Zootaxa 3137: 56–63 (2011)
www.mapress.com/zootaxa/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

Chewing lice of the genus *Myrsidea* (Phthiraptera: Menoponidae) from New World warblers (Passeriformes: Parulidae) from Costa Rica, with descriptions of four new species

FILIP KOUNEK[1], OLDRICH SYCHRA[1, 3], MIROSLAV CAPEK[2] & IVAN LITERAK[1]

[1]*Department of Biology and Wildlife Diseases, Faculty of Veterinary Hygiene and Ecology, University of Veterinary and Pharmaceutical Sciences, Palackeho 1–3, 612 42 Brno, Czech Republic. E-mail: sychrao@vfu.cz*

[2]*Institute of Vertebrate Biology, Academy of Sciences of the Czech Republic, v. v. i., Kvetna 8, 603 65 Brno, Czech Republic*

[3]*Corresponding author. E-mail: sychrao@vfu.cz*

Abstract

Four new species of chewing lice of the genus *Myrsidea* parasitic on members of the avian family Parulidae are described. They and their type hosts are: *Myrsidea basileuteri* ex *Basileuterus rufifrons*, *M. myiobori* ex *Myioborus miniatus*, *M. paleno* ex *Parkesia motacilla* and *M. zeledoni* ex *Phaeothlypis fulvicauda*. Records of undescribed *Myrsidea* representing new louse-host associations for *Basileuterus tristriatus* and *Parula pitiayumi* are also discussed.

Key words: Amblycera, Menoponidae, *Myrsidea*, lice, new species, Parulidae, new host-louse associations, Costa Rica

Introduction

The New World warblers belong to the family Parulidae comprising 114 species, with 53 of them recorded in Costa Rica (Garrigues & Dean 2007). Despite the high proportion of Costa Rican species, data concerning their chewing lice are scarce and incomplete. At present only one species of chewing lice of the genus *Myrsidea*—*M. ridulosa* (Kellogg & Chapman, 1899)—has been reported from a parulid host, *Dendroica petechia* Linnaeus, from California, U.S.A. (Kellogg & Chapman 1899: 135) and the Galapagos Islands (Palma & Price 2010). The aim of this paper is to present new data on the species composition and distribution of chewing lice of the genus *Myrsidea* found on New World warblers in Costa Rica, including the description of four new species (Table 1).

Material and methods

We conducted fieldwork during the 2004, 2009 and 2010 at seven study sites in Costa Rica. For detailed locations and methods of chewing louse study see Sychra *et al.* (2006) and Kounek *et al.* (2011).

The taxonomy of the birds follows Clements *et al.* (2010). In the following descriptions, all measurements are in millimeters. Abbreviations for dimensions are TW, temple width; HL, head length at midline; PW, prothorax width; MW, metathorax width; AW, abdomen width at level of segment IV; TL, total length; ANW, female anus width; GW, male genitalia width; GSL, genital sac sclerite length. The new species are attributed to the first two authors only. The type specimens of the new species described in this paper are deposited in the National Biodiversity Institute, Santo Domingo de Heredia, Costa Rica (INBio). Other material is deposited in the Moravian Museum, Brno, Czech Republic (MZM).

 Accepted by K. Johnson: 7 Nov. 2011; published: 20 Dec. 2011

TABLE 1. List of hosts and their lice.

Bird species	P[1]	E[2]	*Myrsidea* species	♂	♀	nymphs	Location
Basileuterus rufifrons (Swainson)	15	41	***M. basileuteri* sp. nov.**	6	11	5	Rincon de la Vieja NP
" " "	0	1		0	0	0	Zona Protectora Las Tablas
Basileuterus tristriatus (Tschudi)	4	5	***Myrsidea* sp.1**	0	2	6	Tapanti NP, Sector Tapanti
Myioborus miniatus (Swainson)	2	18	***M. myiobori* sp. nov.**	2	1	3	Tapanti NP, Sector Tapanti
" " "	0	1		0	0	0	Zona Protectora Las Tablas
" " "	0	1		0	0	0	Braulio Carillo NP, Sector Barva
Parkesia motacilla (Vieillot)	2	4	***M. paleno* sp. nov.**	0	2	4	Barbilla NP
" " "	1	3	***M. paleno* sp. nov.**	0	0	1	Rincon de la Vieja NP
" " "	1	1	***M. paleno* sp. nov.**	1	0	1	Zona Protectora Las Tablas
Parula pitiayumi (Vieillot)	1	1	***Myrsidea* sp.2**	0	1	0	Tapanti NP, Sector Tapanti
Phaeothlypis fulvicauda (Spix)	5	6	*** M. zeledoni* sp. nov.**	12	5	15	Zona Protectora Las Tablas,
" " "	0	1		0	0	0	Barbilla NP
" " "	0	2		0	0	0	Hitoy Cerere BR
Totals	31	85		21	22	35	

[1] = number of birds parasitized; [2] = number of birds examined; ** = new parasite-host association.

Results

A total of 107 individuals of 12 bird species belonging to the familiy Parulidae were examined. Thirty-one birds of 6 species were parasitised with 4 species of *Myrsidea* (Table 1). All these records represent new louse-host associations. Six samples from 4 hosts represent new species that are described below.

No species of *Myrsidea* were found on the following species of birds: *Basileuterus culicivorus* (6 birds examined), *Basileuterus melanogenys* (8), *Geothlypis poliocephala* (1), *Myioborus torquatus* (1), *Oreothlypis gutturalis* (5) and *Parkesia novaeboracensis* (1).

Myrsidea basileuteri Kounek & Sychra sp. nov.

(Figs. 1–4)

Type host: *Basileuterus rufifrons* (Swainson)—Rufous-capped warbler

Female (n = 9). Hypopharyngeal sclerites well developed (Fig. 1). Length of head seta 10, 0.045–0.050; seta 11, 0.095–0.100; ratio10/11, 0.45–0.50. Gula with 4 setae on each side. Metasternal plate with 6–7 setae; metanotum not enlarged, with 8–10 marginal setae.

Abdominal tergites not enlarged, with posterior margins almost straight, with median gap in each setal row (Fig. 2), and setal numbers as follows: I, 9–12; II, 11–13; III, 10–14; IV, 9–11; V, 8–10; VI, 8; VII, 7–8; VIII, 8. Postspiracular setae: extremely long (0.43–0.50) on II, IV and VIII; very long (0.28–0.33) on I and VII; and conspicously shorter (0.14–0.18) on III, V and VI. Sternal setae: II, 4 in each aster, 13–15 marginal between asters, 4–5 anterior; III, 17–20; IV, 25–27; V, 27–32; VI, 21–24; VII, 10–12; VIII–IX, 13–16 including 7–8 setae on deeply serrated vulval margin; without medioanterior sternal setae. Inner posterior seta of last tergum not longer than anal fringe setae with length 0.05–0.07; length of short lateral marginal seta of last tergum, 0.03–0.04. Dimensions: TW, 0.41; HL, 0.28–0.32; PW, 0.23–0.25; MW, 0.37–0.39; AW, 0.47–0.53; TL, 1.21–1.32; ANW, 0.17–0.18.

Male (n = 3). Length of head seta 10, 0.045–0.050; seta 11, 0.095–0.100; ratio10/11, 0.45–0.50. Gula with 4 setae on each side. Metasternal plate with 6 setae, metanotum with 6–8 marginal setae.

Tergal setal counts: I, 7–10; II, 10–12; III, 10–13; IV, 8–10; V, 8–10; VI, 8; VII, 8; VIII, 7–8. Postspiracular setae: extremely long (0.40–0.42) on II, IV and VIII; very long (0.23–0.28) on I and VII; and conspicously shorter (0.13–0.20) on III, V and VI. Sternal setae: II, aster 2–4, 11 marginal between asters, 3 anterior (Fig. 3); III, 12–14; IV, 20–22; V, 22–26; VI, 18–21; VII, 10; VIII, 7; without medioanterior sternal setae. Genital sac sclerite with slight apical indentation, distinct subapical lateral projection on each side and with dark medioposterior line (Fig. 4). Dimensions: TW, 0.38–0.39; HL, 0.27–0.30; PW, 0.22–0.24; MW, 0.32–0.33; AW, 0.39–0.40; TL, 1.08–1.16; GW, 0.09–0.10; GSL, 0.07–0.08.

Type material. Female holotype (O. Sychra CR171) ex *Basileuterus rufifrons* (Swainson), **COSTA RICA**: Rincon de la Vieja Vieja National Park, Miravieja Lodge (10°43'N, 85°18'N; elevation 600 m), 19 August 2009, Sychra and Literak leg. Paratypes: 1 female and 2 males (O. Sychra CR171–172), with same data as holotype; 1 female and 1 male (O. Sychra CR173) ex *Basileuterus rufifrons*, **COSTA RICA**: Rincon de la Vieja National Park, Sector Santa Maria, Sendero del Padre (10°46'N, 85°18'N; elevation 800 m), 20 August 2009. Deposited in INBio. Other specimens deposited in MZM.

Remarks. This is the first record of chewing lice from *Basileuterus rufifrons*. *Myrsidea basileuteri* is characterized by the following characteristics: (1) well developed hypopharyngeal sclerites; (2) wide median gap in all rows of tergal setae; (3) metanotum not enlarged with almost straight posterior margin; (4) all abdominal tergites of female of essentially similar size each with straight posterior margin; (5) tergite VIII with not >8 setae; (6) male genital sac sclerite as in Fig. 4. These characters place *M. basileuteri* close to *M. ridulosa* (see Palma & Price 2010). While the male of *M. basileuteri* is almost indistinguishable from that of *M. ridulosa* – it slightly differs by its smaller PW (0.22–0.24 vs. 0.25) and MW (0.32–0.33 vs. 0.36) and a small number of sternal setae, for example on sternite IV (20–22 vs. 24–26) and on V (22–26 vs. 29–30) – the female of *M. basileuteri* can be separated from that of *M. ridulosa* by the following combination of features: (1) metanotal margin with not >10 setae; (2) postspiracular setae on VII long, distinctly larger than those on V and VI, (3) smaller number of setae on tergites I–V.

Etymology. The specific name derives from the generic name of the type host.

***Myrsidea myiobori* Kounek & Sychra sp. nov.**
(Figs. 5–8)

Type host: *Myioborus miniatus* (Swainson)—Slate-throated redstart

Female (n = 1). Hypopharyngeal sclerites slightly reduced (Fig. 5). Length of head seta 10, 0.030; seta 11, 0.110; ratio10/11, 0.27. Gula with 5 setae on each side. Metasternal plate with 6 setae, metanotum not enlarged, with 11 marginal setae.

Abdomen with tergite I slightly enlarged, tergites II and III with a pronounced medioposterior convexity, IV and V with a medioposterior enlargement, but with an almost straight posterior margin in the middle (Fig. 6). Tergal setae with wide median gap in each row, and setal numbers as follows: tergite I, 10; II, 17; III–IV, 18; V–VI, 19; VII, 15; VIII, 11. Postspiracular setae: extremely long (0.37–0.43) on II, IV and VIII; very long (0.25–0.27) on I; and conspicously shorter (0.12–0.16) on III and V–VII. Sternal setae: II, 4 in each aster, 16 marginal between asters, 6 anterior; III, 21; IV, 32; V, 35; VI, 33; VII, 18; VIII–IX, 21 including 12 setae on deeply serrated vulval margin; without medioanterior sternal setae. Inner posterior seta of last tergum not longer than anal fringe setae with length 0.04–0.05; length of short lateral marginal seta of last tergum, 0.05. Dimensions: TW, 0.45; HL, 0.29; PW, 0.28; MW, 0.42; AW, 0.54; TL, 1.46; ANW, 0.24.

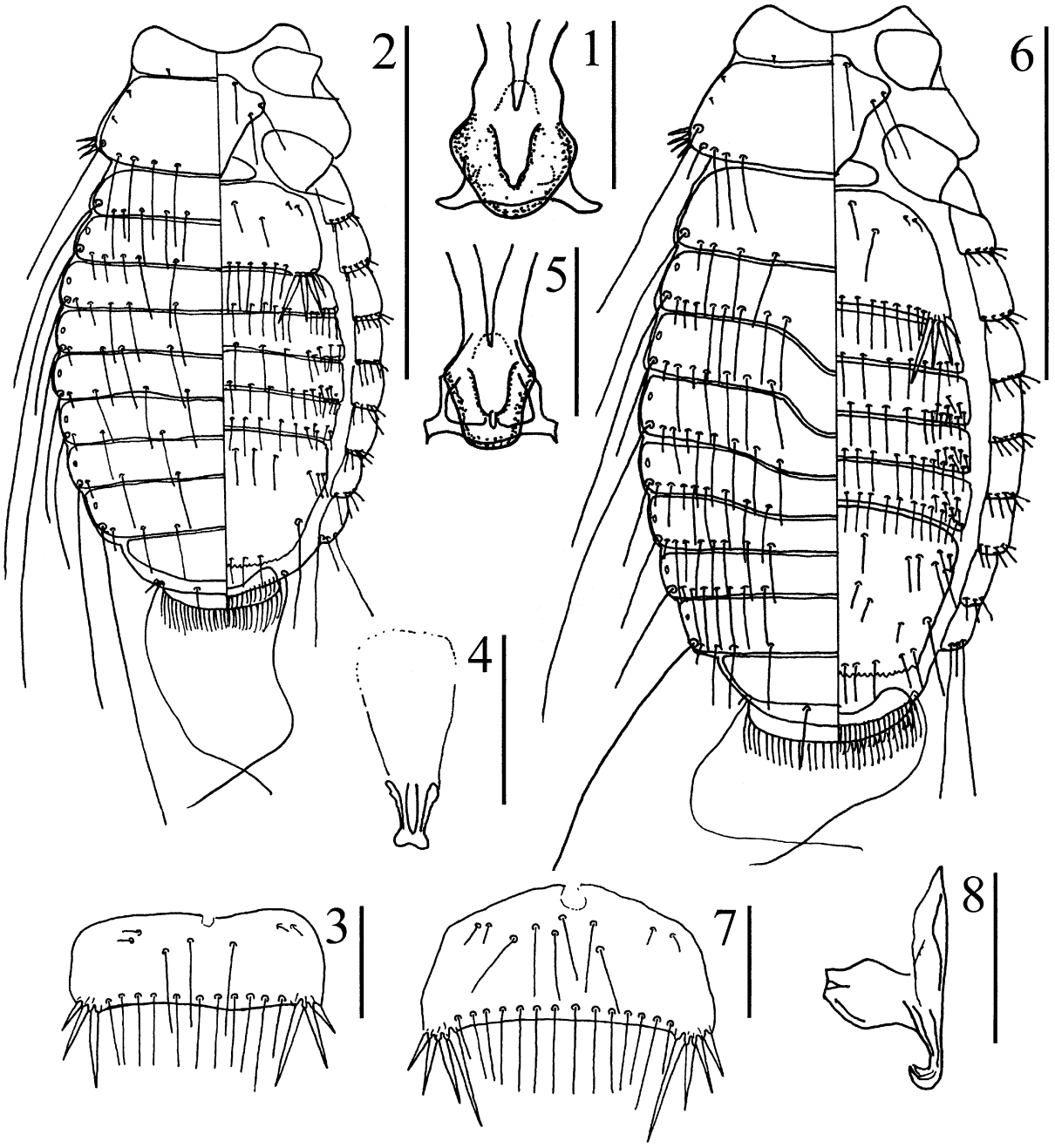
Male (n = 2). Length of head seta 10, 0.030; seta 11, 0.100; ratio10/11, 0.30. Gula with 5 setae on each side. Metasternal plate with 6 setae, metanotum with 10 marginal setae.

Tergal setal counts: I, 11; II, 16–17; III, 18; IV, 17–18; V, 18; VI, 16–17; VII, 14–15; VIII, 11–12. Postspiracular setae: extremely long (0.40–0.42) on II, IV and VIII; very long (0.22–0.24) on I; and conspicously shorter (0.10–0.18) on III and V–VII. Sternal setae: II, aster 4, 13–14 marginal between asters, 4–7 anterior (Fig. 7); III, 20; IV, 23–24; V, 27; VI, 22–26; VII, 18; VIII, 7; without medioanterior sternal setae. Genital sac sclerite distorted, but probably of the same type as those of other three described species (see Fig. 8 vs. Fig. 15). Dimensions: TW, 0.39–0.40; HL, 0.27; PW, 0.26–0.27; MW, 0.33–0.35; AW, 0.42–0.43; TL, 1.10–1.20; GW, 0.10; GSL, 0.07.

Type material. Female holotype and paratype male (O. Sychra CR175) ex *Myioborus miniatus* (Swainson), **COSTA RICA**: Tapanti National Park, Sector Tapanti (09°46'N, 83°47'W; 1200 m), 11 August 2009, Sychra and Literak leg. Deposited in INBio; 1 paratype male (O. Sychra CR182) with the same data deposited in MZM.

Remarks. This is the first record of chewing lice from *Myioborus miniatus. Myrsidea myiobori* differs from all parulid *Myrsidea* by pronounced medioposterior convexity on tergites II–III of female and male with tergite VIII with at least 10 setae. *Myrsidea myiobori* is also well defined by the following characteristics: (1) slightly reduced hypopharyngeal sclerites; (2) well-developed median gap in all rows of tergal setae; (3) metanotum not enlarged with slightly convex posterior margin; (4) postspiracular setae on VII conspicuously shorter than those on I, similar to those on III, V and VI; (5) unique shape of female abdominal tergites I to V.

Etymology. The specific name derives from the generic name of the type host.



FIGURES 1–8. 1–4. *Myrsidea basileuteri* **sp. nov.** 1. Hypopharyngeal sclerites. 2. Female dorsoventral thorax and abdomen. 3, Male sternite II. 4. Male genital sac sclerite. 5–8. *Myrsidea myiobori* **sp. nov.** 5. Hypopharyngeal sclerites. 6. Female dorsoventral thorax and abdomen. 7. Male sternite II. 8. Male genital sac sclerite. Scales 0.50 mm (Figs. 2, 6), 0.10 mm (Figs. 3, 7), 0.05 mm (Figs. 1, 4, 5, 8).

***Myrsidea paleno* Kounek & Sychra sp. nov.**
(Figs. 9–11)

Type host: *Parkesia motacilla* (Vieillot)—Louisiana waterthrush.

Female (n = 2). Hypopharyngeal sclerites well developed, as in Fig. 1. Length of head seta 10, 0.060; seta 11, 0.100–0.110; ratio10/11, 0.55–0.60. Gula with 4–5 setae on each side. Metasternal plate with 7–8 setae, metanotum not enlarged, with 10–11 marginal setae.

Abdomen with tergites I–II with slightly convex posterior margins (Fig. 9); tergites with median gap in each setal row and setal numbers as follows: I, 13–15; II, 16–18; III, 16–17; IV, 16–17; V, 16; VI, 11–13; VII, 8; VIII, 8. Postspiracular setae: extremely long (0.40–0.42) on II, IV and VIII; very long (0.25–0.30) on I and VII; long (0.20–0.23) on VI; and shorter (0.16–0.18) on III and V. Sternal setae: II, 4 in each aster, 13 marginal between asters, 4 anterior; III, 21–23; IV, 28; V, 29–32; VI, 24–25; VII, 10; VIII–IX, 21–22 including 9–10 setae on deeply serrated vulval margin; without medioanterior sternal setae. Inner posterior seta of last tergum quite long extending beyond ends of anal fringe setae (Fig. 9) with length 0.09–0.10; length of short lateral marginal seta of last tergum, 0.03–0.04. Dimensions: TW, 0.43; HL, 0.23–0.30; PW, 0.26; MW, 0.40–0.41; AW, 0.53; TL, 1.37–1.40; ANW, 0.19.

Male (n = 1). Length of head seta 10, 0.060; seta 11, 0.100–0.110; ratio10/11, 0.55–0.60. Gula with 4–5 setae on each side. Metasternal plate with 6 setae, metanotum with 9 marginal setae.

Tergal setal counts: I, 8; II, 14; III, 15; IV, 12; V, 13; VI, 10; VII, 9; VIII, 8. Postspiracular setae: extremely long (0.40–0.44) on II, IV and VIII; long (0.21–0.24) on I and VII; somewhat shorter (0.16–0.19) on VI; and conspicously shorter (0.11–0.13) on III and V. Sternal setae: II, 4 in each aster, 11 marginal between asters, 4 anterior (Fig. 10); III, 17; IV, 24; V, 29; VI, 25; VII, 12; VIII, 5; without medioanterior sternal setae. Genital sac sclerite with slight apical indentation, distinct subapical lateral projection on each side and with dark medioposterior line (Fig. 11). Dimensions: TW, 0.38; HL, 0.26; PW, 0.23; MW, 0.31; AW, 0.53; TL, 1.18; GW, 0.10; GSL, 0.08.

Type material. Female holotype (O. Sychra CR176) ex *Parkesia motacilla* (Vieillot), **COSTA RICA**: Barbilla NP, (9°59'N, 85°27'W; 600 m), 4 September 2004, Literak leg. Paratypes: 1 female (O. Sychra CR176) with same data as holotype; and 1 male (O. Sychra CR177) ex *Parkesia motacilla*, **COSTA RICA**: Zona Protectora Las Tablas, La Amistad Lodge (8°54'N, 82°47'W; 1300 m), 20 August 2010, Sychra and Literak leg. Deposited in INBio.

Remarks. This is the first record of chewing lice of the genus *Myrsidea* from *Parkesia motacilla.* In general, *M. paleno* is similar to *M. basileuteri*. It can be separated by: (1) abdominal tergites I–II of female with slightly convex posterior margin; (2) higher number of setae on tergites (for example tergite VI of both sexes, 10–13 vs. 8); (3) inner posterior seta of the female last tergum long, extending beyond the end of the anal fringe setae; (4) larger dimensions (for example TW of female 0.43 vs. 0.41).

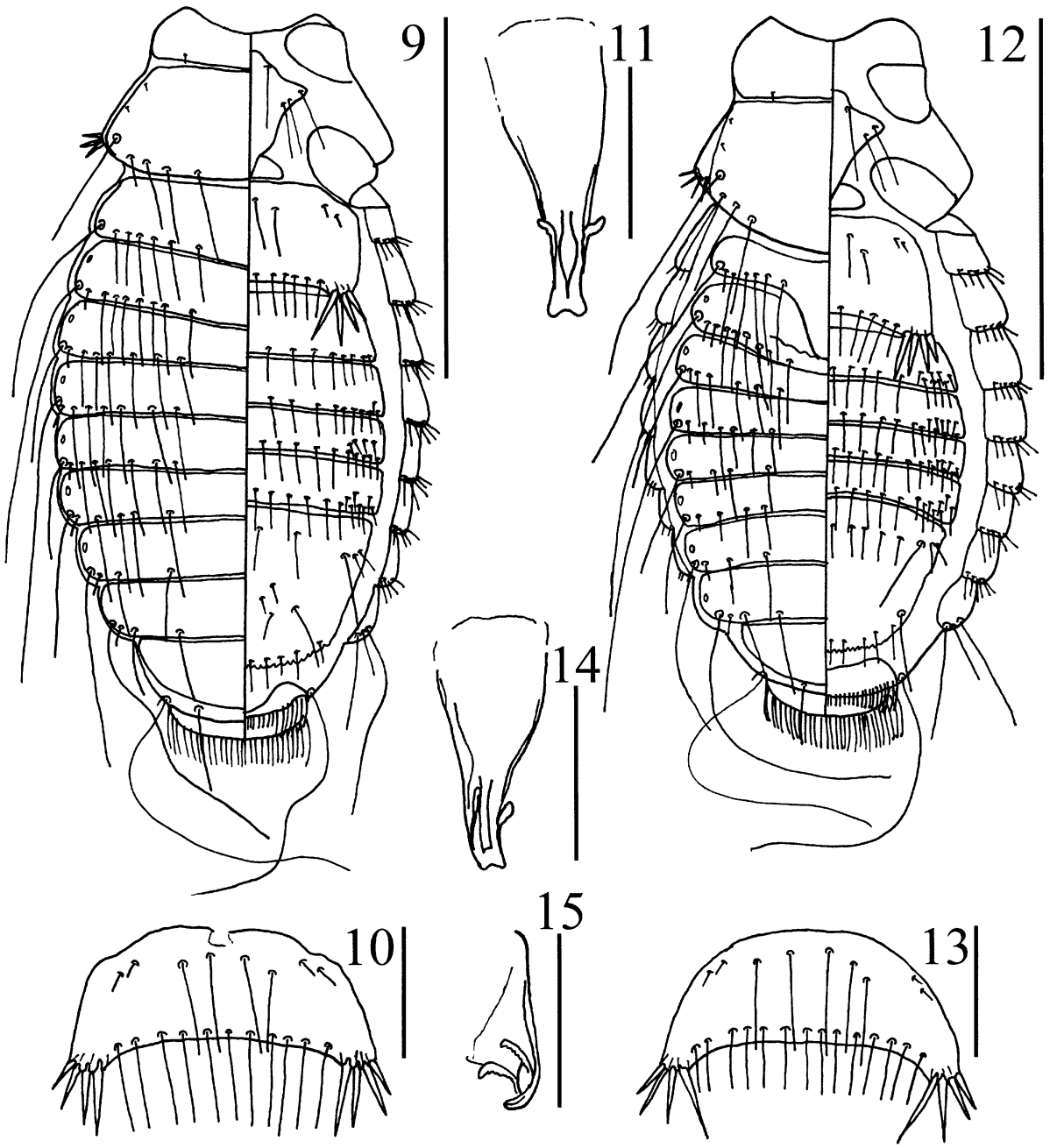
Etymology. The specific name derives from the salutation or exclamation of one of our colleagues that accompanied us during our stay in Costa Rica in 2010, and which we adopted as our good luck charm.

***Myrsidea zeledoni* Kounek & Sychra sp. nov.**
(Figs. 12–15)

Type host: *Phaeothlypis fulvicauda* (Spix)—Buff-rumped warbler.

Female (n = 4). Hypopharyngeal sclerites slightly reduced, as in Fig. 5. Length of head seta 10, 0.035–0.040; seta 11, 0.090; ratio10/11, 0.39–0.44. Gula with 4–6 setae on each side. Metasternal plate with 6, rarely 7 setae, metanotum enlarged, with 8 marginal setae.

Abdominal tergite I with pronounced tapered medioposterior convexity, II enlarged rounded, III with slight mediopestrior convexity (Fig. 12); tergites with median gap in each setal row and setal numbers as follows: I, 14–15; II, 17–20; III, 13–15; IV, 13–14; V, 11–12; VI, 10–11; VII, 8-9; VIII, 7-8. Postspiracular setae: extremely long (0.40–0.47) on II, IV and VIII; very long (0.22–0.29) on I and VII; and shorter (0.13–0.18) on III, V and VI. Sternal setae: II, 4 in each aster, 17–19 marginal between asters, 6–7 anterior; III, 22–28; IV, 30–31; V, 29–33; VI, 28–30; VII, 12–15; VIII–IX, 18–22 including 9–11 setae on deeply serrated vulval margin; without medioanterior sternal setae. Inner posterior seta of last tergum not longer than anal fringe setae with length 0.05–0.07; length of short lateral marginal seta of last tergum, 0.04–0.05; without medioanterior sternal setae. Dimensions: TW, 0.39–0.41; HL, 0.26–0.28; PW, 0.25–0.26; MW, 0.39–0.40; AW, 0.50–0.53; TL,1.27–1.32; ANW, 0.18–0.20.



FIGURES 9–15. 9–11. *Myrsidea paleno* **sp. nov.** 9. Female dorsoventral thorax and abdomen. 10, Male sternite II. 11. Male genital sac sclerite. 12–15. *Myrsidea zeledoni* **sp. nov.** 12. Female dorsoventral thorax and abdomen. 13. Male sternite II. 14. Male genital sac sclerite. 15. Distorted male genital sac sclerite. Scales 0.50 mm (Figs. 9, 12), 0.10 mm (Figs. 10, 13), 0.05 mm (Figs. 11, 14, 15).

Male (n = 4). Length of head seta 10, 0.035–0.040; seta 11, 0.090; ratio10/11, 0.39–0.44. Gula with 4–6 setae on each side. Metasternal plate with 6, rarely 7 setae, metanotum with 6 marginal setae.

Tergal setal counts: I, 9–11; II, 12–14; III, 13–14; IV, 13–14; V, 12; VI, 11; VII, 9; VIII, 6–8. Postspiracular setae: extremely long (0.37–0.45) on II, IV and VIII; very long (0.21–0.28) on I and VII; and shorter (0.10–0.15) on III, V and VI. Sternal setae: II, aster 4, 12–14 marginal between asters, 5–6 anterior (Fig. 13); III, 21–23; IV, 27–29; V, 23–32; VI, 22–28; VII, 20; VIII, 7–8; without medioanterior sternal setae. Genital sac sclerite with slight apical indentation, distinct subapical lateral projection on each side and with dark medioposterior line (Fig. 14, 15). Dimensions: TW, 0.35–0.37; HL, 0.24–0.27; PW, 0.22–0.24; MW, 0.30–0.31; AW, 0.39; TL, 1.07–1.12; GW, 0.09–0.10; GSL, 0.07–0.08.

Type material. Female holotype (O. Sychra CR178) ex *Phaeothlypis fulvicauda* (Spix), **COSTA RICA**: Zona Protectora Las Tablas, La Amistad Lodge (8°54'N, 82°47'W; 1300 m), 20 August 2010, Sychra and Literak leg. Paratypes: 3 females and 4 males (O. Sychra CR178–181) with same data as holotype. Deposited in INBio.

Remarks. This is the first record of chewing lice from *Phaeothlypis fulvicauda*. *Myrsidea zeledoni* differs from all parulid *Myrsidea* by the enlarged metanotum and the shape of tergites I–III in the female. These characters place this species close to *M. campestris* Price & Dalgleish and *M. marini* Price & Dalgleish described from birds of the family Emberizidae (Price and Dalgleish 2007). However, the female of *M. zeledoni* can be separated from those two species by the following combination of features: (1) unique shape of tergites I–III (Fig. 12); (2) smaller numbers of tergal setae, for example 7–9 vs. 11–23 on tergites VII–VIII, and (3) smaller dimensions. The male of *M. zeledoni* is almost indistinguishable from that of *M. paleno*, but it differs by its smaller TW (0.35–0.37 vs. 0.38) and by a larger number of setae on sternites III (21–23 vs. 17) and IV (27–29 vs. 24).

Etymology. This species is named in honor of Roberto Montero Zeledon (La Amistad Lodge, Costa Rica) for his hospitality and for giving us the opportunity to carry out our research on his private land in 2010.

Myrsidea species 1 and 2

Material studied. 1 female (O. Sychra CR174) ex *Basileuterus tristiatus* (Tschudi), **COSTA RICA**: Tapanti National Park, Sector Tapanti (09°46'N, 83°47'W; 1200 m), 6 August 2009, Sychra and Literak leg. Deposited in INBio; 1 female with same data deposited in MZM; 1 female ex *Parula pitiayumi* (Vieillot), **COSTA RICA**: Tapanti NP, Sector Tapanti (09°46'N, 83°47'W; 1200 m), 31 July 2009, Sychra and Literak leg. Deposited in MZM.

Remarks. These are the first records of chewing lice from both *Basileuterus tristriatus* and *Parula pitiayumi*. Although the 2 females from *B. tristriatus* are very similar in all characters to those of *M. basileuteri*, they probably represent a new different species or at least a new subspecies. They have a greater number of setae on tergites II (14–16 vs. 11–13), IV (15 vs. 9–11), V (11–12 vs. 8–10), and also on the vulval margin (10 vs. 7–8). However, males are needed to complete a proper description of this taxon.

The single female from *P. pitiayumi* is also very similar in all characters to those of *M. basileuteri*. Nevertheless, it slightly differs in TW (0.39 vs. 0.41), and in setal counts on tergites I (14 vs. 9–12) and V (12 vs. 8–10), and on vulval margin (11 vs. 7–8). Unfortunately, having only one female is insufficient to ascertain whether this *Myrsidea* represents either a different new species or a new host-louse association for *M. basileuteri*.

Discussion

In the course of this study, four new species of *Myrsidea* were described from 4 species of New World warblers (Parulidae) examined in Costa Rica. While all females are easily identified by the shape of their abdominal tergites, males of three of these four new species—*M. basileuteri*, *M. paleno* and *M. zeledoni*—are morphologically very similar to *M. ridulosa*, the only previously described parulid *Myrsidea* (Palma & Price 2010). Males of the fourth species—*M. myiobori*—differ from other males in the abdominal chaetotaxy. Unfortunately, the two males of *M. myiobori* examined have distorted genital sac sclerites. Despite this, we believe that it is of the same type as those of other parulid *Myrsidea* (see Fig. 8 vs. Fig. 15). The same type of male genital sac sclerite has already been recorded from *Myrsidea* occurring on birds from families Emberizidae and Thraupidae (Price and Dalgleish 2007, Price and Johnson 2009). These two families, together with the Fringillidae, Calcariidae, Icteridae, Cardinalidae and Coerebidae, belong in the so called "nine-primaried oscines clade" (Ericson & Johansson 2003). The fact that *Myrsidea* males from birds in these closely related families have the same type of genital sac sclerite is consistent with Clay (1966), who predicted that species of *Myrsidea* grouped together by characters of the male genital sclerite are frequently found to be parasitic on a group of related hosts. On the other hand, Bueter *et al.* (2009), who analysed mitochondrial and nuclear DNA sequences of *Myrsidea*, found that undetermined *Myrsidea* from *Seiurus aurocapilla* (Parulidae) could be related to those from thrushes of the genus *Catharus* (Turdidae). Since Turdidae are not close related to Parulidae and males of *Myrsidea* from *Catharus* thrushes have different type of genital sac sclerite we agree with Bueter's hypothesis (Bueter *et al.* 2009) that sympatry and similar habitat preferences of the hosts might explain the phylogenetic relationships of these *Myrsidea*.

Acknowledgments

We are grateful to the Ministerio de Ambiente, Energia y Telecomunicaciones de Costa Rica (Resoluciones No. 106-2004-OFAU, No. 136-2009-SINAC and No. 120-2010-SINAC) for their permits and support towards our fieldwork. We would like to thank Bernardo Calvo Rodriguez, Martin Havlicek, Zuzana Literakova and Martina Literakova for their help in the field. We especially thank: Jorge Poveda Quiros (Sacramento, Costa Rica) and Roberto Montero Zeledon (La Amistad Lodge, Costa Rica) for their hospitality and for giving us the opportunity to carry out research on their private land; and to Ricardo L. Palma (Museum of New Zealand Te Papa Tongarewa, Wellington, New Zealand) for his review and improvement of our first draft. Funding was provided by the Grant Agency of the Academy of Sciences of the Czech Republic (Grant No. IAA601690901). Miroslav Capek was also supported in part by the Ministry of Education, Youth and Sports of the Czech Republic (Grant No. LC06073).

Literature cited

Bueter, C., Weckstein, J., Johnson, K.P., Bates, J.M. & Gordon, C.E. (2009) Comparative phylogenetic histories of two louse genera found on *Catharus* thrushes and other birds. *Journal of Parasitology*, 95, 295–307.

Clay, T. (1966) Contributions towards a revision of *Myrsidea* Waterston. I. (Menoponidae: Mallophaga). *Bulletin of the British Museum (Natural History) Entomology*, 17, 327–395.

Clements, J.F., Schulenberg, T.S., Iliff, M.J., Sullivan, B.L. & Wood, C.L. (2010) The Clements checklist of birds of the world: Version 6.5. Available from http://www.birds.cornell.edu/clementschecklist/Clements%206.5.xls/view (accessed 18 January 2011)

Ericson, P.G.P. & Johansson, U.S. (2003) Phylogeny of Passerida (Aves: Passeriformes) based on nuclear and mitochondrial sequence data. *Molecular Phylogenetics and Evolution*, 29, 126–138.

Garrigues, R. & Dean, R. (2007) *The birds of Costa Rica: A field guide*. Christopher Helm, London, U.K., 387 pp.

Kellogg, V.L. & Chapman, B.L. (1899) Mallophaga from birds of California. *California Academy of Sciences Occasional Papers*, 6, 53–143.

Kounek, F., Sychra, O., Capek, M., Lipkova, A. & Literak, I. (2011) Chewing lice of the genus *Myrsidea* (Phthiraptera: Menoponidae) from the Cardinalidae, Emberizidae, Fringillidae and Thraupidae (Passeriformes) from Costa Rica, with descriptions of four new species. *Zootaxa*, 3032, 1–16.

Palma, R.L. & Price, R.D. (2010) The species of *Myrsidea* Waterston (Insecta: Phthiraptera: Menoponidae) from the Galápagos Islands, with descriptions of new taxa. *Tuhinga - Records of the Museum of New Zealand te Papa Tongarewa*, 21, 135–146.

Price, R.D. & Dalgleish, R.C. (2007) *Myrsidea* Waterston (Phthiraptera: Menoponidae) from the Emberizidae (Passeriformes), with descriptions of 13 new species. *Zootaxa*, 1467, 1–18.

Price, R.D. & Johnson, K.P. (2009) Five new species of *Myrsidea* Waterston (Phthiraptera: Menoponidae) from tanagers (Passeriformes: Thraupidae) in Panama. *Zootaxa*, 2200, 61–68.

Sychra, O., Literak, I., Capek, M. & Havlicek, M. (2006) Chewing lice (Phthiraptera) from typical antbirds and ground antbirds (Passeriformes: Thamnophilidae, Formicariidae) from Costa Rica, with descriptions of three new species of the genera *Formicaphagus* and *Myrsidea*. *Zootaxa*, 1206, 47–61.