which are composed of the postspiracular seta and the lateral seta associated with it (*b*, of Clay 1970).

On tergite I there may or may not be a lateral seta differentiated from the rest of the marginal setae in size and position; therefore, in the counts of the tergo-central setae of segment I all the marginal setae except the postspiracular are included, but in the tergo-central setal counts of segments II–VIII the seta associated (*b*, see Fig. 21) with the postspiracular seta are also excluded as proposed by Clay (1966). When an anterior row of setae on each tergite is present, those are reported in parentheses after the account for the posterior tergal setae. In the anterior sternal setal count, the two pairs of anterolateral setae on sternite II (setae *a* of Clay 1966, see Figs. 13 and 20), which are constant in *Myrsidea* species, are excluded. Sternal setal counts for the III–VI (females) and III–VII (males) include the posterior row plus the lateral patches of setae. When an anterior row is present the most posterior row is presented followed by the anterior count (which includes brushes plus anterior setae) in parentheses.

We believe that using Clay's (1966) standardized system for treating *Myrsidea* will help researchers more rapidly compare and describe related species from megadiverse areas. More importantly, Clay's (1966) model was developed using a phylogenetic perspective and thus not only did she re-describe and describe new species, but she also coded phylogenetically informative characters for these taxa. Thus by adopting Clay's (1966) model, over time we will continue to construct a large morphological dataset for phylogenetic analysis of this megadiverse group.

Type specimens as well as the DNA vouchers herein described are deposited in the Ectoparasite Collection of the Museu de Zoologia da Universidade de São Paulo (MZUSP), São Paulo, Brazil, and in the Insect Collection of the Field Museum of Natural History (FMNH), Chicago, USA.

RESULTS

Phthiraptera Haeckel, 1896

Amblycera Kellogg, 1896

Menoponidae Mjöberg, 1910

Myrsidea Waterston, 1915

Entomol. Mo. Mag. 51: 12. Type species: *Myrsidea victrix* Waterston, 1915 by original designation.

Synonyms:
Acolpocephalum Ewing, 1927. J. Washington Acad. Sci. 17 (4): 88; type: *Acolpocephalum brevipes* Ewing, 1927 (= *Myrsidea brevipes*)
Alcediniphilus Ansari, 1951. Proc. Nat. Inst. Sci. India 17 (2): 189; type *Myrsidea* (*Alcediniphilus*) *kuluensis* Ansari, 1951 (= *Myrsidea sultanpurensis* Ansari, 1951)
Allomyrsidea Conci, 1942. Boll. Soc. Entomol. Ital. 74 (2–3): 31; type: *Myrsidea struthidea* Thompson, 1939
Australmenopon Conci, 1942. Boll. Soc. Entomol. Ital. 74 (2–3): 30; type: *Menopon cinerea* Thompson, 1939 (= *Myrsidea cinerea*)
Corvomenopon Conci, 1942. Boll. Soc. Entomol. Ital. 74 (2–3): 31; type: *Menopon robsoni* Cummings, 1914 (= *Myrsidea robsoni*)
Densidea Złotorzycka, 1964. Acta Parasitol. Pol. 12 (17): 171; type: *Menopon rusticum* Giebel, 1874 (= *Myrsidea rustica*)
Eichlerinopon Złotorzycka, 1964. Acta Parasitol. Pol. 12(17): 179; type: *Eichlerinopon celeripes* Złotorzycka, 1964 [= *Myrsidea cornicis* (De Geer, 1778)]
Lanimenopon Złotorzycka, 1964. Acta Parasitol. Pol. 12 (17): 177; type: *Lanimenopon abhorrens* Złotorzycka, 1964 (= *Myrsidea abhorrens*)
Liquidea Złotorzycka, 1964. Acta Parasitol. Pol. 12 (17): 173; type: *Liquidea proterva* Złotorzycka, 1964 (= *Myrsidea proterva*)
Myrsidella Eichler, 1951. Zool. Anz. 146: 49; type: *Menopon consimile* Piaget, 1885 [= *Myrsidea cornicis* (De Geer, 1778)]
Neomyrsidella Złotorzycka, 1964. Acta Parasitol. Pol. 12 (17): 182; type: *N. usitata* Złotorzycka, 1964 [= *Myrsidea anathorax* (Nitzsch in Giebel, 1866)]
Vulgidea Złotorzycka, 1964. Acta Parasitol. Pol. 12 (17): 172; type: *Menopon cucullare* Nitzsch, 1818 (= *Myrsidea cucullaris*)
Wolfdietrichia Złotorzycka, 1973. Lounais-Hämeen Luonto 46: 51; type: *Myrsidea* (*Wolfdietrichia*) *cornicis* (De Geer, 1778) (= *Myrsidea cornicis*)

Although Clayton et al. (1992) published the first records of *Myrsidea* sp. from Formicariidae, only one species of *Myrsidea* has been described from Formicariidae until now: *M. klimesi* Sychra, 2006 ex *Formicarius analis* (d'Orbigny et Lafresnaye). Therefore, here we provide the diagnostic characters that are of significance in defining the genus as it pertains to the species of *Myrsidea* parasitizing the avian family Formicariidae.

We add morphological characters to define this group of species, based on three species parasitizing this host family, the two newly described herein, plus *M. klimesi* previously described by Sychra in Sychra et al. (2006). Some of these characters will not be repeated in the species descriptions.

Clay (1966) thoroughly characterized this genus. The diagnostic characters for the *Myrsidea* species found on other bird families can be found in Price et al. (2005) for the Tyrannidae, in Price and Dalgleish (2006), Price and Johnson (2009), Sychra et al. (2009) for Thraupidae, in Price et al. (2008a) for Troglodytidae, and in Clay (1968) for Icteridae. These will be not repeated herein.
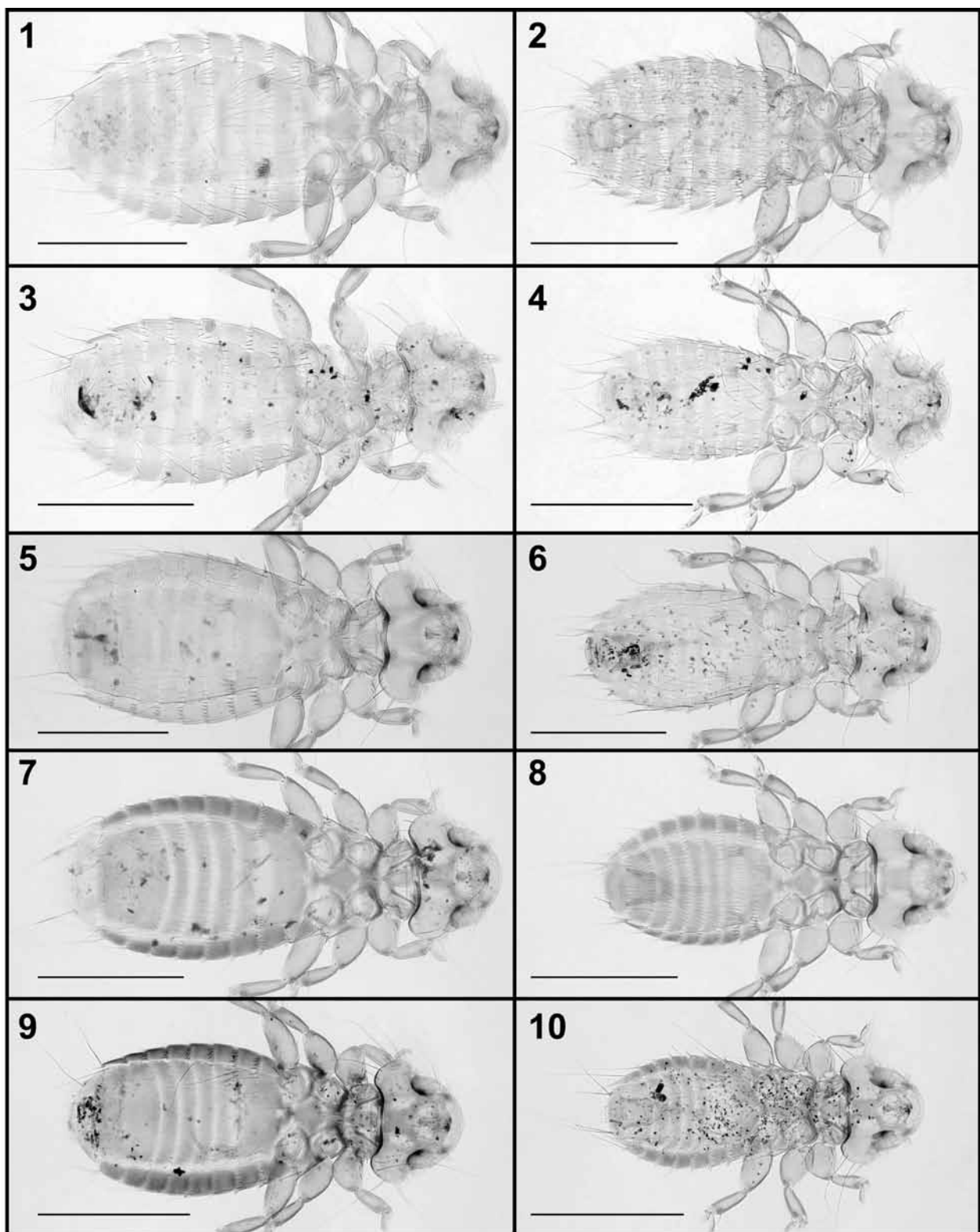
Figs. 1–10. Habitus in dorsal view. Females in left column, males in right column. **Figs. 1**, **2**. *Myrsidea isacantha* sp. n. **Figs. 3**, **4**. *M. circumsternata* sp. n. **Figs. 5**, **6**. *M. cacioppoi* sp. n. **Figs. 7**, **8**. *M. brasiliensis* sp. n. **Figs. 9**, **10**. *M. saviti* sp. n. Scale bars = 0.5 mm.

Species from Formicariidae

Major reviews: Sychra et al. (2006), present study.

Head evenly rounded anteriorly; lacking lateral slit or notch; with long inner (*dhs21*) and outer (*dhs22*) occipital setae, both surpassing pronotal carina (Fig. 12); *dhs23* present and set anterolateral to *dhs22* (Fig. 12); gula usually with 4 setae on each side, less often 3 only on one side, with heavier longer posterior seta; hypopharyngeal sclerite reduced (Fig. 14).

Thorax with pronotum bearing a pair of minute central setae (*dps2*) (Fig. 12) (also in *M. klimesi* ?); with 3 setae at each lateral angle and 7–11 longer posterior marginal setae. Mesonotum without median division, but with a Y-shaped line just below postnotum, not forming a suture or even splitting mesonotum. This Y-shaped line slightly less evident, but also discernible in good specimens from other host families. Mesonotum of *M. klimesi* supposedly divided medially. Metanotum without central setae, but with 3 short setae around anterolateral margins on each side. Metapleura with 3 short spine-like setae. Prosternal plate well developed, elongate, with 2 short anterior setae (like in *M. klimesi*, see Sychra et al. 2006); metasternal plate prominent, diamond shaped with its posterior angle at least reaching middle of sternite I, usually with 11 setae, much less often 12, or 14.

Abdomen with undivided tergites, apparently without anterior setae except for very small seta at corner of each side of tergite I (not included in tergal count), but in males of one species anterior row of setae present on I–VI; sternite I medium sized, mostly surrounded by sternite II, apparently without setae (except for one male of *M. isacantha* sp. n.); sternite II enlarged, with aster of heavy setae at each posterior corner (Fig. 13). Sternite VII fused with VIII + IX + X, forming female subgenital plate, although with a distinct transverse fenestra distinctly enclosed at lateral sides of subgenital plate where seventh and eighth segments fused (Fig. 11). Sternite VII supposedly distinct from remaining subgenital plate in *M. klimesi* (Sychra et al. 2006). Female anus oval, without inner setae; subgenital plate of fused sternites VII–IX, vulva with posterior margin smooth. Male subgenital plate of fused sternites VIII–IX; genitalia of usual shape for genus (Fig. 20), with spinous sac having distinctively shaped associated sclerite. Male genital sclerite reduced to two roughly serrated or spiculated lateral arms (Figs. 18, 19).

In summary of the characters listed above, the combination of presence of *dhs23* and *dps2*, plus *dhs22* being as long as *dhs21*, make the species parasitizing Formicariidae unique among the *Myrsidea* species named thus far.

Myrsidea isacantha sp. n.   Figs. 1, 2, 11, 12, 16, 18, 20, 21

Female. Habitus as in Figs. 1 and 11 and head shape as in Fig. 1. Dorsal head seta 10, 0.026–0.029 long; *dhs11*, 0.106–0.126 long, ratio *dhs10/11* 0.206–0.274. Hypophar-

ynx reduced (as in Fig. 14), *ls5* 0.03–0.05, ventrolateral fringe, 9–10 setae. Gula with 4 setae on each side. First tibia with 4 outer lateral ventral and dorsal setae. Metanotum with posterior margin straight and with 7–10 setae on posterior margin, metasternal plate with 11–14 setae (as in Fig. 16). Setae of femoral brush, 15–17. Metanotum and abdomen as in Fig. 11. Tergites I–III straight on posterior margin, with a continuous tergal setal row. Small central gap discernible in each tergal setal row of segments IV–VIII. Tergal setae: I, 16–20; II, 22; III, 19–24; IV, 17–20; V, 15–17; VI, 11–14; VII, 8–11; VIII, 5–6. Tergites III and IV with 1 + 1 anterior setae in one paratype only. Postspiracular setae shortest (0.19–0.25) on I, II, III and VI, and long (0.27–0.37) on IV, V, VII and VIII.

Sternal setae: I, 0; II, each aster of 6 setae (one paratype with 5 and 7 on each side, respectively), posterior margin with 15 and anteriorly with 18–21; III, 29–33 (20–22); IV, 29–31 (14–17); V, 26–33 (15–19); VI, 24–33 (15–22); VII, 16–20 (17–20); VIII–IX, 31–41; vulvar margin with 10–14 setae. Each pleurite (III–VII) with about 5–6 short marginal setae; presence of 1–2 anterior setae on pleurites III–VII; pleurite VIII as in Fig. 15. Tergite IX with inner posterior setae set near lateral margin of last tergite, 0.03–0.04 long (Fig. 11). Anus with 38–39 ventral fringe setae, 37–38 dorsal. Dimensions (n = 3): TW, 0.47–0.48; POW, 0.35–0.36; HL, 0.28–0.30; PW, 0.29–0.33; PSPL, 0.11–0.12; MW, 0.44–0.48; MSPL, 0.21–0.23; AWIV, 0.60–0.69; ANW, 0.21–0.23; TL, 1.55–1.58.

Male. Much as in female, habitus as in Fig. 2. Gular plate with 4 setae on each side. Metanotum with 10–11 setae on posterior margin. Setae of femoral brush, 16–18. Anterior setae present on tergites I–VII. Tergal setae: I, 20–24 (1–4); II, 24–29 (10–14); III, 27–30 (14–17); IV, 25–30 (11–22); V, 23–32 (9–11); VI, 23–25 (4–8); VII, 22–24 (7); VIII, 16–17. Without median gap in each tergal setal row; tergal setae of similar length reaching alveoli of next tergal row. Postspiracular setae as for female. Pattern of chaetotaxy of tergites V–IX+X as in Fig. 21.

Sternal setae: I, 0 (one paratype with 1 seta); II, each aster of 3–5 setae, posterior margin with 12–15 and anteriorly with 16–19; III, 26–34 (16–19); IV, 25–33 (17–18); V, 23–40 (13–24); VI, 24–30 (19–21); VII, 17–24 (18–24); VIII, 45–50. Tergite IX with inner posterior setae set near lateral margin of last tergite, 0.02–0.03 long (Fig. 21), except one paratype with 1 additional seta only on one side, 0.06 long. Anus with 8 internal setae on ventral side and 3 on dorsal. Genitalia and genital sac sclerite as in Figs. 20 and 18, respectively. Dimensions (n = 3): TW, 0.45–0.47; POW, 0.34–0.35; HL, 0.27–0.28; PW, 0.30; PSPL, 0.11; MW, 0.38–0.40; MSPL, 0.17–0.19; AWIV, 0.50–0.53; GL, 0.36–0.40; GSL, 0.08–0.09; TL, 1.33–1.37.

T y p e   h o s t : *Chamaeza nobilis* Gould – striated antthrush (Formicariidae).

T y p e   l o c a l i t y : Rio Acanauí, Japurá, Amazonas State, Brazil (02°01'38"S; 66°40'28"W).
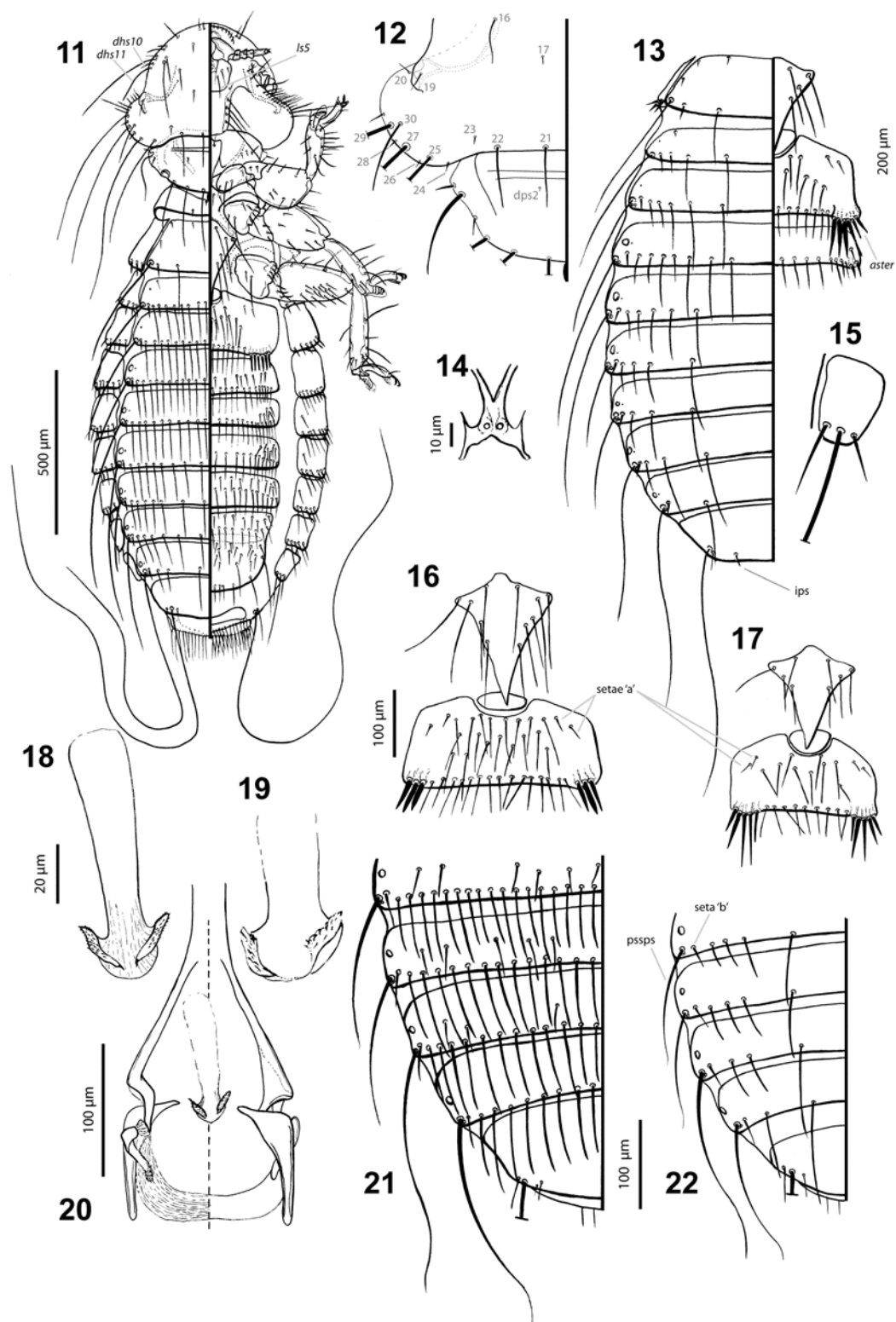
Figs. 11, **12**, **16**, **18**, **20**, **21**. *Myrsidea isacantha* sp. n. **Fig. 11.** Entire female, dorsoventral view. **Fig. 12.** Temporal and occipital chaetotaxy, plus the dorsal pronotal surface (*dhs* 16–30). **Fig. 16.** Metasternal, sternal I and II plates. **Fig. 18.** Male genital sclerite. **Fig. 20.** Male genitalia, in dorsoventral view. **Fig. 21.** Tergites V–IX + X of male. **Figs. 13–15**, **17**, **19**, **22.** *M. circumsternata* sp. n. **Fig. 13.** Female metanotum and dorsal abdomen. **Fig. 14.** Female hypopharynx. **Fig. 15.** Pleurite VIII of female. **Fig. 17.** Metasternal, sternal I and II plates. **Fig. 19.** Male genital sclerite. **Fig. 22.** Tergites V–IX + X of male. *Abbreviations:* aster – patch of spine-like setae on sternite II; *dhs10* and *dhs11* – dorsal head setae 10 and 11; dps – dorsal pronotal seta; ips – inner posterior seta; *ls5* – labial seta 5; pssps – post-spiracular seta; setae 'a' – anterior lateral setae of sternite II; setae 'b' – lateral seta associated with post-spiracular seta.

Type material: Holotype female (MZUSP 2310), ex *Chamaeza nobilis*, JAP341 MPEG 62964; Rio Acanauí, Município Japurá, Amazonas, Brazil, 18 July 2007, collected by J.D. Weckstein. Paratypes: three males and two females, same data as the holotype. Coll. Nos.: one male (FMNH-INS 94000) and one female (FMNH-INS 94001, DNA voucher Mysp.Chno.1.4.2011.4); two males (MZUSP 2312, 2313) and one female (MZUSP 2311).

Etymology: Composed by *iso-* (= equal in Greek), and *-acanthus* (= spine in Greek), which refers to the size and shape for spine-like setae that compose the aster on sternite II.

Diagnosis. Distinct from other groups of *Myrsidea* by the characters provided above. Its distinctive feature is the even length and comb-like shape of the spine-like setae on the aster of sternite II. The comb-like shape of the setal aster of sternite II is so far unknown for other Brazilian or Neotropical species of *Myrsidea*.

Myrsidea isacantha sp. n. is morphologically and genetically close to *M. circumsternata* sp. n., and also morphologically close to *M. klimesi*, but is distinguished from them by shape and chaetotaxy of sternites II, including the aster and elevated number of metasternal, tergal and sternal setae; in males the tergal plates have a distinct anterior row of setae on I–VII (absent in *M. klimesi* and *M. circumsternata* sp. n.).

Myrsidea circumsternata sp. n. Figs. 3, 4, 13–15, 17, 19, 22

Female. Habitus and head shape as in Fig. 3. Dorsal head seta 10, 0.022–0.027 long; *dhs11*, 0.096–0.112 long, ratio *dhs10/11* 0.194–0.241. Hypopharynx reduced (Fig. 14), *ls5* 0.02–0.03, ventrolateral fringe, 8–9 setae. Gula with 4 setae on each side. First tibia with 3 and 4 outer lateral ventral and dorsal setae, respectively. Metanotum with posterior margin straight and 4 setae on posterior margin, metasternal plate with 8–9 setae (as in Fig. 17). Setae of femoral brush, 11–13. Metanotum and abdomen as in Fig. 13. Tergites I–III straight on posterior margin. With a median gap in each tergal setal row of the segments I–VIII. Tergal setae: I, 7–10; II, 8–10; III, 10–11; IV, 8–9; V, 8; VI, 6–8; VII, 6–7; VIII, 4. Postspiracular setae shortest (0.14–0.18) on V, VI and long (0.25–0.40) on I, II, III, IV, VII and VIII.

Anterior row of setae present on sternites; sternite III with reminiscent aster, weak and discrete, composed by 2–3 spine-like setae, each side, arising from an indistinct tubercle (these setae included in sternite III setal account). Sternal setae: I, 0; II, each aster of 4–6 setae, posterior margin with 11–13 and anteriorly with 13–14; III, 19–21 (2); IV, 17–20 (15); V, 21–26 (13–16); VI, 16–21 (13–16); VII, 5 (9–15); VIII–IX, 32–37; vulvar margin with 10–11 setae. Each pleurite III–VII with about 5–8 short marginal setae; presence of 1 anterior setae rarely on pleurites III–V; pleurite VIII as in Fig. 15. Tergite IX with

inner posterior setae set near lateral margin of last tergite, 0.03–0.04 long (Fig. 13). Anus with 36–39 ventral fringe setae, 34–37 dorsal. Dimensions (n = 3): TW, 0.39–0.42; POW, 0.31–0.32; HL, 0.28–0.29; PW, 0.26; PSPL, 0.11; MW, 0.35–0.37; MSPL, 0.18; AWIV, 0.48–0.52; ANW, 0.19–0.20; TL, 1.39–1.43.

Male. Much as in female, habitus as in Fig. 4. Gular plate with 4 setae on each side. Metanotum with 4 setae on posterior margin. Setae of femoral brush, 11–13. Tergal setae: I, 7–8; II, 8–9; III, 9; IV, 7–8; V, 7–8; VI, 6–8; VII, 5–6; VIII, 4. Median gap present in each tergal setal row; tergal setae of similar length reaching alveoli of next tergal row. Postspiracular setae as for female. Pattern of chaetotaxy of tergites V–IX + X as in Fig. 22.

Anterior row of setae present on sternites. Sternal setae: I, 0; II, each aster of 5 setae (rarely 4 only in one side), posterior margin with 9–12 and anteriorly with 9–12; III, 17–20 (0–1); IV, 23–26 (2–6); V, 20–22 (11); VI, 19 (10–12); VII, 13–17 (6–7); VIII, 21–23. Tergite IX with inner posterior setae set near lateral margin of last tergite, 0.02–0.03 long (Fig. 22). Anus with 6 internal setae on ventral side and 3 on dorsal. Genital sac sclerite as in Fig. 19. Dimensions (n = 3): TW, 0.37–0.38; POW, 0.29–0.30; HL, 0.25–0.26; PW, 0.24–0.25; PSPL, 0.09–0.10; MW, 0.31–0.32; MSPL, 0.16; AWIV, 0.39–0.40; GL, 0.30–0.33; GSL, 0.06; TL, 1.11–1.15.

Type host: *Formicarius colma* Boddaert – rufous-capped antthrush (Formicariidae).

Type locality: Rio Acanauí, Japurá, Amazonas State, Brazil (02°01'38"S; 66°40'28"W).

Type material: Holotype female (MZUSP 2314), ex *Formicarius colma*, JAP385 MPEG 62957; Rio Acanauí, Município Japurá, Amazonas State, Brazil, 20 July 2007, collected by J.D. Weckstein. Paratypes: three males and two females, same data as the holotype. Coll. Nos.: one male (FMNH-INS 94002) and one female (FMNH-INS 94003, DNA voucher Mysp.Foco.1.4.2011.3); two males (MZUSP 2316, 2317) and one female (MZUSP 2315).

Etymology: Composed by *circum-* (= around in Latin); *-stern* (= the breast, breastbone in Greek), which refers the fact that this species possesses sternal plate I almost surrounded by segment II.

Diagnosis. Morphologically close to *M. klimesi* and *M. isacantha* sp. n. by sharing the above-mentioned characters for species parasitic on Formicariidae. However, *M. circumsternata* sp. n. has sparser chaetotaxy (including metanotal, metaesternal, femoral brush, tergal and sternal setae), and only three outer latero-ventral setae, in both sexes; the absence of anterior row of setae on male tergites of *M. circumsternata* promptly distinguishes it from its genetically close relative (*M. isacantha* sp. n. – see above). On the other hand, these features make *M. circumsternata* morphologically close to *M. klimesi*, from which it can be easily distinguished based on chaetotaxy of sternite II, the smaller number of posterior setae and

the larger number of anterior setae that separate both sexes of these species (see key below).

Key for the *Myrsidea* species parasitic on Formicariidae

1 First tibia with 3 outer ventrolateral setae; both sexes with a median gap in each tergal setal row on segments I–III; anterior setae on sternite II, less than 15 setae; aster of sternite II with spine-like setae of distinct length; reminiscent aster on sternites III present 2

– First tibia with 4 outer ventrolateral setae; both sexes without a median gap, with a continuous tergal setal row on segments I–III; anterior setae on sternite II, more than 15 setae; aster of sternite II with spine-like setae of same length; reminiscent aster on sternites III absent .... ***M. isacantha*** sp. n.

2 Setae on sternite II: posterior margin with 18–23 and anteriorly with 4–7; reminescent aster on sternites III very conspicuous .... *M. klimesi* Sychra, 2006

– Setae on sternite II: posterior margin with 9–13; anteriorly with 9–14; reminescent aster on sternites III weak and discrete .... ***M. circumsternata*** sp. n.

Species from Thraupidae

Major reviews: Price and Dalgleish (2006), Price and Johnson (2009), Sychra et al. (2009), Kounek et al. (2011a).

Myrsidea cacioppoi sp. n.   Figs. 5, 6, 23–27

Female. Habitus and head shape as in Fig. 5. Dorsal head seta 10, 0.033–0.047 long; *dhs11*, 0.092–0.114 long, ratio *dhs10/11* 0.289–0.489. Hypopharynx fully developed, *ls5* 0.06–0.07, ventrolateral fringe, 9–10 setae. Gula with 4 setae on each side. First tibia with 3 and 4 outer lateral ventral and dorsal setae, respectively. Mesonotum without median division. Metanotum with posterior margin straight and 4 setae on posterior margin, metasternal plate with 4 setae (as in Fig. 25). Setae of femoral brush, 13–17. Metanotum and abdomen as in Fig. 23. Tergites I–II with straight posterior margin, segments III–IV very slightly pronounced on posterior margin. With a median gap in each tergal setal row. Tergal setae: I, 4–8; II, 11–12; III, 11–12; IV, 12–14; V, 12–15; VI, 10–14; VII, 10–12; VIII, 6–7. Postspiracular setae shortest (0.19–0.22) on I, III, V and VI, and extremely long (0.26–0.55) on II, IV, VII and VIII.

Sternal setae: I, 0; II, each aster of 4 setae (one paratype with 3 only on one side), posterior margin with 13–14 and anteriorly with 4–6; III, 21–23; IV, 31–35; V, 37–38; VI, 32–37; VII, 16–19; VIII–IX, 7–8; vulvar margin with 11 setae. Each pleurite III–VII with about 5–8 short marginal setae; absence of anterior setae on pleurites; pleurite VIII as in Fig. 24. Tergite IX with 1 inner posterior setae, on each side, 0.07–0.08 long. Anus with 33–37 ven-

tral fringe setae, 34–35 dorsal. Dimensions (n = 3): TW, 0.49–0.51; POW, 0.36–0.37; HL, 0.35; PW, 0.30–0.31; PSPL, 0.12–0.13; MW, 0.47–0.49; MSPL, 0.16–0.17; AWIV, 0.65–0.67; ANW, 0.21–0.23; TL, 1.60–1.64.

Male. Much as in female, habitus as in Fig. 6. Gular plate with 4 setae on each side. Metanotum with 4 setae on posterior margin. Setae of femoral brush, 12–15. Tergal setae: I, 4–8; II, 7–11; III, 9–11; IV, 9–12; V, 9–12; VI, 9–10; VII, 6–9; VIII, 4–5. Without median gap in each tergal setal row; tergal setae of similar length reaching the alveoli of the next tergal row. Postspiracular setae as for female. Pattern of chaetotaxy of tergites V–IX + X as in Fig. 26.

Sternal setae: I, 0; II, each aster of 4 setae, posterior margin with 13–15 and anteriorly with 5; III, 18–22; IV, 27; V, 31–34; VI, 24–29; VII, 13–17; VIII, 10–12. Tergite IX with 1 inner posterior setae, on each side, 0.06–0.08 long. Anus with 8 internal setae on ventral side and 3 on dorsal. Genital sac sclerite as in Fig. 27, rounded apically and with ventral arms laterally projected and curved. Dimensions (n = 3): TW, 0.45–0.46; POW, 0.34; HL, 0.31–0.33; PW, 0.28–0.31; PSPL, 0.11–0.12; MW, 0.40–0.41; MSPL, 0.14–0.15; AWIV, 0.49–0.52; GL, 0.43–0.48; GSL, 0.06–0.10; TL, 1.33–1.40.

T y p e   h o s t : *Lanio fulvus* (Boddaert) – fulvous shrike-tanager (Thraupidae).

T y p e   l o c a l i t y : Lago Cumapi, Município Maraã, Amazonas State, Brazil (01°33'35"S; 65°52'48"W).

T y p e   m a t e r i a l : Holotype female (MZUSP 2318), ex *Lanio fulvus*, JAP780 MPEG 63215; Lago Cumapi, Município Maraã, Amazonas State, Brazil, 31 July 2007, collected by J.D. Weckstein. Paratypes: three males and two females, same data as the holotype. Coll. Nos.: one male (FMNH-INS 94004, DNA voucher Mysp.Lafu.1.4.2011.7) and one female (FMNH-INS 94005) paratypes at FMNH; two males (MZUSP 2320, 2321) and one female (MZUSP 2319).

E t y m o l o g y : This species is named in honour of Joseph Cacioppo, who has sequenced DNA from more *Myrsidea* than any other person alive and whose senior thesis project produced the largest phylogeny (unpublished data) yet of this megadiverse louse genus.

Diagnosis. Belonging to the *fusca* species group (*sensu* Price and Dalgleish 2006), based on the presence of a median gap in the rows of tergal setae in both sexes. Morphologically close to *M. spizae* Price et Dalgleish, 2006 based on unmodified tergites I–III and the smaller number of metanotal and metasternal setae. Both sexes can be promptly distinguished by their large dimensions (TL of female, 1.60–1.64 *vs* 1.47–1.56; male, 1.33–1.40 *vs* 1.22–1.25).

Females of *M. cacioppoi* sp. n. can be separated from those of *M. spizae* based on large number of setae on: tergites VI (10–14 *vs* 6–7, the 10–11 of Price and Dalgleish 2006) and sternite VI (32–37 *vs* 22–24). The males can also be separated based on large number of setae on: tergite VI (9–10 setae *vs* 6 of Price and Dalgleish 2006),
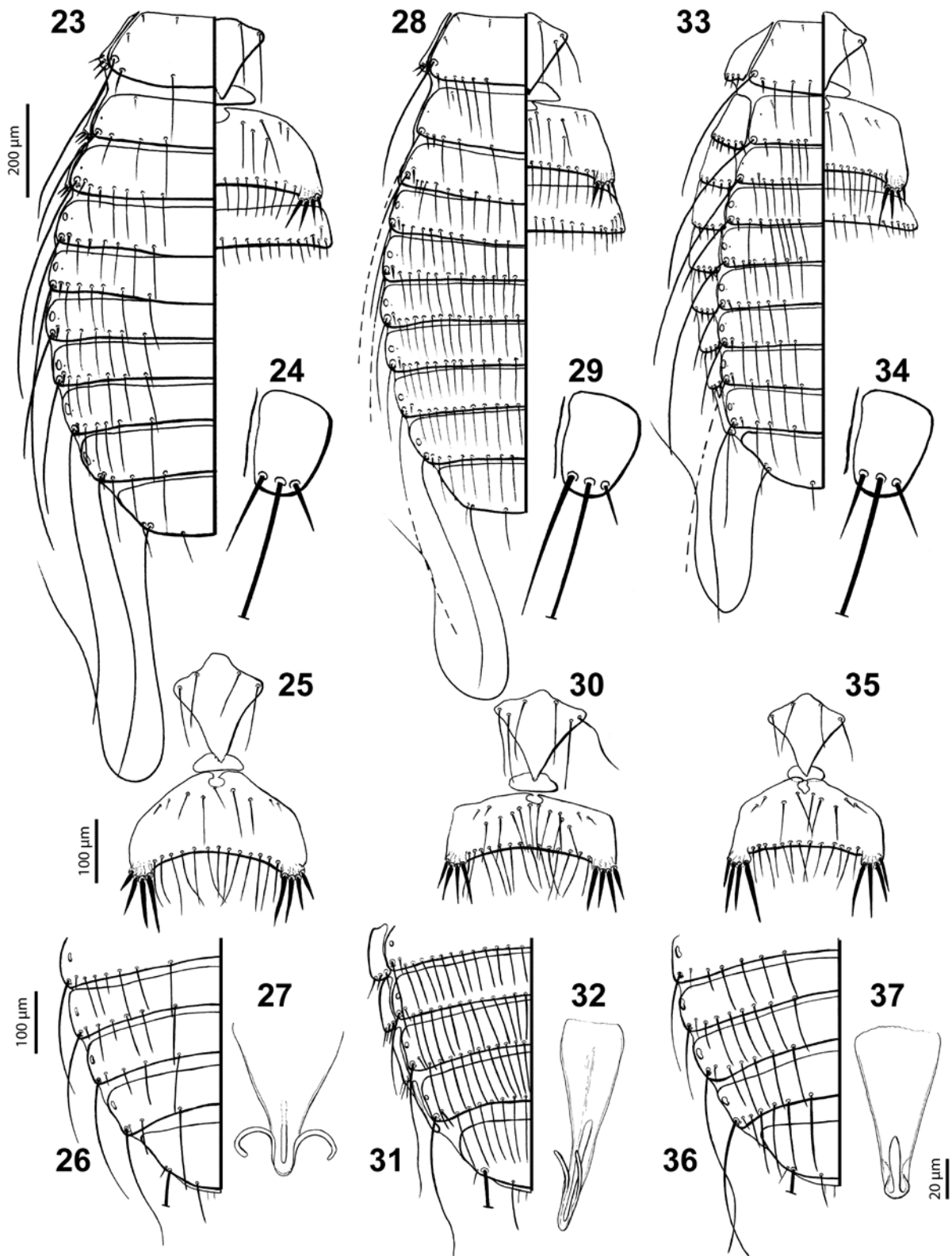
Figs. 23–27. *Myrsidea cacioppoi* sp. n. **Figs. 28–32.** *M. brasiliensis* sp. n. **Figs. 33–37.** *M. saviti* sp. n. Female metanotum and dorsal abdomen (23, 28, 33). Pleurite VIII of female (24, 29, 34). Metasternal, sternal I and II plates (25, 30, 35). Tergites V–IX + X of male (26, 31, 36). Male genital sclerite (27, 32, 37).

and sternite VI (24–29 *vs* 19–20). Males of the new species are distinct from other *Myrsidea* parasitic on Thraupidae by the shape of the genital sclerite (Fig. 27).

Myrsidea brasiliensis sp. n.   Figs. 7, 8, 28–32

Female. Habitus and head shape as in Fig. 7. Dorsal head seta 10, 0.034 long; *dhs11*, 0.095 long, ratio *dhs10/11* 0.358. Hypopharynx fully developed, *ls5* 0.07, ventrolateral fringe, 10 setae. Gula with 5 setae on each side. First tibia with 3 and 4 outer lateral ventral and dorsal setae, respectively. Mesonotum without median division. Metanotum with posterior margin straight and 12 setae on posterior margin, metasternal plate with 6 setae (as in Fig. 30). Setae of femoral brush, 18. Metanotum and abdomen as in Fig. 28. Tergites I–III roughly straight on posterior margin, those of II–III with a very indistinct posterior enlargement. Median gap present in each tergal setal row, most noticeably on segments I–III and VIII. Segments IV–VII with a continuous row of setae. Tergal setae: I, 10; II, 19; III, 21; IV, 27; V, 26; VI, 22; VII, 22; VIII, 14. Postspiracular setae shortest (0.12–0.19) on I, III, V and VI, and long (~0.43) on II, IV, VII and VIII.

Sternal setae: I, 0; II, each aster of 4 setae, posterior margin with 16 and anteriorly with 9; III, 30; IV, 39; V, 41; VI, 37; VII, 21; VIII–IX, 9; vulvar margin with 12 setae. Each pleurite III–VII with about 4–8 short marginal setae, three first medial setae on ventral surface distinctly longer and setiform on III–VII; absence of anterior setae on pleurites; pleurite VIII as in Fig. 29. Tergite IX with 1 inner posterior setae, on each side, 0.09 long. Anus with 34 ventral fringe setae, 35 dorsal. Dimensions (n = 1): TW, 0.44; POW, 0.34; HL, 0.30; PW, 0.29; PSPL, 0.11; MW, 0.44; MSPL, 0.17; AWIV, 0.58; ANW, 0.21; TL, 1.55.

Male. Much as in female, habitus as in Fig. 8. Gular plate with 5 setae on each side. Metanotum with 10–12 setae on posterior margin. Setae of femoral brush, 18. Tergal setae: I, 17–19; II, 23–24; III, 24–25; IV, 24–26; V, 25–27; VI, 25–26; VII, 24–25; VIII, 17–18. Without median gap in each tergal setal row; tergal setae of similar length reaching alveoli of next tergal row. Postspiracular setae as for female. Pattern of chaetotaxy of tergites V–IX + X as in Fig. 31.

Sternal setae: I, 0; II, each aster of 4 setae, posterior margin with 14–18 and anteriorly with 10; III, 23–26; IV, 34–35; V, 38–39; VI, 32–33; VII, 22–24; VIII, 18. Tergite IX with 1 inner posterior setae, on each side, 0.08 long. Anus with 8 internal setae on ventral side and 3–4 on dorsal. Genital sac sclerite as in Fig. 32, rounded apically and with thin and long ventral arms. Dimensions (n = 2): TW, 0.40–0.41; POW, 0.31; HL, 0.30; PW, 0.27; PSPL, 0.11; MW, 0.35–0.36; MSPL, 0.14; AWIV, 0.45; GL, 0.40–0.44; GSL, 0.10–0.11; TL, 1.22–1.27.

T y p e   h o s t : *Tangara chilensis* (Vigors) – paradise tanager (Thraupidae).

T y p e   l o c a l i t y : Rio Mapari, Município Japurá, Amazonas

State, Brazil (02°02'32"S; 67°17'17"W).

T y p e   m a t e r i a l : Holotype female (MZUSP 2322, DNA voucher Mysp.Tach.1.4.2011.8), ex *Tangara chilensis*, JAP010 MPEG 63218; Rio Mapari, Município Japurá, Amazonas State, Brazil, 10 July 2007, collected by J.D. Weckstein. Paratypes: two males, same data as the holotype. Coll. Nos.: one male (FMNH-INS 94006); one male (MZUSP 2323).

E t y m o l o g y : Specific name is derived from country of origin (Brasilia).

Diagnosis. Belonging to the *bonariensis* species group (*sensu* Price and Dalgleish 2006), based on the presence, in both sexes, of a continuous row of setae on most tergites. Morphologically close to females of *M. icterocephalae* Price et Dalgleish, 2006 by tergite I lacking an extensive median enlargement; tergite I with < 15 setae; tergites III–V with > 20 setae; tergite VIII with < 18 setae; postspiracular setae IV long (similar to length of II or VIII). Males also morphologically close to *M. icterocephalae* by the normal-sized (not enlarged) metanotum and with >6 marginal setae (8 of Price and Dalgleish 2006); tergite I with > 14 and < 22 setae (16–24 of Price and Dalgleish 2006); tergite III with >20 setae (24 of Price and Dalgleish 2006); tergite IV–VI with >15 and < 25 setae (19–29 of Price and Dalgleish 2006); and tergite VIII with 13–14 setae (17–18 of Price and Dalgleish 2006).

Both sexes can be promptly identified by the chaetotaxy on tergites VIII (females, 14 *vs* 15–20 in *M. icterocephalae*; and males, 17–18 *vs* 3–7 in *M. icterocephalae*), and the tergal modifications in females of the new species are more discreet when compared with *M. icterocephalae*. Another possible distinctive character is the long length of the inner setae of the pleurite VIII in *M. brasiliensis* sp. n., which is at least 3 times longer than the outer setae on pleurite VIII. Whether one would group the new species with *M. violaceae* Price et Dalgleish, 2006, would depend on the individual examined from our type series (see, e.g. couplet 7 for females and 10 for males of the key presented by Price and Dalgleish 2006). However, they can be separated based on the slightly more numerous setae on sternites IV–VI and by the shape of the male genital sclerites.

Myrsidea saviti sp. n.   Figs. 9, 10, 33–37

Female. Habitus and head shape as in Fig. 9. Dorsal head seta 10, 0.037 long; *dhs11*, 0.095–0.101 long, ratio *dhs10/11* 0.366–0.389. Hypopharynx fully developed, *ls5* 0.06–0.07, ventrolateral fringe, 10 setae. Gula with 4 setae on each side. First tibia with 3 and 4 outer lateral ventral and dorsal setae, respectively. Mesonotum without median division. Metanotum with posterior margin straight and 8 setae on posterior margin, metasternal plate with 5–6 setae (as in Fig. 35). Setae of femoral brush, 14. Metanotum and abdomen as in Fig. 33. Tergites I–III very slightly pronounced on posterior margin. Median gap

present in each tergal setal row. Tergal setae: I, 11–12; II, 15; III, 14; IV, 12–13; V, 13; VI, 10–12; VII, 9–11; VIII, 6–8. Postspiracular setae shortest (0.12–0.14) on III, V and VI, and long (0.20–0.49) on I, II, IV, VII and VIII.

Sternal setae: I, 0; II, each aster of 4 setae, posterior margin with 17 and anteriorly with 4–5; III, 22–23; IV, 30–33; V, 32–38; VI, 32; VII,19; VIII–IX, 10–11; vulvar margin with 10–11 setae. Each pleurite III–VII with about 5–8 short marginal setae; absence of anterior setae on pleurites; pleurite VIII as in Fig. 34. Tergite IX with 1 inner posterior seta, on each side, 0.07 long. Anus with 32 ventral fringe setae, 30–32 dorsal. Dimensions (n = 2): TW, 0.43–0.44; POW, 0.32–0.33; HL, 0.31; PW, 0.28; PSPL, 0.11; MW, 0.41; MSPL, 0.14–0.15; AWIV, 0.53–0.55; ANW, 0.20–0.21; TL, 1.42–1.43.

Male. Much as in female, habitus as in Fig. 10. Gula with 4 setae on each side (one paratype with 5 on only one side). Metanotum with 8 setae on posterior margin. Setae of femoral brush, 11–14. Tergal setae: I, 7–10; II, 10–11; III, 10–13; IV, 10; V, 10–12; VI, 11–14; VII, 8–10; VIII, 9–10. Median gap present in each tergal setal row; tergal setae of similar length reaching the alveoli of the next tergal row. Postspiracular setae as for female. Pattern of chaetotaxy of tergites V–IX + X as in Fig. 36.

Sternal setae: I, 0; II, each aster of 4 setae (one paratype with 5 in only one side), posterior margin with 13–17 and anteriorly with 4–5; III, 17–20; IV, 21–25; V, 25–28; VI, 22–25; VII, 12–13; VIII, 12–15. Tergite IX with 1 inner posterior setae, on each side, 0.06–0.07 long. Anus with 8 internal setae on ventral side and 3 on dorsal. Genital sac sclerite as in Fig. 37, rounded apically and without distinct lateral arms. Dimensions (n = 3): TW, 0.39; POW, 0.29; HL, 0.27–0.28; PW, 0.25–0.26; PSPL, 0.10; MW, 0.33–0.34; MSPL, 0.12–0.13; AWIV, 0.40–0.41; GL, 0.38–0.39; GSL, 0.08–0.09; TL, 1.13–1.16.

Type host: *Tangara schrankii* (Spix) – green-and-gold tanager (Thraupidae).

Type locality: Rio Acanauí, Município Japurá, Amazonas State, Brazil (02°01'38"S; 66°40'28"W).

Type material: Holotype female (MZUSP 2324), ex *Tangara schrankii*, JAP378 MPEG 63222; Rio Acanauí, Município Japurá, Amazonas State, Brazil, 20 July 2007, collected by J.D. Weckstein. Paratypes: three males and one female, same data as the holotype. Coll. Nos.: one male (FMNH-INS 94007) and one female (FMNH-INS 94008, DNA voucher Mysp.Tasch.1.4.2011.9); two males (MZUSP 2325, 2326).

Etymology: Named in honour of Aaron Zvi Savit for his love of Thraupidae, *Tangara* in particular, and for collecting so many Thraupidae *Myrsidea* and other avian ecto- and endoparasites.

Diagnosis. Belonging to the *fusca* species group (*sensu* Price and Dalgleish 2006), based on the above-mentioned characters. Morphologically similar to *M. spizae* by lack of modifications on tergites I–III, and by fewer metasternal plate setae (only two pairs). However, fe-

males of *M. saviti* sp. n. have more setae on metanotal, tergal (e.g. VI, 10–12 *vs* 6–7) and sternal plates (e.g. VI, 32 *vs* 22–24); for the males, the shapes of the male genital sclerites are conspicuously distinct between these two species.

Species from Tyrannidae

Major review: Price et al. (2005).

Myrsidea cinnamomei Dalgleish et Price, 2005

Myrsidea cinnamomei Dalgleish et Price, 2005: 2, Type host and locality. *Pachyramphus cinnamomeus* Lawrence from Costa Rica. Valim et al., 2011: 13, ex *P. homochrous* Sclater in Panama.

Hosts: *Pachyramphus cinnamomeus* – Dalgleish and Price (2005), *P. homochrous* – Valim et al. (2011) (both Tityridae); *Attila citriniventris* Sclater – present study (Tyrannidae).

Material examined: three males and three females, ex *Attila citriniventris*, JAP141 MPEG 63079; Rio Mapari, Município Japurá, Amazonas State, Brazil (02°02'32"S; 67°17'17"W), 13 July 2007, collected by J.D. Weckstein. Coll. Nos.: one male (FMNH-INS 94009) and one female (FMNH-INS 94010, DNA voucher Mysp.Atci.1.4.2011.11); two males (MZUSP 2329, 2330) and two females (MZUSP 2327, 2328) .

Remarks. This *Myrsidea* species is unusual in several ways. First, *M. cinnamomeus* is now known to parasitise three host species, *Pachyramphus cinnamomeus*, *P. homochrous* and *Attila citriniventris*. The specimens from these three hosts are morphologically indistinguishable and DNA sequence data for *M. cinnamomei* from two of these hosts, *P. homochrous* and *A. citriniventris*, confirm that these parasites are in fact nearly identical (uncorrected mtDNA sequence divergence = 0.79%) as well.

Second, this louse species is found on two genera of hosts including *Attila*, which is in the family Tyrannidae, and *Pachyramphus*, which has been associated with the avian suboscine families Tyrannidae, Cotingidae and Tityridae (suborder Tyranni). Most recent molecular analyses place *Pachyramphus* in the avian family Tityridae (Ohlson et al. 2007a,b), which is related to Tyrannidae. However, the two avian genera that host *M. cinnamomei*, *Pachyramphus* and *Attila*, are not particularly closely related within the suboscine passerine tree of life.

Third, not only is *M. cinnamomei* found on multiple host species and genera, but it is also found in both Central America and South America and thus has a cross-Andes distribution. We only know of a handful of other records of *Myrsidea* species with cross-Andes distributions, *M. seminuda* ex *Thraupis palmarum* and *T. episcopus* in Costa Rica (Price and Dalgleish 2006) and ex *T. palmarum* in Brazil (Sychra et al. 2009). Additional genetic data from these and other cross-Andes louse taxa will help clarify whether there is ongoing geneflow or recent separation of populations of chewing lice in these cross-Andes regions.
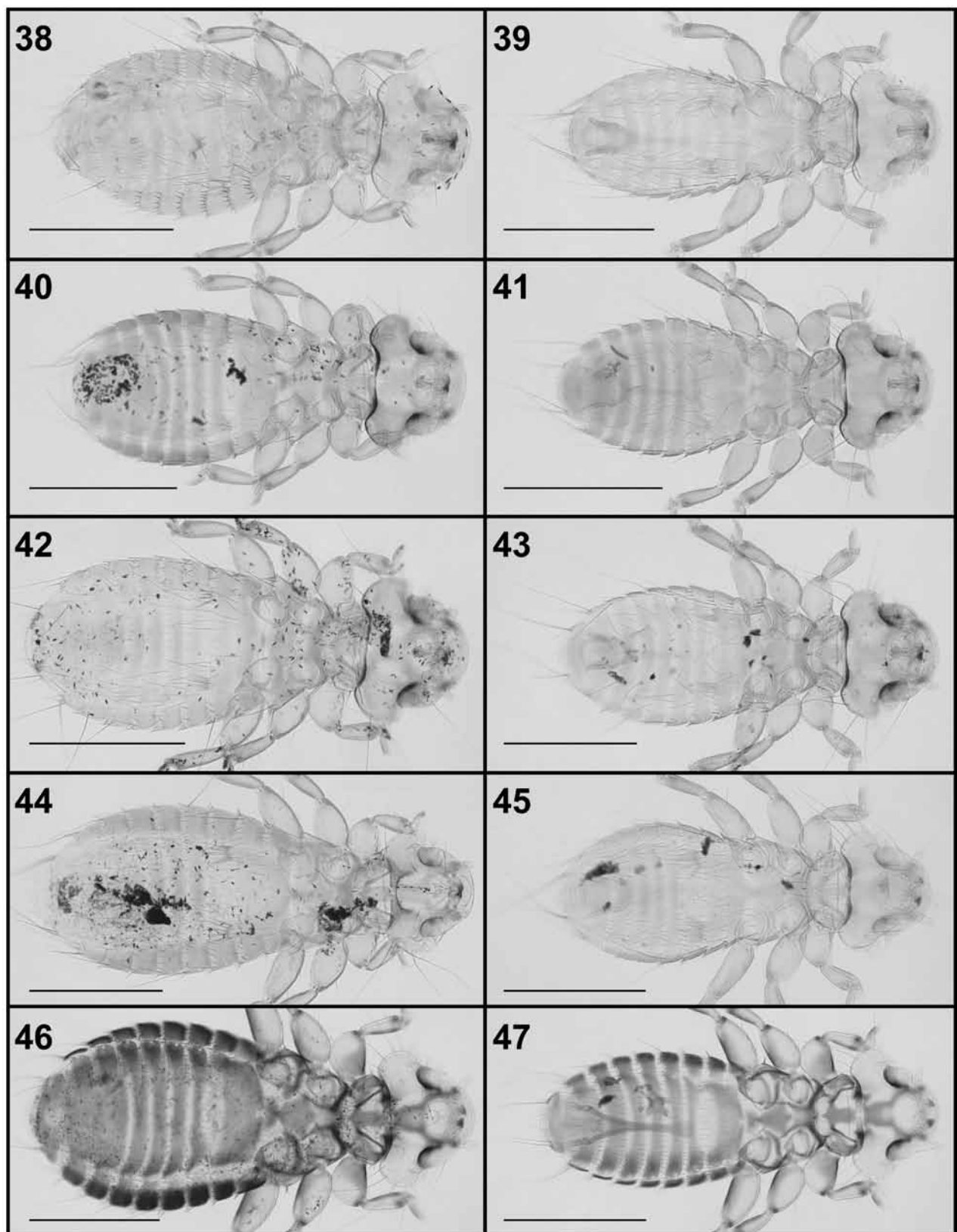
Figs. 38–47. Habitus in dorsal view. Females in left column, males in right column. **Figs. 38**, **39.** *Myrsidea rodriguesae* sp. n. **Figs. 40**, **41.** *M. cnemotriccola* sp. n. **Figs. 42**, **43.** *M. lathrotriccola* sp. n. **Figs. 44**, **45,** *M. faccioae* sp. n. **Figs. 46**, **47.** *M. lampropsaricola* sp. n. Scale bars = 0.5 mm.

Myrsidea rodriguesae sp. n.   Figs. 38, 39, 48–52

Female. Habitus and head shape as in Fig. 38. Dorsal head seta 10, 0.040–0.057 long; *dhs11*, 0.088–0.103 long, ratio *dhs10/11* 0.449–0.580. Hypopharynx fully developed, *ls5* 0.05–0.06, ventrolateral fringe, 9 setae. Gula with 4 setae on each side. First tibia with 3 and 4 outer lateral ventral and dorsal setae, respectively. Mesonotum without median division. Metanotum enlarged, with posterior margin conspicuously concave and 4 setae on posterior margin, metasternal plate with 6–7 setae (as in Fig. 50). Setae of femoral brush, 12–13. Metanotum and abdomen as in Fig. 48. Tergites I–III slightly pronounced on posterior margin. Median gap present in each tergal setal row. Tergal setae: I, 11–13; II, 12–16; III, 14–17; IV, 16–17; V, 17–20; VI, 16–20; VII, 13–15; VIII, 5. Post-spiracular setae shortest (0.12–0.24) on III, V and VI, and long (0.30–0.52) on I, II, IV, VII and VIII.

Sternal setae: I, 0; II, each aster of 4 setae (one paratype with 2 setae only on one side), posterior margin with 16–20 and anteriorly with 4; III, 26–32; IV, 28–31; V, 30–34; VI, 23–32; VII, 15–20; VIII–IX, 9–15; vulvar margin with 12 setae. Each pleurite III–VII with about 5–10 marginal setae, two first medial on ventral surface distinctly longer and setiform on IV–VII; presence of 1–6 anterior setae on pleurites II–VII; pleurite VIII as in Fig. 49. Tergite IX with 1 inner posterior setae, on each side, 0.05–0.06 long (holotype missing inner posterior setae in both sides). Anus with 37–41 ventral fringe setae, 35–41 dorsal. Presence of 5–6 setae on ventral fringe set submarginal on each side (included in total count). Dimensions (n = 3): TW, 0.43–0.44; POW, 0.33–0.34; HL, 0.29–0.31; PW, 0.26–0.28; PSPL, 0.10–0.11; MW, 0.40; MSPL, 0.14–0.15; AWIV, 0.57–0.59; ANW, 0.20–0.21; TL, 1.44–1.50.

Male. Much as in female, habitus as in Fig. 39. Gula with 4 setae on each side (rarely 5 setae on one side). Metanotum with 4 setae on posterior margin. Setae of femoral brush, 12–13. Tergal setae: I, 6; II, 8–10; III, 8–10; IV, 11–12; V, 10; VI, 10–12; VII, 6–10; VIII, 4. Median gap present in each tergal setal row. Postspiracular setae as for female. Pattern of chaetotaxy of tergites V–IX + X as in Fig. 51.

Sternal setae: I, 0; II, each aster of 4 setae, posterior margin with 14–15 and anteriorly with 3–4; III, 20–24; IV, 21–24; V, 25; VI, 24–26; VII, 14–15; VIII, 10–13. Tergite IX with 1 inner posterior setae (sometimes lacking on one side), on each side, 0.04–0.05 long. Anus with 7–8 internal setae on ventral side and 2–3 on dorsal. Genital sac sclerite as in Fig. 52, incised apically and with thin subapical lateral projections (lateral arms). Dimensions (n = 3): TW, 0.40; POW, 0.30–0.32; HL, 0.29; PW, 0.25–0.26; PSPL, 0.10–0.11; MW, 0.35–0.36; MSPL, 0.13–0.14; AWIV, 0.43–0.44; GL, 0.40–0.41; GSL, 0.08–0.09; TL, 1.24–1.27.

T y p e   h o s t : *Cnipodectes subbrunneus* (Sclater) – brownish flycatcher (Tyrannidae).

T y p e   l o c a l i t y : Lago Cumapi, Município Maraã, Amazonas State, Brazil (01°33'00"S; 65°50'14"W).

T y p e   m a t e r i a l : Holotype female (MZUSP 2331), ex *Cnipodectes subbrunneus*, JAP632 MPEG 63037; Lago Cumapi, Município Maraã, Amazonas State, Brazil, 29 July 2007, collected by J.D. Weckstein. Paratypes: three males and two females, same data as the holotype. Coll. Nos.: one male (FMNH-INS 94011) and one female (FMNH-INS 94012, DNA voucher Mysp.Cnsb.1.4.2011.13); two males (MZUSP 2333, 2334) and one female (MZUSP 2332).

E t y m o l o g y : This species is named in honour of Elinete Batista Rodrigues in appreciation of her hard work and dedication as a team member that helped make the collection of these louse specimens possible on the joint Museu Paraense Emilío Goeldi/Field Museum of Natural History Japurá expedition.

Diagnosis. Belonging to the *pitangi* species group (*sensu* Price et al. 2005), based on the reduced number of abdominal tergal and sternal setae, and by females lacking highly modified anterior tergites. Morphologically close to *M. flaviventris* Price, Hellenthal et Dalgleish, 2005, male differs in the shape of the genital sclerite (close to that of *M. flaviventris*, but with posterior portion of the sclerite incised); female differs by the straight shape of the posterior margin of the tergites II–IV (slightly enlarged in I–III of *M. flaviventris*).

The enlargement and sparse chaetotaxy of the metanotum in females are unique features among the *Myrsidea* species parasitizing Tyrannidae. The only species with some metanotal enlargement are *M. olivacei* Price, Hellenthal et Dalgleish, 2005 and *M. spadicei* Price, Hellenthal et Dalgleish, 2005, but they can be promptly distinguished in both sexes by fewer metanotal setae in *M. rodriguesae* sp. n. (4 *vs* 8–11, 10–13, respectively, of Price et al. 2005). On the other hand, the only *Myrsidea* species parasitizing Tyrannidae with such sparse metanotal chaetotaxy is *M. barbati* Price, Hellenthal et Dalgleish, 2005, which differs from *M. rodriguesae* sp. n. by the shape of the metanotum (not enlarged in *M. barbati*), larger number of tergal setae and shape of genital sclerite in males.

Myrsidea cnemotriccola sp. n.   Figs. 40, 41, 53–57

Female. Habitus and head shape as in Fig. 40. Dorsal head seta 10, 0.051–0.054 long; *dhs11*, 0.103–0.115 long, ratio *dhs10/11* 0.443–0.524. Hypopharynx fully developed, *ls5* 0.04–0.05, ventrolateral fringe, 10. Gula with 5 setae on each side. First tibia with 3 and 4 outer lateral ventral and dorsal setae, respectively. Mesonotum without median division. Metanotum with posterior margin straight and 8 setae on posterior margin, metasternal plate with 6 setae (as in Fig. 55). Setae of femoral brush, 13. Metanotum and abdomen as in Fig. 53. Tergites I–III very
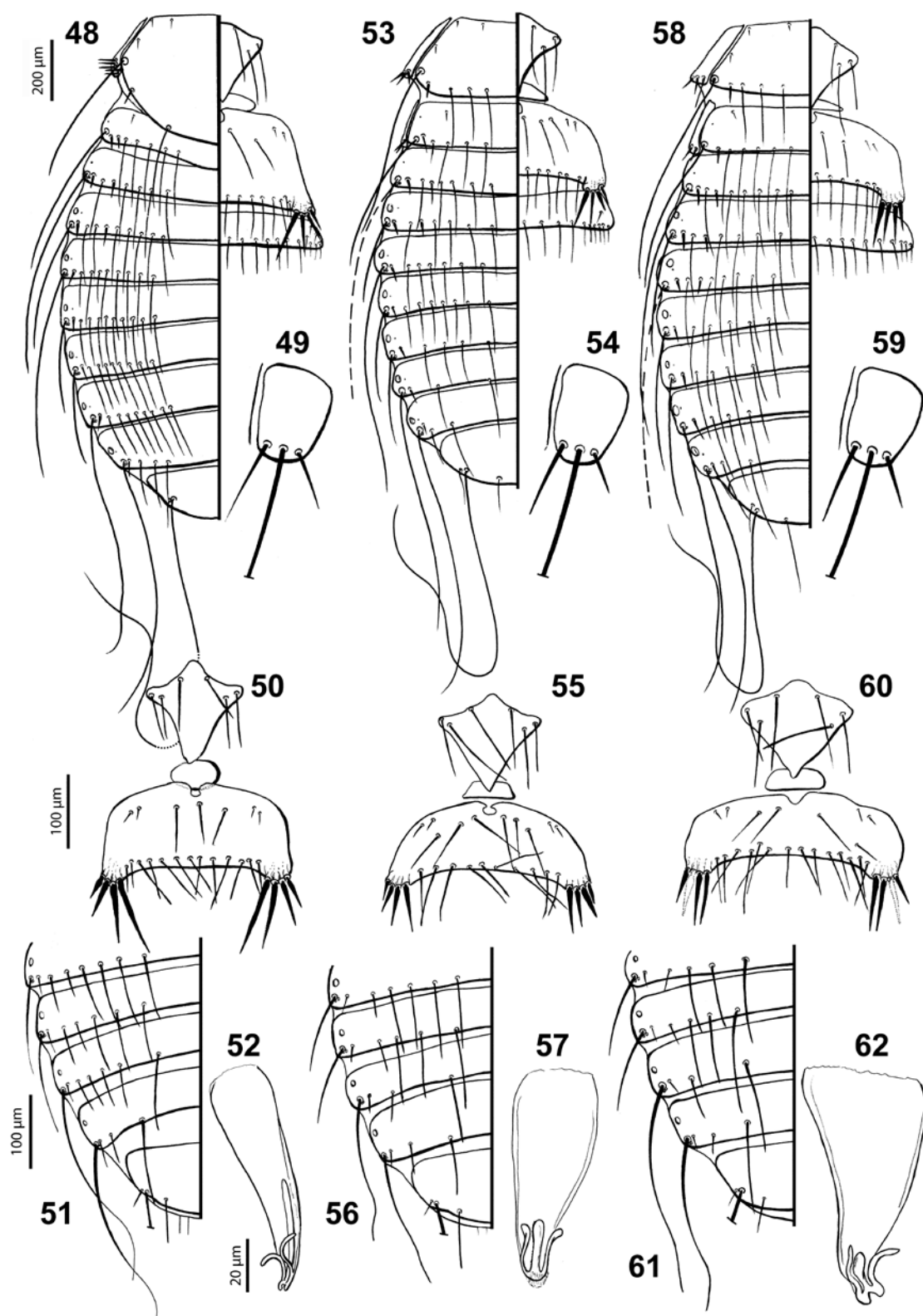
Figs. 48–52. *Myrsidea rodriguesae* sp. n. **Figs. 53–57.** *M. cnemotriccola* sp. n. **Figs. 58–62.** *M. lathrotriccola* sp. n. Female metanotum and dorsal abdomen (48, 53, 58). Pleurite VIII of female (49, 54, 59). Metasternal, sternal I and II plates (50, 55, 60). Tergites V–IX + X of male (51, 56, 61). Male genital sclerite (52, 57, 62).

slightly posterior pronounced, but undoubtedly of similar size. Median gap present in each tergal setal row. Tergal setae: I, 11; II, 12; III, 11; IV, 11; V, 12; VI, 8; VII, 4; VIII, 4. Postspiracular setae shortest (0.15–0.21) on III, V and VI, and long (0.26–0.44) on I, II, IV, VII and VIII.

Sternal setae: I, 0; II, each aster of 4 setae, posterior margin with 15 and anteriorly with 6; III, 22; IV, 31; V, 33; VI, 27; VII, 10; VIII–IX, 9; vulvar margin with 12 setae. Each pleurite III–VII with about 5–11 short marginal setae; absence of anterior setae on pleurites; pleurite VIII as in Fig. 54. Tergite IX with 1 inner posterior setae, on each side, 0.06–0.07 long. Anus with 34 ventral fringe setae, 33 dorsal. Dimensions (n = 1): TW, 0.45; POW, 0.34; HL, 0.30; PW, 0.26; PSPL, 0.11; MW, 0.41; MSPL, 0.15; AWIV, 0.53; ANW, 0.20; TL, 1.33.

Male. Much as in female, habitus as in Fig. 41. Gula with 5 setae on each side, rarely 4 setae on one side. Metanotum with 5 setae on posterior margin. Setae of femoral brush, 13–15. Tergal setae: I, 5–6; II, 8–9; III, 9–11; IV, 9–10; V, 10–11; VI, 4; VII, 4; VIII, 6. Median gap present in each tergal setal row. Postspiracular setae as for female. Pattern of chaetotaxy of tergites V–IX + X as in Fig. 56.

Sternal setae: I, 0; II, each aster of 4 setae (rarely 3 only on one side), posterior margin with 10–14 and anteriorly with 5–6; III, 18–19; IV, 24; V, 24–27; VI, 22–23; VII, 10–11; VIII, 8–10. Tergite IX with 1 inner posterior setae, on each side, 0.05–0.07 long. Anus with 8 internal setae on ventral side, and 3–4 on dorsal. Genital sac sclerite as in Fig. 57, rounded apically and with short and thick subapical lateral projections. Dimensions (n = 2): TW, 0.41–0.42; POW, 0.31–0.33; HL, 0.28–0.29; PW, 0.25–0.26; PSPL, 0.10; MW, 0.35–0.36; MSPL, 0.12–0.13; AWIV, 0.43–0.44; GL, 0.37–0.39; GSL, 0.08; TL, 1.19–1.20.

T y p e h o s t : *Cnemotriccus fuscatus* (Wied-Neuwied) – fuscous flycatcher (Tyrannidae).

T y p e l o c a l i t y : Rio Mapari, Município Japurá, Amazonas State, Brazil (02°02'60"S; 67°15'47"W).

T y p e m a t e r i a l : Holotype female (MZUSP 2335, DNA voucher Mysp.Cnfu.1.4.2011.12), ex *Cnemotriccus fuscatus*, JAP226 MPEG 63051; Rio Mapari, Município Japurá, Amazonas State, Brazil, 15 July 2007, collected by J.D. Weckstein. Paratypes: two males, same data as the holotype. Coll. Nos.: one male (FMNH-INS 94013); one male (MZUSP 2336).

E t y m o l o g y : Composed by *Cnemotriccus*, the monotypic genus of the host; and *-cola* (= dwell in Latin).

Diagnosis. Belonging to the *pitangi* species group (*sensu* Price et al. 2005), based on the reduced number of abdominal tergal and sternal setae, and by females lacking highly modified anterior tergites. The females have a slightly pronounced posterior margin on tergites I–III, making it morphologically close to *M. lathrotriccola* sp. n. (see below). They differ in both sexes by the relatively short tergal setae, reaching at most the alveolus or

slightly surpassing it, never reaching the middle of next seta (in *M. lathrotriccola* these setae reach the middle of the length of the tergal setae on next segment; *t*-test p = 0.0001, N = 20 setae measured). Males of *M. cnemotriccola* sp. n. have the same type of genital sclerites as *M. lathrotriccola*, with slight differences including rounded posterior margin (incised in *M. lathrotriccola*), longer median sclerotization, occupying about 1/3 of the entire sclerite (1/5 in *M. lathrotriccola*) and shorter inner setae on tergite IX (0.05–0.07 *vs* 0.02 in *M. lathrotriccola*). Other characters also distinguish these two morphologically similar species. The rough shape of the sternites II are distinctive (compare Figs. 55 and 60). The females are also most distinguishable by the length of inner setae on tergite IX (0.06–0.07 *vs* 0.14–0.15 in *M. lathrotriccola*) and by the pattern of chaetotaxy in tergite VII (compare Figs. 53 and 58). In addition to the genetic distinctiviness between these two species (Fig. 73), *M. cnemotriccola* seems to have the tendency to present smaller body measurements.

Based on the number of setae on sternite V (< 48), posterior margin of metanotum (at least 10, which is our 8 + 2) and temporal width (< 0.48), *M. cnemotriccola* could also be grouped with *M. contopi* Price, Hellenthal et Dalgleish, 2005 and *M. elaeniae* Price, Hellenthal et Dalgleish, 2005. The females can be distinguished based on slightly pronounced posterior margin of the tergites I–III (more noticeable on *M. contopi* and *M. elaeniae*). The males of these species are primarily separated based on the gross shape of their genital sclerites.

Myrsidea lathrotriccola sp. n.   Figs. 42, 43, 58–62

Female. Habitus and head shape as in Fig. 42. Dorsal head seta 10, 0.060 long; *dhs11*, 0.106 long, ratio *dhs10/11* 0.566. Hypopharynx fully developed, *ls5* 0.04, ventrolateral fringe, 10 setae. Gula with 4 setae on each side. First tibia with 3 and 4 outer lateral ventral and dorsal setae, respectively. Mesonotum without median division. Metanotum with posterior margin straight and 8 setae on posterior margin, metasternal plate with 6 setae (as in Fig. 60). Setae of femoral brush, 17. Metanotum and abdomen as in Fig. 58. Tergites unmodified, of similar size. Median gap present in each tergal setal row. Tergal setae: I, 12; II, 12; III, 14; IV, 13; V, 11; VI, 9; VII, 6 VIII, 4. Postspiracular setae shortest (0.21–0.30) on III, V and VI, and extremely long (0.38–0.56) on I, II, VII and VIII. Postspiracular setae IV broken in holotype, but seems to be long.

Sternal setae: I, 0; II, each aster of 4 setae, posterior margin with 14 and anteriorly with 4; III, 21; IV, 37; V, 37; VI, 32; VII, 11; VIII–IX, 11; vulvar margin 9 setae. Each pleurite III–VII with about 4–6 short marginal setae; absence of anterior setae on pleurites; pleurite VIII as in Fig. 59. Tergite IX with 1 inner posterior setae, on each side, 0.14–0.15 long. Anus with 29 ventral fringe setae, 35 dorsal. Dimensions (n = 1): TW, 0.47; POW, 0.36;

HL, 0.33; PW, 0.29; PSPL, 0.10; MW, 0.44; MSPL, 0.13; AWIV, 0.57; ANW, 0.20; TL, 1.44.

Male. Much as in female, habitus as in Fig. 43. Gula with 4 setae on left and 5 setae on right side. Metanotum with 7 setae on posterior margin. Setae of femoral brush, 12. Tergal setae: I, 8; II, 10; III, 10; IV, 11; V, 8; VI, 8; VII, 4; VIII, 3. Median gap present in each tergal setal row. Postspiracular setae as for female. Pattern of chaetotaxy of tergites V–IX + X as in Fig. 61.

Sternal setae: I, 0; II, each aster of 4 setae, posterior margin with 14 and anteriorly with 4; III, 19; IV, 25; V, 30; VI, 27; VII, 11; VIII, 9. Tergite IX with 1 inner posterior setae, on each side, 0.02 long. Anus with 8 internal setae on ventral side, and 4 on dorsal side. Genital sac sclerite as in Fig. 62, notched apically and with well-developed subapical lateral projections. Dimensions (n = 1): TW, 0.43; POW, 0.34; HL, 0.31; PW, 0.27; PSPL, 0.10; MW, 0.39; MSPL, 0.13; AWIV, 0.47; GL, 0.39; GSL, 0.09; TL, 1.28.

Type host: *Lathrotriccus euleri* (Cabanis) – Euler's flycatcher (Tyrannidae).

Type locality: Lago Cumapi, Município Maraã, Amazonas State, Brazil (01°33'35"S; 65°52'48"W).

Type material: Holotype female (MZUSP 2337, DNA voucher Mysp.Laeu.1.4.2011.14), ex *Lathrotriccus euleri*, JAP762 MPEG 63048; Lago Cumapi, Município Maraã, Amazonas State, Brazil, 31 July 2007, collected by J.D. Weckstein. Paratype: one male (MZUSP 2338), same data as the holotype.

Etymology: Composed by *Lathrotriccus*, the monotypic genus of the host; and *-cola* (= dwell in Latin).

Diagnosis. Belonging to the *pitangi* species group (*sensu* Price et al. 2005), based on the same reasons mentioned above for *M. cnemotriccola* sp. n. and *M. rodriguesae* sp. n. Morphologically close to *M. cnemotriccola* by the absence of medioposterior convexity on tergites I–III (slightly developed on II–III in *M. cnemotriccola*) and by metanotal and tergal chaetotaxy, their main distinctive characters were discussed above (see diagnosis of *M. cnemotriccola*). Also could be grouped with *M. contopi* and *M. elaeniae* using the same distinctive characters listed above (for *M. cnemotriccola*). The new species is unique among the *Myrsidea* parasitizing the Tyrannidae by the complete absence of any medioposterior convexity on tergites I–III in female (see Price et al. 2005).

Species from Troglodytidae

Major reviews: Price et al. (2008a).

Myrsidea faccioae sp. n.   Figs. 44, 45, 63–67

Female. Habitus and head shape as in Fig. 44. Dorsal head seta 10, 0.052–0.055 long; *dhs11*, 0.120–0.125 long, ratio *dhs10/11* 0.416–0.458. Hypopharynx reduced, *ls5* 0.04, ventrolateral fringe, 9 setae. Gula with 4 setae on each side. First tibia with 3 and 4 outer lateral ventral and dorsal setae, respectively. Mesonotum without median division. Metanotum with posterior margin straight and 8–9 setae on posterior margin, metasternal plate with 6 setae (as in Fig. 65). Setae of femoral brush, 16. Metanotum and abdomen as in Fig. 63. Tergites I–III straight on posterior margin, without modification. Median gap present in each tergal setal row. Tergal setae: I, 12–13; II, 15–16; III, 16–17; IV, 17; V, 14–16; VI, 12–13; VII, 5–9; VIII, 4. Postspiracular setae shortest (0.16–0.22) on I, III, V and VI, and long (0.34–0.49) on II, IV, VII and VIII.

Sternal setae: I, 0; II, each aster of 6 setae (one paratype with 5 only on one side), posterior margin with 17–20 and anteriorly with 8; III, 21–25; IV, 32–34; V, 38–42; VI, 33–38; VII, 29; VIII–IX, 17–21; vulvar margin spiculated and with 12–13 setae. Each pleurite III–VII with about 5–9 short marginal setae; absence of anterior setae on pleurites; pleurite VIII as in Fig. 64. Tergite IX with 1 inner posterior setae, on each side, 0.04–0.05 long. Anus with 33–39 ventral fringe setae, 39–41 dorsal. Dimensions (n = 2): TW, 0.45–0.46; POW, 0.34; HL, 0.31; PW, 0.31; PSPL, 0.13; MW, 0.45–0.46; MSPL, 0.16–0.17; AWIV, 0.64; ANW, 0.26; TL, 1.64.

Male. Much as in female, habitus as in Fig. 45. Gular plate with 4 setae on each side (rarely 3 on only one side). Metanotum with 6–8 setae on posterior margin. Setae of femoral brush, 12–13. Tergal setae: I, 10–12; II, 14–15; III, 14–19; IV, 15–18; V, 14–15; VI, 13–16; VII, 10–11; VIII, 6–7. Median gap present in each tergal setal row; tergal setae of similar length reaching the alveoli of the next tergal row. Postspiracular setae as for female. Pattern of chaetotaxy of tergites V–IX + X as in Fig. 66.

Sternal setae: I, 0; II, each aster of 6 setae (one paratype with 7 only on one side), posterior margin with 16–18 and anteriorly with 7–11; III, 16–23; IV, 27–33; V, 33–36; VI, 32–34; VII, 29; VIII, 30–36. Tergite IX with 1 inner posterior setae, on each side, 0.03–0.04 long. Anus with 8 internal setae on ventral side, and 4–5 on dorsal. Genital sac sclerite as in Fig. 67. Dimensions (n = 3): TW, 0.41; POW, 0.31; HL, 0.28–0.30; PW, 0.28–0.29; PSPL, 0.10–0.12; MW, 0.39; MSPL, 0.13–0.14; AWIV, 0.50–0.53; GL, 0.42–0.47; GSL, 0.09; TL, 1.30–1.36.

Type host: *Cyphorhinus arada transfluvialis* (Todd) – musician wren (Troglodytidae).

Type locality: Lago Cumapi, Município Maraã, Amazonas State, Brazil (01°33'35"S; 65°52'48"W).

Type material: Holotype female (MZUSP 2339), ex *Cyphorhinus arada transfluvialis*, JAP713 MPEG 63195; Lago Cumapi, Município Maraã, Amazonas State, Brazil, 30 July 2007, collected by J.D. Weckstein. Paratypes: three males and one female, same data as the holotype. Coll. Nos.: one male (FMNH-INS 94014) and one female (FMNH-INS 94015, DNA voucher Mysp.Cyar.1.4.2011.10); two males (MZUSP 2340, 2341).

Etymology: This species is named in honour of Maya Sonnenschein Faccio in appreciation of her hard work and dedication as a team member that helped make the collection of
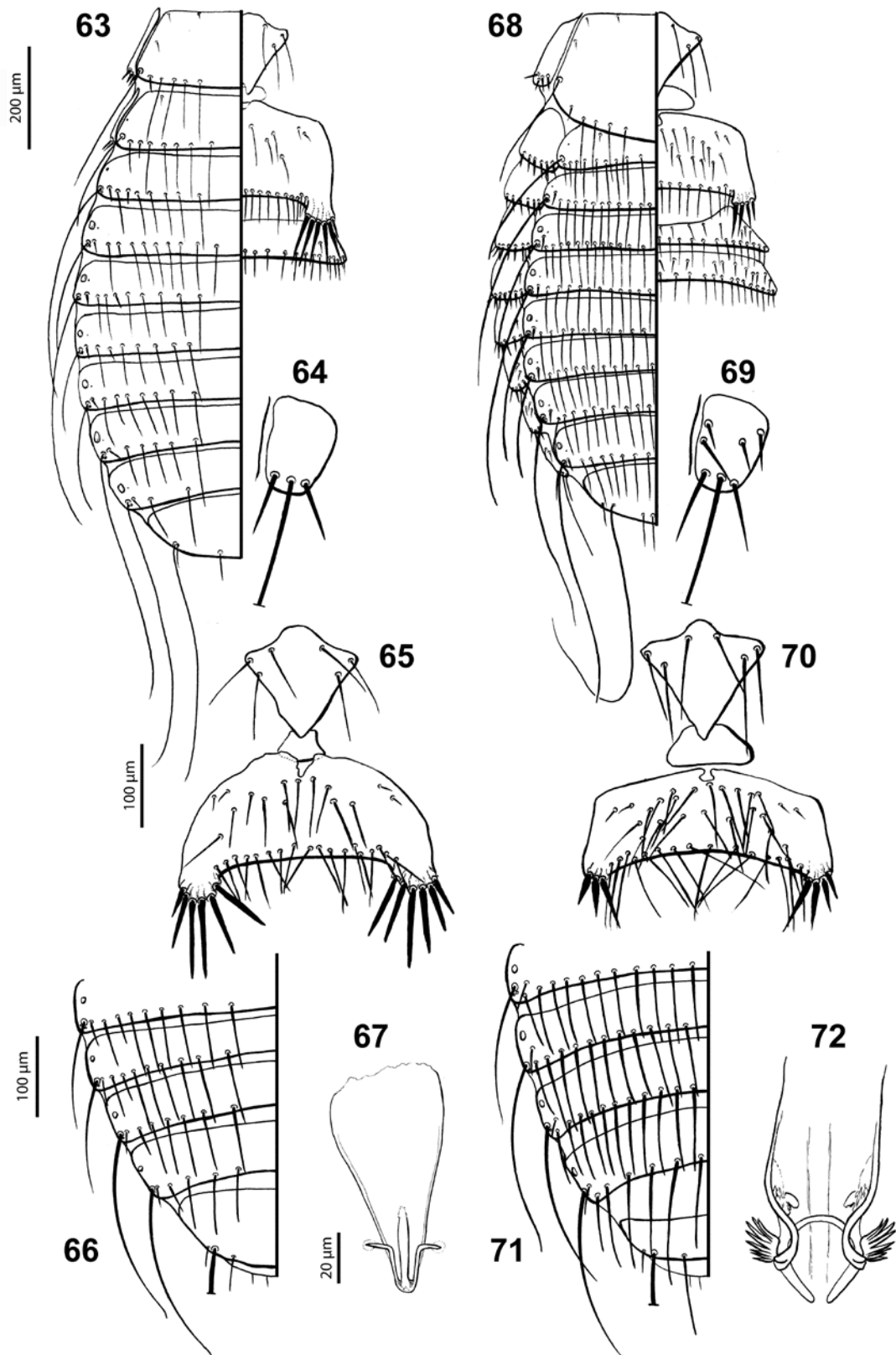
Figs. 63–67. *Myrsidea faccioae* sp. n. **Figs. 68–72.** *M. lampropsaricola* sp. n. Female metanotum and dorsal abdomen (63, 68). Pleurite VIII of female (64, 69). Metasternal, sternal I and II plates (65, 70). Tergites V–IX + X of male (66, 71). Male genital sclerite (67, 72).

these louse specimens possible on the joint Museu Paraense Emilío Goeldi/Field Museum of Natural History Japurá expedition.

Diagnosis. Among the *Myrsidea* species which parasitise wrens, both sexes of this new species are morphologically close to *Myrsidea whitemani* Price, Johnson et Dalgleish, 2008 by having weakly developed hypopharyngeal sclerites. In both sexes the long length, reaching the posterior margin of sternite III, of the lateral spine-like setae on the asters of sternite II is distinctive (short in *M. whitemani*, no more than one very long internal spine); the postspiracular setae on segments I, III, V and VI are short (long in *M. whitemani*); and the smaller total length (1.68–1.81 in females, 1.46–1.49 in males of *M. whitemani*). The males have distinct genital sclerite with rounded posterior margin (incised in *M. whitemani*) and females have distinctly shaped sternite II (as long as wide, instead of wider than longer in *M. whitemani*). Also they have the tendency to present fewer setae on tergites VI (12–13 *vs* 18–20 in *M. whitemani*, 22–24 of Price et al. 2008a) and VII (5–9 *vs* 13–14 in *M. whitemani*, 17–18 of Price et al. 2008a).

Species from Icteridae

Major reviews: Clay (1968).

Myrsidea lampropsaricola sp. n.   Figs. 46, 47, 68–72

Female. Habitus and head shape as in Fig. 46. Dorsal head seta 10, 0.039–0.044 long; *dhs11*, 0.114–0.135 long, ratio *dhs10/11* 0.322–0.360. Hypopharynx reduced, *ls5* 0.09–0.13, ventrolateral fringe, 9 setae. Gula with 5 setae on each side (one paratype with 4 and 5 on each side). First tibia with 3 and 4 outer lateral ventral and dorsal setae, respectively. Mesonotum without median division. Metanotum with posterior margin concave, central portion surpassing up to middle of tergite I, with 12–13 setae on posterior margin, metasternal plate with 7–8 setae (as in Fig. 70). Setae of femoral brush, 14–16. Metanotum and abdomen as in Fig. 68. Tergites I–III roughly straight on posterior margin. Without median gap in each tergal setal row. Tergal setae: I, 21–22; II, 23–26; III, 21–27; IV, 20–27; V, 25–27; VI, 24–25; VII, 21–22; VIII, 15–16. Postspiracular setae shortest (0.15–0.25) on I, III, V and VI, and long (0.38–0.47) on II, IV, VII and VIII.

Sternite III greatly arched and narrowed medially (Fig. 68). Anterior row of setae present on sternites. Sternal setae: I, 0; II, each aster of 4 setae, posterior margin with 16–20 and anteriorly with 26–29; III, 28–32 (16–18); IV, 26–30 (21–22); V, 27–33 (22–23); VI, 24–28 (23–26); VII, 15 (22–24); VIII–IX, 50–56; vulvar margin spiculated and with 15 setae. Each pleurite III–VII with about 5–8 short marginal setae; presence of 1–6 anterior setae on pleurites II–VII; pleurite VIII as in Fig. 69. Tergite IX with 2–4 inner posterior setae, on each side, 0.04–0.07 long. Anus with 36–38 ventral fringe setae, 41–45 dor-

sal. Dimensions (n = 3): TW, 0.50–0.52; POW, 0.37; HL, 0.32–0.35; PW, 0.35–0.36; PSPL, 0.15; MW, 0.51–0.55; MSPL, 0.16–0.18; AWIV, 0.66–0.76; ANW, 0.25–0.26; TL, 1.58–1.69.

Male. Much as in female, habitus as in Fig. 47. Gular plate with 4–6 setae on each side. Metanotum with 8–9 setae on posterior margin. Setae of femoral brush, 12–15. Tergal setae: I, 15–19; II, 16–19; III, 19–20; IV, 18–23; V, 20–22; VI, 17–22; VII, 15–21; VIII, 12–13. Without median gap in each tergal setal row; tergal setae of similar length reaching alveoli of next tergal row. Postspiracular setae as for female. Pattern of chaetotaxy of tergites V–IX + X as in Fig. 71.

Anterior row of setae present on sternites. Sternal setae: I, 0; II, each aster of 2–4 setae, posterior margin with 15–16 and anteriorly with 20–21; III, 20–24 (13); IV, 26–28 (17–20); V, 23–27 (20–22); VI, 20–25 (22); VII, 13–19 (24); VIII, 30–39. Tergite IX with 1 inner posterior seta, on each side, 0.09 long. Anus with 8 internal setae on ventral side, and 3 on dorsal. Genital sac sclerite as in Fig. 72. Dimensions (n = 3): TW, 0.45–0.46; POW, 0.32–0.33; HL, 0.28–0.30; PW, 0.30–0.31; PSPL, 0.13; MW, 0.40–0.41; MSPL, 0.14–0.15; AWIV, 0.47–0.49; GL, 0.46–0.48; GSL, 0.10; TL, 1.39–1.42.

T y p e   h o s t : *Lampropsar tanagrinus* (Spix) – velvet-fronted grackle (Icteridae).

T y p e   l o c a l i t y : Rio Acanauí, Município Japurá, Amazonas State, Brazil (02°00'53"S; 66°39'56"W).

T y p e   m a t e r i a l : Holotype female (MZUSP 2342), ex *Lampropsar tanagrinus*, JAP366 MPEG 63237; Rio Acanauí, Município Japurá, Amazonas State, Brazil, 20 July 2007, collected by J.D. Weckstein. Paratypes: three males and two females, same data as the holotype. Coll. Nos.: one male (FMNH-INS 94016) and one female (FMNH-INS 94017, DNA voucher Mysp.Lata.1.4.2011.5); two males (MZUSP 2344, 2345) and one female (MZUSP 2343).

E t y m o l o g y : Composed by *Lampropsar*, the monotypic genus of the host; and *-cola* (= dwell in Latin).

Diagnosis. Morphologically close to *M. psittaci* Carriker, 1955 by the greatly reduced sitophore sclerite of the hypopharynx, absence of anterior tergal setae, reduced number of anterior pleural setae, and on males the inwardly projecting posterior arm of basal plate angulated (see Clay 1968). However, *M. lampropsaricola* sp. n. can be promptly distinguished by *M. psittaci* by the shape of genital sclerites in males and on females by the shape of the metanotum and tergite III.

Phylogenetic and morphological analyses

Molecular phylogenetic data are consistent with the morphological diagnosis of these ten new *Myrsidea* species. All ten of these new species are both genetically and phylogenetically distinct as shown in the maximum likelihood phylogram based on mtDNA COI sequences (Fig. 73). If one takes the tree at face value, without

Fig. 73. Best maximum likelihood phylogram of Neotropical *Myrsidea* taxa based on the mtDNA COI sequences. Numbers above nodes are maximum likelihood bootstrap support. Only support values greater than 50% are shown on the tree. New species described in the present paper are in bold type and bigger font.

considering the weak bootstrap support for many nodes, clades of closely related *Myrsidea* species tend to be from the same or closely related host families. Furthermore, most of the strongly supported nodes also group *Myrsidea* taxa found on the same or closely related host families. For example, *M. brasiliensis* comes out in a large but weakly supported clade of *Myrsidea* species parasitizing birds in the family Thraupidae.

One particularly interesting phylogenetic result is that the two newly described *M. circumsternata* and *M. isacantha*, which parasitise birds in the family Formicariidae, are well supported sister taxa and are phylogenetically distinct from nearly all other *Myrsidea* species, which matches their morphological distinctiveness (e.g. pres-

ence of *dhs23* and *dps2*) and required us to broaden the set of diagnostic characters used to the define of the genus *Myrsidea*.

As defined by Clay (1966, 1969) one of the key characters that distinguishes the genus *Myrsidea* from other Menoponidae (e.g. *Dennyus* Neumann, 1906) is the absence of dorsal head seta 23 (*sensu* Clay 1969). Another defining character of the genus *Myrsidea* is the absence of central pronotal setae (*dps* 1 and 2) (Clay 1966), although three years later Clay (1969) presented data showing that some species of *Myrsidea* could have at least one pair of central pronotal setae (see couplet 32). The occipital setae (*dhs* 21 and 22) are present in all Menoponidae and their

Table 1. Estimate of total known and unknown Brazilian *Myrsidea* species diversity based on an index of host specificity calculated from a list of perching birds (Passeriformes), hummingbirds (Trochilidae) and toucans (Ramphastidae) found in Brazil derived from the Howard and Moore (Dickinson 2003) checklist reported by Avibase (Lepage 2013).

Brazilian bird families parasitised by *Myrsidea*	Known World fauna				Potential Brazilian fauna**		Brazilian fauna			
	Bird species	*Myrsidea* species	Host species for *Myrsidea*	IS*	*Myrsidea* species	Host species for *Myrsidea*	Bird species ***	*Myrsidea* species	Host species for *Myrsidea*	Estimate of *Myrsidea* species in Brazil****
Trochilidae	331	3	3	1.00	1	1	80	0	0	80
Ramphastidae	120	9	18	0.50	7	9	27	7	8	13
Pipridae	48	4	3	1.33	3	2	35	2	2	47
Cotingidae	96	2	2	1.00	1	1	53	0	0	53
Tyrannidae	400	15	14	1.07	16	15	204	4	4	219
Thamnophilidae	206	6	6	1.00	4	4	162	0	0	162
Formicariidae	62	3	3	1.00	3	3	15	3	3	15
Furnariidae	236	4	6	0.67	2	3	106	0	0	71
Dendrocolaptidae	50	2	2	1.00	2	2	36	0	0	36
Corvidae	117	66	56	1.18	1	1	8	1	1	9
Hirundinidae	84	7	10	0.70	6	5	16	0	0	11
Troglodytidae	76	4	4	1.00	1	1	17	1	1	17
Turdidae	165	21	27	0.78	7	6	17	1	1	13
Estrildidae	130	4	5	0.80	1	1	1	0	0	1
Icteridae	98	10	18	0.56	7	8	37	3	3	21
Coerebidae	1	1	1	1.00	1	1	1	0	0	1
Emberizidae	308	16	16	1.00	6	6	73	2	2	73
Thraupidae	202	31	32	0.97	18	19	78	5	5	76
Cardinalidae	42	5	4	1.25	3	3	16	1	1	20
Parulidae	114	4	4	1.00	2	2	22	0	0	22
Fringillidae	168	5	8	0.63	2	3	4	0	0	2
Total	3054	222	242	0.93	94	96	1008	30	31	962

*Index of specificity (IS) = *Myrsidea* species / host species of *Myrsidea;* IS = 1; high specificity; IS < 1; low specificity, one *Myrsidea* species parasitises many host species; IS > 1; some cases of duplication (or secondary infestation) leads to one host species being parasitised by multiple *Myrsidea* species; **based on host association data of *Myrsidea* from Dalgleish and Price 2003, Price et al. 2003, 2004, 2005, 2008a,b,c, Price and Dalgleish 2006, Price and Johnson 2009, Sychra et al. 2009, Kounek et al. 2011a,b; ***the total value does not include 19 *incertae sedis* host species for which there are no *Myrsidea* records and thus this a slight underestimate; ****estimate of *Myrsidea* species in Brazil = bird species in Brazil × index of specificity.

relative length and thickness may provide specific or generic characters (Clay 1969).

In addition to other generic characters for the genus, Clay (1966) suggested that the small size of the outer occipital setae (*dhs* 22) of *Myrsidea* could be diagnostic for the genus. This is true for *Myrsidea* from other species groups examined by us, including material from a variety of host families (ex Cardinalidae, Corvidae, Dendrocolaptidae, Emberizidae, Hirundinidae, Icteridae, Ramphastidae, Thraupidae, Trochilidae, Troglodytidae, Turdidae, Tyrannidae, Tityridae), which all have a very short *dhs22*. However, in the species from Formicariidae, the *dhs22* is as long as the *dhs21* (as noted by Sychra et al. 2006).

Nevertheless, instead of erecting a new generic name for these three taxa, we have opted to broaden the definition of the genus *Myrsidea* as having *dhs22* short or long and *dhs23* absent or rarely present (Fig. 12). These generic limits are conservatively provisional until a large systematic study involving morphological and molecular data, including additional material from the Formicariidae, has been undertaken to better characterize morphological features that define groups in this speciose chewing louse

genus. However, for the most part, named *Myrsidea* species and unnamed ones can still be generically placed in *Myrsidea* using the generic key presented by Clay (1969) and the key for genera found on Passeriformes by Price et al. (2003).

The phylogenetic results also suggest that *M. icterocephalae* and *M. brasiliensis*, two members of the *bonariensis* species group as defined by Price and Dalgleish (2006), are phylogenetically in the same clade, although bootstrap support for these relationships is weak. However, morphologically defined members of the *fusca* species group, also defined by Price and Dalgleish (2006), do not necessarily come out as close relatives in the tree presented here, perhaps because many relationships in this tree are not strongly supported. Therefore, additional data are likely to move many of the taxa around and one important focus of future work on *Myrsidea* should be to collect additional molecular data and test the monophyly of groups defined by morphological features.

Lastly, nearly all of the *Myrsidea* species analysed here using both morphology and molecular data are extremely host specific. Exceptions indicated by both morphologi-

cal and molecular analysis include *M. seminuda*, which parasitises *Thraupis episcopus* and *T. palmarum*, *M. bessae*, which parasitises *Thryothorus fasciatoventris* and *T. semibadius*, and *M. cinnamomei*, which parasitises three hosts in two different, but somewhat related host families, *Attila citriniventris*, *Pachyramphus homochrous* and *P. cinnamomeus*. Interestingly, two of these 'host generalist' *Myrsidea*, *M. bessae* and *M. cinnamomei*, are phylogenetically closely related (Fig. 73) and thus, perhaps, there is something about this clade of *Myrsidea* that allows them to parasitise multiple suboscine (suborder Tyranni) host species. Future analyses of host specificity (similar to those by Johnson et al. 2009, 2011) in a larger phylogenetic context could clarify this pattern.

Estimate of Brazilian *Myrsidea* species diversity

Our analysis (see Table 1) of published *Myrsidea* host association records (Clay 1968, Dalgleish and Price 2003, Price et al. 2003, 2004, 2005, 2008a–c, Price and Dalgleish 2006, Price and Johnson 2009, Sychra et al. 2009) with reference to the Howard and Moore (Dickinson 2003) checklist of birds from Brazil reported by Avibase produced an estimate of the potential number of described *Myrsidea* species found on avian hosts known from Brazil (90 species) and an estimate of the total number of *Myrsidea* species given levels of host specificity and the total number of bird species found in Brazil from avian families known to host *Myrsidea* (*ca* 940 species).

Our extrapolated estimate of the number of *Myrsidea* species that should be in Brazil is approximately one order of magnitude greater than the potential number of named *Myrsidea* species from Brazil (90) and more than one order of magnitude greater than the number of described *Myrsidea* species known from Brazil (19 plus the 10 described in this paper = 29 species). Our extrapolation suggests that given our understanding of *Myrsidea* host specificity and the diversity of Brazilian birds, nearly 930 unnamed *Myrsidea* species are in need of discovery, study and description. Furthermore, if one puts this estimate into the context of overall louse diversity in Brazil, which has *ca* 470 known species of Phthiraptera (M.P. Valim – unpublished data), our result is even more staggering. Essentially, there may be nearly twice as many *Myrsidea* species waiting to be described from Brazilian birds than there are named Phthiraptera taxa known from Brazil so far.

Furthermore, from a worldwide perspective, the Brazilian estimate is more than two times the total worldwide number of *Myrsidea* species (*ca* 350) described thus far (Sychra 2010, Valim et al. 2011). Therefore, the ten new species described here are only a drop in the bucket of *Myrsidea* species diversity in Brazil and on the planet. We have only begun to understand this megadiverse parasite group and this estimate clearly underscores the importance of the critical first steps, taxonomic description and

phylogenetic analysis, to understanding the biodiversity of megadiverse parasite groups such as the louse genus *Myrsidea*.

Checklist for the species of *Myrsidea* recorded in Brazil. Records are based on Brazilian states.

1. *Myrsidea abbreviata* Eichler, 1951
   Host: *Ramphastos dicolorus* Linnaeus
   (Piciformes: Ramphastidae)
   Record: Santa Catarina
   Reference: Eichler (1951: 50), Price et al. (2004: 11)
2. *Myrsidea aleixoi* Price, Hellenthal et Weckstein, 2004
   Host: *Pteroglossus beauharnaesii* Wagler
   (Piciformes: Ramphastidae)
   Record: Mato Grosso
   Reference: Price et al. (2004: 13)
3. *Myrsidea andyolsoni* Dalgleish et Price, 2003
   Host: *Heterocercus linteatus* (Strickland)
   (Passeriformes: Pipridae)
   Record: Brazil (no precise locality)
   Reference: Dalgleish and Price (2003: 171)
4. ***Myrsidea brasiliensis* sp. n.**
   Host: *Tangara chilensis*
   Record: Amazonas
   Reference: Present study (2013: 386)
5. ***Myrsidea cacioppoi* sp. n.**
   Host: *Lanio fulvus*
   Record: Amazonas
   Reference: Present study (2013: 384)
6. *Myrsidea ceciliae* Carriker et Díaz-Ungría, 1961
   Hosts: *Ramphastos vitellinus culminatus* Gould
   and *Ramphastos vitellinus ariel* Vigors
   Records: Amazonas, Mato Grosso, Pará
   and São Paulo
   Reference: Price et al. (2004: 5, 6)
7. *Myrsidea cinnamomei* Dalgleish et Price, 2005
   Host: *Attila citriniventris*
   Record: Amazonas
   Reference: Present study (2013: 387)
8. ***Myrsidea circumsternata* sp. n.**
   Host: *Formicarius colma*
   Record: Amazonas
   Reference: Present study (2013: 383)
9. ***Myrsidea cnemotriccola* sp. n.**
   Host: *Cnemotriccus fuscatus*
   Record: Amazonas
   Reference: Present study (2013: 389)
10. *Myrsidea coronatae* Price et Dalgleish, 2007
    Host: *Paroaria capitata* (Orbigny et Lafresnaye)
    (Passeriformes: Emberizidae)
    Record: Mato Grosso do Sul
    Reference: Sychra et al. (2009: 501)
11. *Myrsidea dorotheae* Eichler, 1953
    Host: *Pteroglossus inscriptus humboldti* Wagler
    Record: Amazonas
    Reference: Price et al. (2004: 5, 6)

12. *Myrsidea downsi* Clay, 1968
   Host: *Psarocolius decumanus* (Pallas)
   (Passeriformes: Icteridae)
   Record: Brazil (no precise locality)
   Reference: Clay (1968: 218).
13. *Myrsidea edgarsmithi* Dalgleish et Price, 2003
   Host: *Pipra erythrocephala* (Linnaeus)
   (Passeriformes: Pipridae)
   Record: Brazil (no precise locality)
   Reference: Dalgleish and Price (2003: 170)
14. *Myrsidea elegans* Ansari, 1956
   Host: *Turdus rufiventris* Vieillot
   (Passeriformes: Turdidae)
   Localities: Rio de Janeiro and Rio Grande do Sul
   References: Valim and Serra-Freire (2003: 155);
   Valim et al. (2009: 252)
   Remarks. The specimens reported by Valim and
   Serra-Freire (2003) are most likely an undescribed
   species of *Myrsidea*, representing a second record of
   this louse genus on *Turdus rufiventris* (M.P. Valim –
   unpublished data)
15. *Myrsidea extranea* (Carriker, 1903)
   Host: *Ramphastos tucanus cuvieri* Wagler
   Records: Amazonas and Mato Grosso
   Reference: Price et al. (2004: 8)
16. ***Myrsidea faccioae* sp. n.**
   Host: *Cyphorhinus arada transfluvialis* (Todd)
   Record: Amazonas
   Reference: Present study (2013: 392)
17. *Myrsidea fallax* Kéler, 1938
   Host: *Cyanocorax cyanomelas* (Vieillot)
   Record: Mato Grosso
   Reference: Oniki (1999: 189)
18. ***Myrsidea isacantha* sp. n.**
   Host: *Chamaeza nobilis*
   Record: Amazonas
   Reference: Present study (2013: 381)
19. ***Myrsidea lampropsaricola* sp. n.**
   Host: *Lampropsar tanagrinus*
   Record: Amazonas
   Reference: Present study (2013: 394)
20. *Myrsidea lanei* Price, Hellenthal et Weckstein, 2004
   Host: *Pteroglossus aracari* (Linnaeus)
   Record: Pará
   Reference: Price et al. (2004: 13)
21. ***Myrsidea lathrotriccola* sp. n.**
   Host: *Lathrotriccus euleri*
   Record: Amazonas
   Reference: Present study (2013: 391)
22. *Myrsidea lightae* Price, Johnson et Dalgleish, 2008
   Host: *Saltator maximus* (Müller)
   (Passeriformes: Cardinalidae)
   Record: Tocantins
   Reference: Enout et al. (2012: 1734)

23. *Myrsidea picta* Carriker, 1955
   Host: *Cacicus cela cela* (Linnaeus)
   (Passeriformes: Icteridae)
   Record: 'Brazil Village' (no precise locality)
   Reference: Clay (1968: 212)
24. *Myrsidea ramphoceli* Price et Dalgleish, 2006
   Host: *Ramphocelus carbo* (Pallas)
   (Passeriformes: Thraupidae)
   Records: Mato Grosso do Sul and Tocantins
   References: Sychra et al. (2009: 502);
   Enout et al. (2012: 1735)
25. ***Myrsidea rodriguesae* sp. n.**
   Host: *Cnipodectes subbrunneus*
   Record: Amazonas
   Reference: Present study (2013: 389)
26. ***Myrsidea saviti* sp. n.**
   Host: *Tangara schrankii*
   Record: Amazonas
   Reference: Present study (2013: 386)
27. *Myrsidea seminuda* Eichler, 1951
   Host: *Thraupis sayaca* (Linnaeus)
   (Passeriformes: Thraupidae)
   Records: Mato Grosso do Sul and Tocantins
   References: Sychra et al. (2009: 502);
   Enout et al. (2012: 1735)
28. *Myrsidea taciturni* Price et Dalgleish, 2007
   Host: *Arremon taciturnus* (Hermann)
   (Passeriformes: Emberizidae)
   Record: Tocantins
   Reference: Enout et al. (2012: 1735)
29. *Myrsidea witti* Price, Hellenthal et Weckstein, 2004
   Host: *Ramphastos toco toco* Statius Müller
   Records: Amapá and Pará
   Reference: Price et al. (2004: 7)

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