J. Parasitol., 101(3), 2015, pp. 304–313

THE CHEWING LICE (INSECTA: PHTHIRAPTERA: ISCHNOCERA: AMBLYCERA) OF JAPANESE PIGEONS AND DOVES (COLUMBIFORMES), WITH DESCRIPTIONS OF THREE NEW SPECIES

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ABSTRACT: The chewing louse fauna of pigeons and doves in Japan is reviewed based on published records and new collections. An updated checklist of the chewing lice of Japanese pigeons and doves is provided, and 3 new species are described: *Columbicola asukae* n. sp. and *Coloceras nakamurai* n. sp., both from *Columba janthina* Temminck, 1830 (Japanese wood pigeon), and *Columbicola lemoinei* n. sp. from *Treron formosae permagnus* Stejneger, 1887, and *Treron formosae medioximus* (Bangs, 1901) (whistling green-pigeons). This checklist includes data on the first records of *Coloceras chinense* (Kellogg and Chapman, 1902), *Coloceras piriformis* (Tendeiro, 1969), and *Columbicola guimaraesi* Tendeiro, 1965, in Japan. New host records of *Hohorstiella* sp. from *Columba janthina* and *Treron formosae permagnus,* and *Coloceras* sp. from *Treron sieboldii sieboldii* (Temminck, 1835) (white-bellied green-pigeon) are provided.

The chewing louse fauna of Japan was explored by Uchida (1915, 1916, 1917, 1926, 1948, 1949). In total, Uchida reported 5 species of lice from pigeons and doves in Japan, but one of these (*Colpocephalum tamamurensis* Uchida, 1926 = *Piconiphilus decimfasciatus* (Boisduval and Lacordaire, 1835)) was considered a straggler by Hopkins and Clay (1952). One species is known from the native oriental turtle dove (*Streptopelia orentalis* (Latham, 1790)) (Uchida, 1917), and the remaining 3 species are known from introduced rock pigeons (*Columba livia* Gmelin, 1789) (Uchida, 1916, 1917, 1926). Here we describe 3 new species of lice from native pigeons and doves and provide new geographical and host records (Table I). This includes the first records in Japan of 2 louse species from the native common emerald dove (*Chalcophaps indica indica* (Linnaeus, 1758)) and 2 louse species from the oriental turtle dove. In addition, lice from 3 genera were found on the Japanese wood pigeon (*Columba janthina* Temminck, 1830), a near-endemic bird to Japan (Gibbs et al., 2001; Seki et al., 2007). No chewing lice have previously been reported from this host (Price et al., 2003; Adams et al., 2005; Bush et al., 2009).

MATERIALS AND METHODS

Lice were collected from dead birds sent to the Yamashina Institute for Ornithology (YIO), Chiba Prefecture, Japan. Lice were stored dry or in 95% ethanol at room temperature, preventing extraction of DNA. Lice were prepared as voucher specimens following Johnson et al. (2001). Mounted specimens were examined and drawn using an Eclipse E600 (Nikon, Melville, New York), fitted with a drawing tube. Measurements were made in cellSens Dimension 1.6 (Olympus Corporation, Center Valley, Pennsylvania) from digital photos. All measurements are given in millimeters. Abbreviations used for measurements: AW = abdominal width, measured at widest segment; HL = head length along midline; HW = postantennal head width; PRW = prothorax width; PTW = pterothorax width; TL = total length.

Host nomenclature follows Clements et al. (2013). Head chaetotaxy is based on Clay (1951), as modified by Mey (1994), except the preantennal chaetotaxy of *Columbicola,* which follows Adams et al. (2005). Head sensillae follow Valim and Silveira (2014). Our interpretation of head setae are indicated in Figures 1A and 3A. Abbreviations used for setae: *ads* = anterior dorsal seta; *amhs* = anterior medial head seta; *as1–3* = anterior setae 1–3; *avs1–3* = anterior ventral setae 1–3; *dsms* = dorsal submarginal seta; *mds* = mandibular seta; *mts1–5* = marginal temporal setae 1–5; *os* = ocular seta; *pas* = preantennal seta; *pcs* = preconal seta; *pmhs* = posterior medial head seta; *pns* = postnodal seta; *pos* = postocular seta; *pts* = posttemporal seta; *s1–6* = sensilla 1–6; *vsms1–2* = ventral submarginal setae 1–2. Abdominal chaetotaxy follows Cicchino and Castro (1996), using the following abbreviations: *aps* = accessory post-spiracular setae; *pps* = principal postspiracular setae; *ps* = paratergal setae; *ss* = sutural setae; *sts* = sternal setae; *tps* = tergal posterior setae. In addition to the 6 head sensilla numbered in Valim and Silveira (2014), both *Coloceras* and *Campanulotes* examined by us have a seventh head sensillum, here referred to as *s7* and shown in Figure 1A.

All examined material from Japan, including holotypes, are deposited at the YIO or the Price Institute for Parasite Research, University of Utah, Salt Lake City (PIPeR), as indicated. Hosts, if collected, are deposited at YIO, or the University of Kansas Museum of Natural History (KUMNH), as indicated. To avoid confusion, we have abbreviated generic names as follows: *Columba* = *C.; Chalcophaps* = *Ch.; Coloceras* = *Cc.; Columbicola* = *Cb*.

DESCRIPTION

Coloceras nakamurai n. sp.

(Fig. 1A–E)

Diagnosis: Male: Head about as wide as long in both sexes, shape as in Figure 1A. Marginal carina narrow. Ventral carina broader than marginal carina. Head setae as in Figure 1A; *dsms*, *ads*, *os*, *pns*, and *pts* long. Preantennal nodi pointed, arched. Scape large, triangular; pedicel and flagellomere I elongated, slender; flagellomeres II–III very short, telescoped. Preocular nodi large, protruding antero-laterally. Deep lateral grooves in temporal margin. *mts1* and *mts3* macrosetae; *mts2* and *mts4–5* thorn-like setae. Pronotum divided medianly, shape as in Figure 1B. Anterior half of pteronotum divided medianly; shape and chaetotaxy as in Figure 1B. Abdominal shape as in Figure 1B. Tergites II–III fused anterior to spiracle opening of tergite III. Sternites absent except segment VII. Pleurites visible in segments IV–VIII sublaterally; progressively smaller in more posterior segments. Subgenital plate follows distal margin of abdomen, lateral sections extended anteriorly. Abdominal chaetotaxy (on each side): *ps*: II: absent; III–V: 2; VI–VIII: 3 (plus one trichobothrium on segment VIII); IX+X: 1; XI: 3. *aps:* II–III: absent; IV–VII: 1; VIII–XI: absent. *pps:* II–VII: 1; VIII–XI: absent. *tps:* II: absent; III: 1; IV: 2; V: 1; VI–XI: absent. *ss:* II: absent; III–VII: 1; VIII–XI: absent. *sts:* II: absent; III: 1. IV: 2; V–VIII: 1; IX+X–XI: absent. Tergite IX+X with 3 setae on posterior margin on each side. Several small pores on each side distal to tergite IX+X. Male genitalia as in Figure 1C. Parameres broadly triangular. Anterior end of basal plate not distinct.

Female: As male, except: preantennal area longer; no lateral grooves of temporal margins; preocular nodi not antero-laterally protruding; preantennal nodi rounded, not arched; all dorsal head setae shorter. Pteronotal chaetotaxy as in Figure 1D. Terminalia and vulval margin as in Figure 1E. Two thorn-like setae on each side of gonapophyses separated from 1 shorter, thorn-like setae more medianly. Abdominal chaetotaxy: *ps:* II: absent; III–VII: 2; VIII: 4; IX+X 3; XI: 5–6. *aps:* absent. *pps:* II–III: absent; IV–VII: present; VIII–XI: absent. *tps:* absent. *ss:* II–VI: absent;

Received 3 November 2014; revised 27 January 2015; accepted 25 February 2015.

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DOI: 10.1645/14-683.1

TABLE I. Checklist of lice infesting pigeons and doves in Japan. Taxonomy follows Price et al. (2003). Abbreviations following louse species names refer to suborders and families: A = Amblycera; G = Goniodidae; I = Ischnocera; M = Menoponidae; P = Philopteridae.

Hosts	Lice	Reference
Chalcophaps indica indica (Linnaeus, 1758)	*Coloceras piriformis* (Tendeiro, 1969) (I, G)	This study
	Columbicola guimaraesi Tendeiro, 1965 (I, P)*	This study
Columba janthina janthina Temminck, 1830	*Coloceras nakamurai* n. sp. (I, G)	This study
	Columbicola asukae n. sp. (I, P)	This study
	Hohorstiella sp. (A, M)†	This study
Columba livia Gmelin, 1789	*Colpocephalum turbinatum* Denny, 1842 (A, M)	Uchida (1926: 44)
	Campanulotes compar (Burmeister, 1838) (I, G)	Uchida (1916: 88)
	Columbicola columbae (Linnaeus, 1758) (I, P)	Uchida (1917: 214)
Streptopelia orientalis orientalis (Latham, 1790)	*Coloceras chinense* (Kellogg and Chapman, 1902) (I, G)*†	This study
	Columbicola turturis (Uchida, 1917) (I, P)	Uchida (1917: 212), Adams et al. (2005: 3557)
Treron formosae permagnus Stejneger, 1887	*Columbicola lemoinei* n. sp. (I, P)	This study
	Hohorstiella sp. (A, M)†	This study
Treron formosae medioximus (Bangs, 1901)	*Columbicola sphenurus* Tendeiro, 1984 (I, P)	Tendeiro (1984: 92)
	Columbicola lemoinei, n. sp. (I, P)	This study
Treron sieboldii sieboldii (Temminck, 1835)	*Coloceras* sp. (I, G)†	This study

* New geographical record for Japan.
† New host record.

VII–IX+: 1; XI: 5. *sts:* II: absent; III–IV: 2; V–VII: 3; VIII: 2; IX+X: 2; XI: 3

Measurements: Male (n = 6, except PTW where n = 3): TL: 1.34–1.51; HL: 0.37–0.42; HW: 0.43–0.45; PRW: 0.30–0.39; PTW: 0.39–0.45; AW: 0.69–0.78. Female (n = 5, except PTW and TL where n = 3 and AW where n = 4): TL: 1.55–1.63; HL: 0.45–0.48; HW: 0.49–0.52; PRW: 0.31–0.38; PTW: 0.44; AW: 0.72–0.77.

Taxonomic summary

Type host: Columba janthina janthina Temminck, 1830—Japanese wood pigeon.

Type locality: Nippana, Miyake-mura, Miyake-shicho, Miyake-jima, Tokyo, Japan (34°4′44″N, 139°31′44″E).

Voucher specimens: Holotype: 1♂; Tokyo, Miyake-shicho, Miyake-mura, Nippana (Miyakejima Island), 5 October 1994, M. Tsurumi, YIO-P-00048, from host YIO-05140. Paratypes: 1♂, same collection details as holotype, YIO-P-00049. 3♂, 4♀; Tokyo, Hachijo-shicho, Hachijo-cho, Nakanogo (Hachijojima Island), 11 March 1997, Haruyasu Ito, YIO-P-00047, YIO-P-00050–55, host not collected. 1♂, 1♀, Tokyo, Hachijo-shicho, Hachijo-cho, Nakanogo (Hachijojima Island), 11 March 1997, Haruyasu Ito, PIPeR: 1998-028, host not collected.

Host specimens: Deposited at YIO; see above.

Etymology: Named after Noboru Nakamura, bird bander and researcher at the Yamashina Institute, whose efforts have led to an increased understanding of bird migration in East Asia and made D.G.'s collection efforts in Japan possible.

Remarks

Keys to couplet 23 in Tendeiro's (1973) key, most similar to *Cc. funebreae* Tendeiro, 1973. It differs from this species by head shape, size of the preantennal setae, and size (cf. Tendeiro, 1973). Female head shape of *Cc. nakamurai* n. sp. is very similar to that of males, whereas in *Cc. funebreae* the female temples are flared and not similar to those of the male (Tendeiro, 1973). The parameres of *Cc. nakamurai* n. sp. are broader than those of *Cc. funebreae*, and the setae of the gonapophyses differ between the 2 species, with the medianmost seta in *Cc. nakamurai* n. sp. being much smaller than the other 2, and not of similar length as in *Cc. funebreae*. The male head shape is reminiscent of that of *Cc. aethiopicum* Tendeiro, 1973, but based on measurements and illustrations given by Tendeiro (1973), *Cc. nakamurai* n. sp. is smaller, marginal carina is thinner, postantennal area of *Cc. nakamurai* n. sp. is more elongated, preantennal setae are longer, and shape of posterior margin of the head differs from that illustrated by Tendeiro (1973) for *Cc. aethiopicum*.

REDESCRIPTION

Coloceras piriformis (Tendeiro, 1969)

(Fig. 2A–C)

Diagnosis: Head shape as in Figure 2A. Lateral margin of head bulges anterior to antennae. Marginal carina diffuse, irregular; median section longitudinally very broad. Preantennal setae as in Figure 2A. Ventral carina broad. Coni curved medianly. Scapes relatively small, triangular; pedicel and flagellomere I elongated, the latter with a distinct distal spur on median side; flagellomeres II–III small. Antennal socket continuous with shallow dorsal suture; suture diffuse median to mandibles. Preocular nodi protruding antero-laterally. Deep lateral grooves in temporal margin. *s4* absent or too small to be seen. *mts1* and *mts3* macrosetae, *mts2* and *mts5* minute and stout, *mts4* microseta (not visible in Fig. 2A). Pronotum shaped as in Figure 2B, setae on postero-lateral corners stout. Pteronotum shaped as in Figure 2B, postero-median section rugose, extending posteriorly between tergites II. Pteronotal chaetotaxy as in Figure 2B. Abdominal shape as in Figure 2B. Small, trapezoid, rugose median plates between tergites III–VII. Sternal plates absent. Pleurites visible in segments III–VIII as small, sublateral, irregular plates. Abdominal chaetotaxy (on each side): *ps:* II: absent; III–IV: 1; V: 2; VI: 3; VII: 2; VIII: 3 (plus one trichobothrium); IX+X: absent; XI: 3. *aps:* II–VI: absent; VII: 1; VIII–XI: absent. *pps:* II–III: absent; IV–VII: present; VIII–XI: absent. *tps:* absent. *ss:* II–III: absent; IV–VIII: 1; IX+X with three setae on posterior margin; XI: absent. *sts:* II–III: absent; IV–VIII: 1; IX+X–XI: absent. Male genitalia as in Figure 2C. The basal plate asymmetrically bent, clearly defined anteriorly, reaching to pterothorax.

Measurements: Male (n = 3): TL: 1.53–1.56; HL: 0.46–0.48; HW: 0.42; PRW: 0.31–0.32; PTW: 0.38–0.42; TW: 0.84–0.88.

Taxonomic summary

Type host: Chalcophaps indica indica (Linnaeus, 1758)—common emerald dove.

Voucher specimens: 1♂; Okinawa Prefecture, Miyako-gun, Shioji-cho (Miyakojima Island), 6 May 1998, M. Tsurumi, YIO-P-00062, from host YIO-62871. 1♂; China, Guangxi Province, Jing Xin County, 26 September 2004, S.E. Bush, PIPeR: ATP-2004-97, P-278, from host KUMNH# 96239. 1♂; same collection locality as previous, 27 September 2004, S. E. Bush, PIPeR: AM-422, P-302, from host KUMNH no. 93309.

Host specimens: Deposited at YIO and KUMNH; see above.

Remarks

As the original description (Tendeiro, 1969) does not include any line drawings apart from the male genitalia, we redescribe and reillustrate *Cc. piriformis*, based on 1 male from Japan and 2 males from China. This

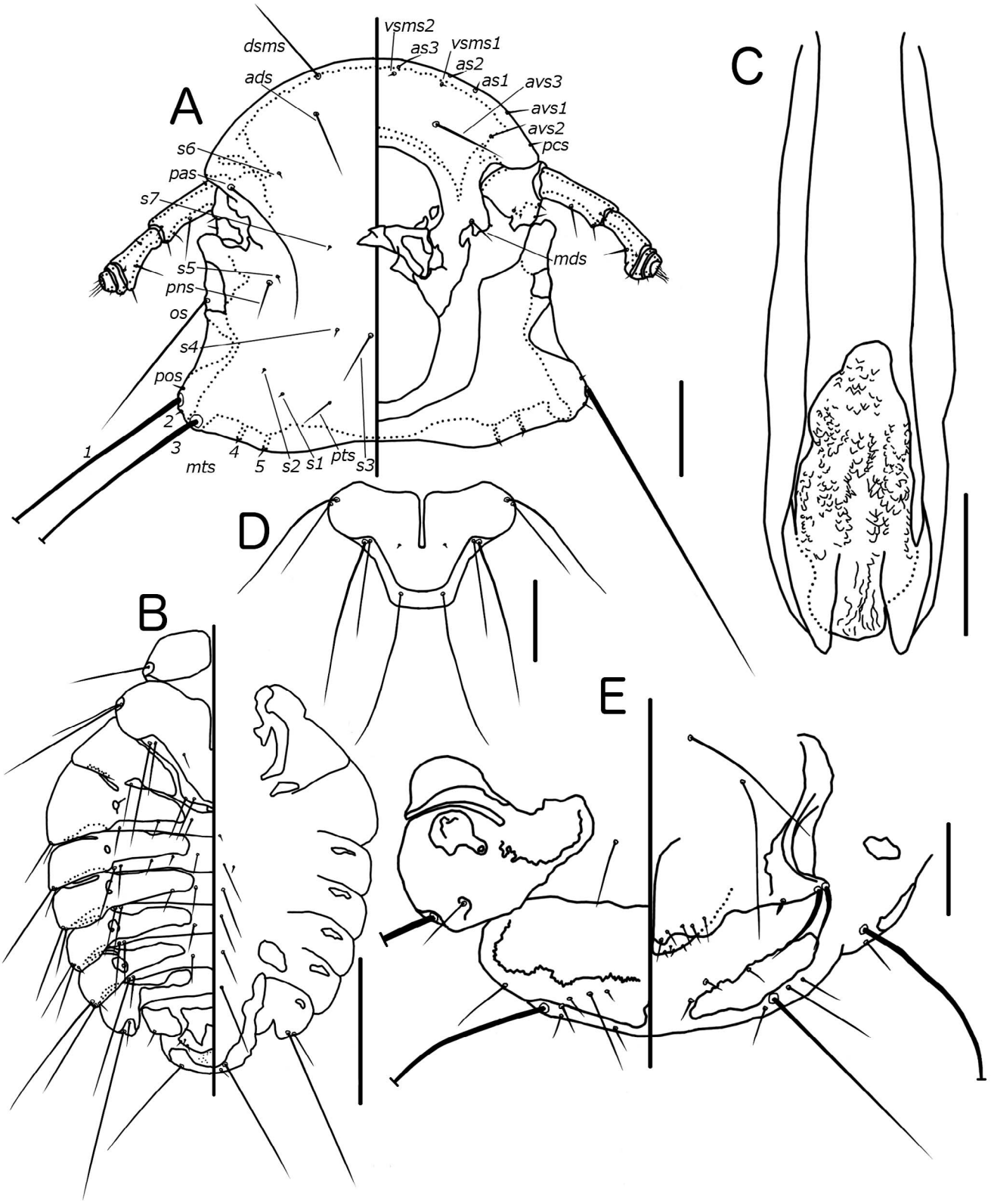

FIGURE 1. *Coloceras nakamurai* n. sp. *ex Columba janthina janthina*. (**A**) Male head, dorsal and ventral views. Pulvinus omitted for clarity. Abbreviations used: *ads* = anterior dorsal seta; *as1–3* = anterior setae 1–3; *avs1–3* = anterior ventral setae 1–3; *dsms* = dorsal submarginal seta; *mds* = mandibular seta; *mts1–5* = marginal temporal setae 1–5; *os* = ocular seta; *pas* = preantennal seta; *pcs* = preconal seta; *pns* = postnodal seta; *pos* = postocular seta; *pts* = posttemporal seta; *s1–6* = sensillae 1–6; *vsms1–2* = ventral submarginal setae 1–2. (**B**) Male thorax and abdomen, dorsal and ventral views. (**C**) Male genitalia, dorsal view. (**D**) Female pteronotum, dorsal view. (**E**) Female terminalia, dorsal and ventral views. Scale bars: A, C–E = 0.1 mm; B = 0.5 mm.

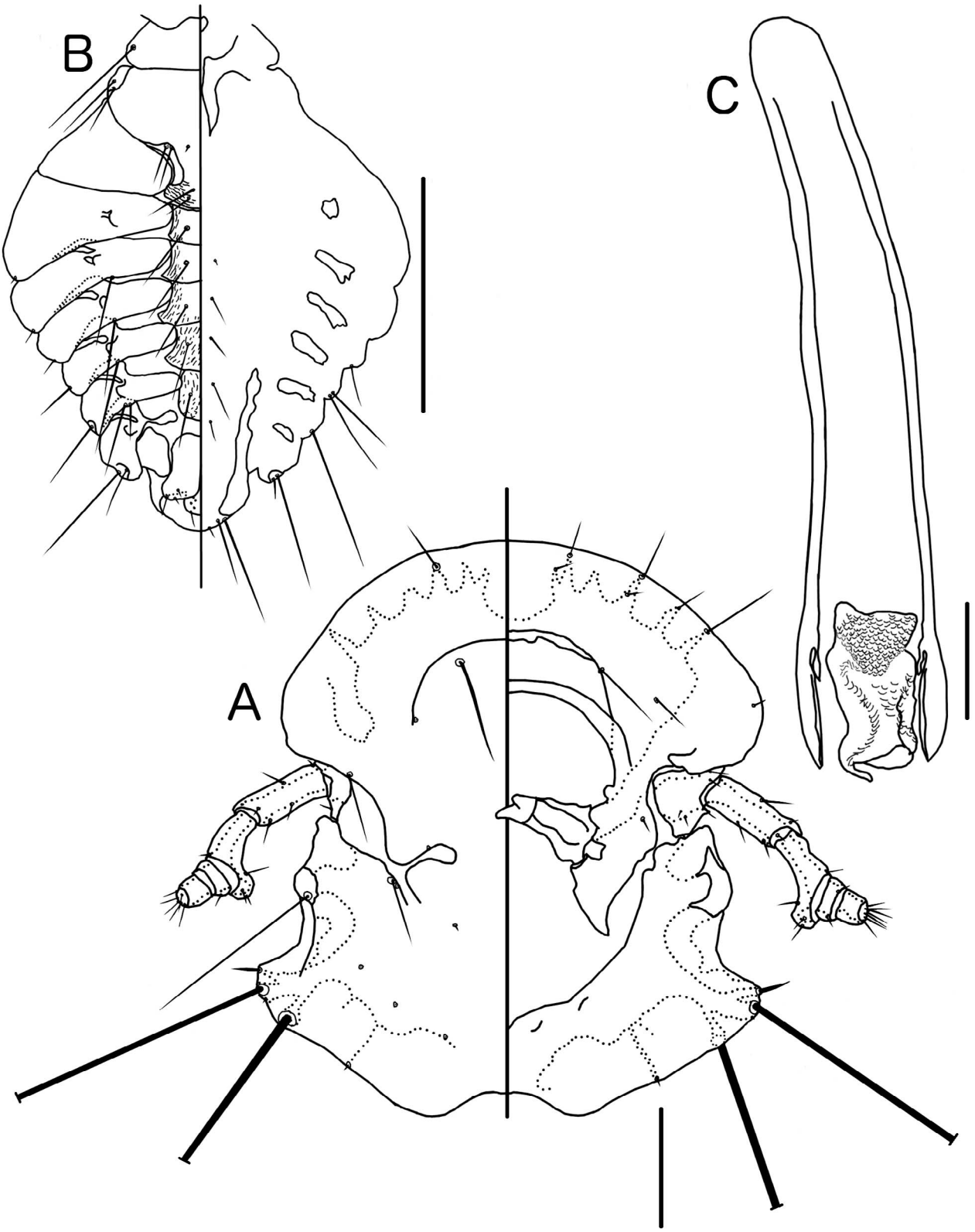

FIGURE 2. *Coloceras piriformis* (Tendeiro, 1969) *ex Chalcophaps indica indica*. (**A**) Male head, dorsal and ventral sides. Pulvinus omitted for clarity. (**B**) Male thorax and abdomen, dorsal and ventral views. (**C**) Male genitalia, dorsal view. Anterior end asymmetrical in all studied material. Scale bars: A, C = 0.1 mm; B = 0.5 mm.

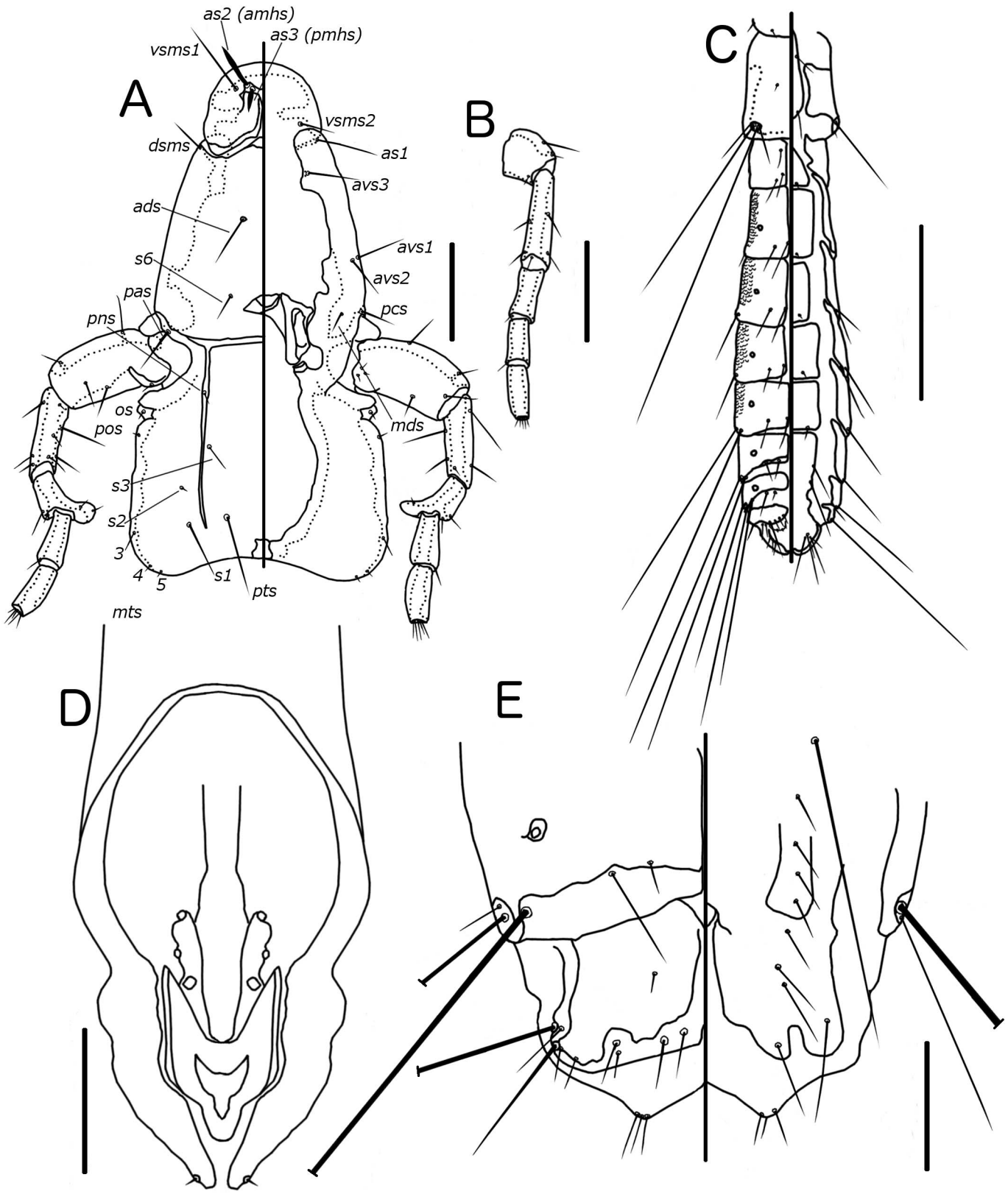

FIGURE 3. *Columbicola asukae* n. sp. *ex Columba janthina janthina*. (**A**) Male head, dorsal and ventral views. Pulvinus omitted for clarity. Abbreviations used: *ads* = anterior dorsal seta; *amhs* = anterior medial head seta; *as1* = anterior seta 1; *avs1–3* = anterior ventral setae 1–3; *dsms* = dorsal submarginal seta; *mds* = mandibular seta; *mts1–5* = marginal temporal setae 1–5; *os* = ocular seta; *pas* = preantennal seta; *pcs* = preconal seta; *pmhs* = posterior medial head seta; *pns* = postnodal seta; *pos* = preocular seta; *pts* = posttemporal seta; *s1–6* = sensillae 1–6; *vsms1–2* = ventral submarginal setae 1–2. (**B**) Female right antennae, ventral view. (**C**) Male thorax and abdomen, dorsal and ventral views. (**D**) Male genitalia, dorsal view. (**E**) Female terminalia, dorsal and ventral views. Scale bars: A, B, E = 0.1 mm; C, D = 0.5 mm.

material corresponds well with Tendeiro's (1969) original description, except that our material is slightly larger in all dimensions than the 2 males measured by Tendeiro (1969). *Coloceras piriformis* was originally described from Sikkim, India, from the same host subspecies as our material from China and Japan. No females were examined by us.

Johnson et al. (2011) showed that *Coloceras* is paraphyletic, and that *Nitzschiella* Kéler, 1939, in which *Cc. piriformis* was originally described, may be a valid genus. *Coloceras piriformis* has a head shape similar to that of *Cc. menadense* (Piaget, 1880), the type species of *Nitzschiella*, and would likely be included in this genus, if considered valid.

DESCRIPTION

Columbicola asukae n. sp.

(Fig. 3A–E)

Diagnosis: Male: Head shape as in Figure 3A. *as3 (pmhs)* shorter than *as2 (amhs)*. Scape and pedicel elongated; flagellomere I with spur on median side; flagellomeres II–III long, slender. *s1* and *pts* extending past posterior margin of head. *s3* and *s6* long; *s4, s5, s7* not visible. Three *mts* visible on each side (Fig. 3A); these likely represent *mts3–5*. Pronotum rounded quadratic. Pteronotal shape and chaetotaxy as in Figure 3C. Abdominal shape as in Figure 3C. Tergal and sternal plates typical for genus. Tergites III–VII with scaled texture on dorsal side. Abdominal chaetotaxy (on both sides): *ps:* II: absent; III: 1; IV–VII: 3; VIII: 3 (plus 1 trichobothrium); IX+X: 2. *aps:* absent. *pps:* II–VIII: present. *tps:* absent. *ss:* II: 1 (plus 1 in anterior end); III–VIII: 1. *sts:* II–VI: 1; 2 along lateral margins of subgenital plate. Tergite IX+X with 5–7 setae on posterior margin. Segment XI with 3 setae dorsally and 5 setae ventrally. Male genitalia as in Figure 3D. Anterior groove deep. Ventral lobes with 3 large lateral pores on each side.

Female: Head as in male (Fig. 3A), but antennae as in Figure 3B, and with shorter dorsal head setae. Thoracic and abdominal segments similar to male (Fig. 3C), but pteronotal setae shorter and scaling of tergites more pronounced. Female abdominal chaetotaxy (on each side): *ps:* II: absent; III: 1; IV–VII: 3; VIII: 5 (trichobothrium not hairlike); IX+X–XI: absent. *aps:* absent. *pps:* II–VIII: present. *tps:* absent. *ss:* II: 1 (plus 1 in anterior end); III–VIII: 1. *sts:* II–VIII: 1; IX+X–XI: absent (excluding genital setae described below). Tergite IX+X with 1 seta on plate and 8–9 setae along posterior margin. Three anal setae on distal margin of abdomen. Subgenital plate groove long and slender (Fig. 3E), widened distally. Seven to 9 (rarely more) setae on each side of groove, 2 setae near posterior margin on each side.

Measurements: Male (n = 12): TL: 2.09–2.32; HL: 0.53–0.56; HW: 0.27–0.29; PRW: 0.23–0.25; PTW: 0.29; AW: 0.34–0.40. Female (n = 10): TL: 2.56–2.77; HL: 0.56–0.60; HW: 0.29–0.31; PRW: 0.23–0.26; PTW: 0.31–0.32; AW: 0.39–0.46.

Taxonomic summary

Type host: Columba janthina janthina Temminck, 1830—Japanese wood pigeon.

Type locality: Nippana, Miyake-mura, Miyake-shicho, Miyake-jima, Tokyo, Japan (34°4′44″N 139°31′44″E).

Voucher specimens: Holotype: 1♂; Tokyo, Miyake-shicho, Miyake-mura, Nippana (Miyakejima Island), 5 October 1994, M. Tsurumi, YIO-P-00001, from host YIO-05140. Paratypes: 3♂, 2♀, same collection details as holotype, YIO-P-00003–7. 4♂, 5♀; Tokyo, Miyake-shicho, Miyake-mura, Izu (Miyakejima Island), 25 December 1995, M. Tsurumi, YIO-P-00002, YIO-P-0008–15, from host YIO-05141. 4♂, 2♀; Tokyo, Miyake-shicho, Miyake-mura, Kamitsuki (Miyakejima Island), collection date unknown, M. Tsurumi, YIO-P-00016–21, from host YIO-05143. 1♂, 1♀; same collection details as holotype, PIPeR: 1995-005. Non-type material: One nymph; Tokyo, Miyake-shicho, Miyake-mura, Ako (Miyakejima Island), 2 January 1997, M. Tsurumi, YIO-P-00022, from host YIO-05147.

Host specimens: Deposited at YIO; see above.

Etymology: The specific epithet refers to Souryuu Asuka Langley, the fiery "Second Child" of Hideaki Anno's (b. 1960) *Shin SeikiEvangerion*, an animated TV series (1995–1996). This refers to the shape of the mesosome, which is reminiscent of the head of Unit 02, the EVA unit Asuka pilots.

Remarks

The key of Adams et al. (2005) places *Columbicola asukae* n. sp. in the *columbae* species-group, where it comes out as member of couplet 31, similar to *Cb. keleri* Tendeiro, 1965, and *Cb. turturis* (Uchida, 1917). Of these, *Cb. asukae* n. sp. is most similar to *Cb. keleri* in that the basal plate has a transverse thickening continuous with the parameres in both species, whereas this thickening is interrupted medianly in *Cb. turturis*. In addition, all pores of the mesosome are located marginally near the proximal end of the mesosome in both *Cb. asukae* n. sp. and *Cb. keleri*, whereas at least one pore is located more distally in *Cb. turturis*. Parameres of *Cb. asukae* n. sp. similar to those of *Cb. keleri*, but marginal thickening more slender anteriorly. The anterior groove of the mesosome is much deeper in *Cb. keleri*, reaching almost to the distal end of mesosome, whereas in *Cb. asukae* n. sp. it reaches to about midline of mesosome. The lateral margins of the mesomere are almost straight in *Cb. keleri* but are sinuous in *Cb. asukae* n. sp. Female subgenital plate groove more slender in *Cb. asukae* n. sp. than in either *Cb. keleri* or *Cb. turturis*, with more lateral genital setae, and more reminiscent of that of *Cb. vitiensis* Tendeiro, 1967.

Emended couplet 31 of the Key of Adams et al. (2005)

31. Basal plate without complete transverse thickening. At least one mesosomal pore on each side not marginal and posterior to median expansions of parameres. Groove with slight lateral expansion near midline … *Columbicola turturis* (Uchida)

—Basal plate with complete transverse thickening. All mesosomal setae marginal and anterior to median expansion of parameres. Grooves with parallel or divergent lateral margins … 31a

31a. Anterior indentation of mesosome almost reaches distal margin of mesosome. Females with lateral margins of groove parallel … *Columbicola keleri* Tendeiro.

—Anterior indentation of mesosome reaches to or barely beyond midline of mesosome. Females with lateral margins of groove divergent distally … *Columbicola asukae* n. sp.

Columbicola lemoinei n. sp.

(Fig. 4A–E)

Diagnosis: Male: Head shape and chaetotaxy as in Figure 4A. *as3 (phms)* shorter than *as2 (amhs)*. Scapes and pedicel elongated; flagellomere I with spur; flagellomeres II–III long, slender. *s1* and *pts* not extending past posterior margin of head. Three pairs of minute *mts* visible (Fig. 4A); these likely represent *mts3–5*. Pronotum rounded quadratic. Pteronotal shape and chaetotaxy as in Figure 4E. Abdominal shape as in Figure 4E, tergites and sternites typical for genus. Tergites III–VI with extensive scaled pattern. Abdominal chaetotaxy (on each side): *ps:* II: absent; III: 1; IV–V: 3; VI–VIII: 4; IX+X: 2. *aps:* absent. *pps:* II–VIII: present. *tps:* absent. *ss:* II: 1 (plus 1 in anterior end); III–VIII: 1 (those of VII–VIII displaced medianly, and may be *tps*). *sts:* II: absent; III–VI: 1; 2 setae along lateral margins of subgenital plate. Tergite IX+X with 4–5 setae on posterior margin. Segment XI with 2 setae dorsally and 4 setae ventrally. Genitalia as in Figure 4C. Antero-lateral corners thickened, interlocking with median extensions of parameres. Proximal margin with 3 pores on each side. Lateral margins of parameres not constricted, gently convergent to median point.

Female: Head roughly as male (Fig. 4A), but antennae as in Figure 4B, and all dorsal head setae shorter than in male. Thoracic and abdominal segments similar to male (Fig. 4E); scaling of tergites more pronounced than in male. Tergite IX+X with prominent posterior projection on posterior margin as in Figure 4D. Female abdominal chaetotaxy (on each side): *ps:* II: absent; III: 1; IV: 2; V: 3; VI–VIII: 4; IX+X–XI: absent. *aps:* absent. *pps:* II–VIII: present. *tps:* absent. *ss:* II: 1 (plus 1 in anterior end); III–VIII: 1. *sts:* II–VIII: 1; IX+X–XI: absent (excluding genital setae described below). Tergite IX+X with 1 seta on plate and 7–8 along posterior margin. Three anal setae on distal margin of abdomen. Subgenital groove broadly oval (Fig. 4D), with distal constriction. One to 3 short setae on each side of groove at about midlength, 1–2 short setae on each side of groove near distal end of plate. Two longer setae on posterior margin of subgenital plate on each side.

Measurements: Male (n = 6): TL: 2.12–2.30; HW: 0.28–0.29; HL: 0.50–0.56; PRW: 0.21–0.23; PTW: 0.28–0.32; TW: 0.39–0.46. Female (n = 11, except TL where n = 10): TL: 2.33–2.56; HL: 0.55–0.61; HW: 0.28–0.31; PRW: 0.21–0.25; PTW: 0.29–0.35; TW: 0.44–0.51.

Taxonomic summary

Type host: Treron formosae permagnus Stejneger, 1887—whistling green-pigeon (*permagnus*).

Other host: Treron formosae medioximus (Bangs, 1901)—whistling green-pigeon (*medioximus*).

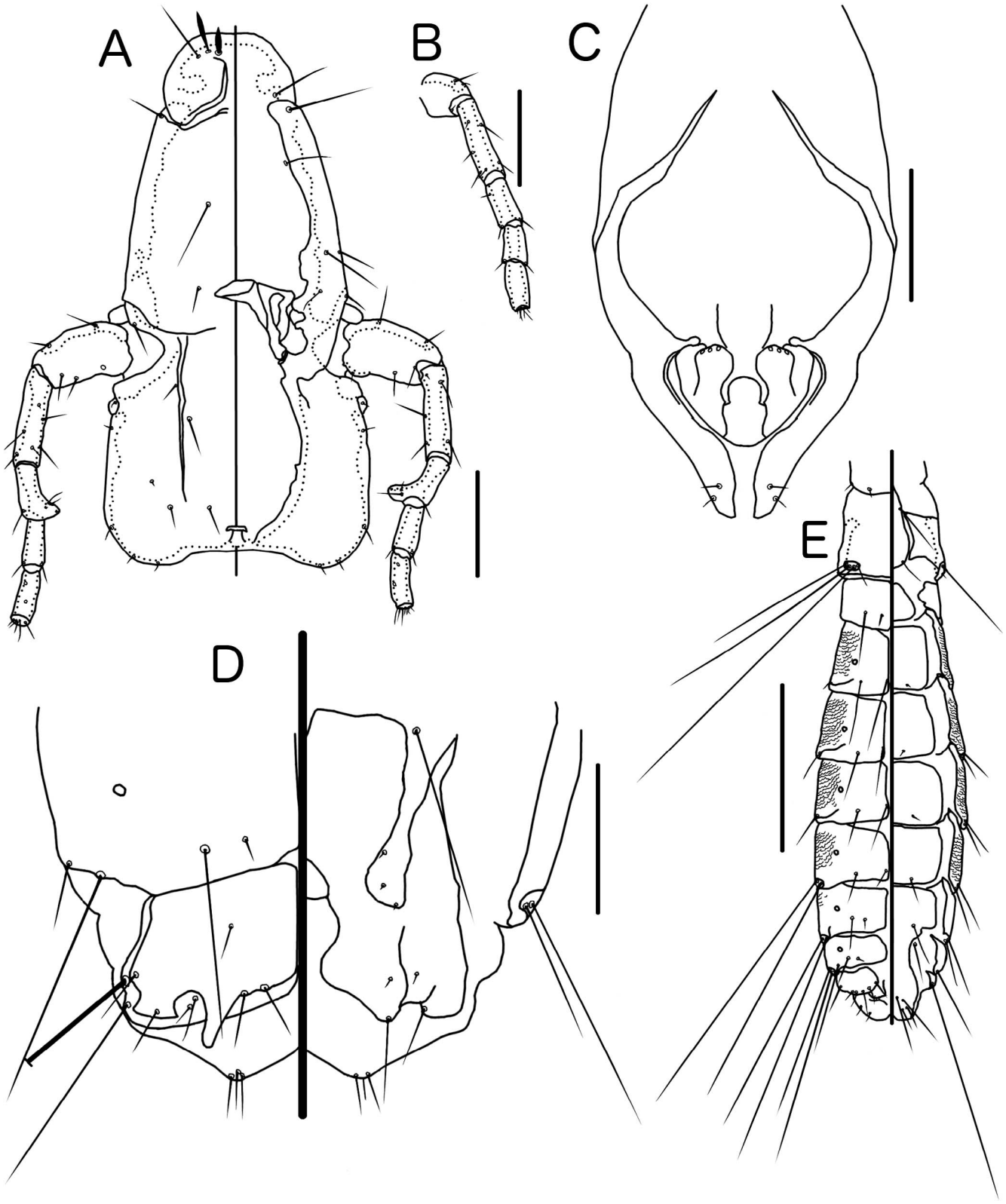

FIGURE 4. *Columbicola lemoinei* n. sp. *ex Treron formosae permagnus*. (**A**) Male head, dorsal and ventral views. Pulvinus omitted for clarity. (**B**) Female right antenna, ventral view. (**C**) Male genitalia, dorsal view. (**D**) Female terminalia, dorsal and ventral views. (**E**) Male thorax and abdomen, dorsal and ventral views. Scale bars: A, B, D = 0.1 mm; C, E = 0.5 mm.

Type locality: Isen-cho, Tokuno-shima, Ohshima-gun, Amami Islands, Kagoshima Prefecture, Japan (27°49′12″N, 128°55′56″E).

Voucher specimens ex Treron formosae permagnus: Holotype: 1♂; Kagoshima Prefecture, Ohshima-gun, Isen-cho (Tokunoshima Island), 16 March 1999, M. Tsurumi, YIO-P-00023, from host YIO-62972. Paratypes: 2♂, 5♀; same collection details as holotype, YIO-P-00024–29. 2♀; Kagoshima Prefecture, Kumage-gun, Yakushima, 12 April 2005, M. Tsurumi, YIO-P-00033–34, from host YIO-63750. 2♂, 2♀; same collection details as holotype, PIPeR: 1999-027. Non-types: 2 nymphs; same collection details as holotype, YIO-P-00030–32

Voucher specimens ex Treron formosae medioximus: Non-types: 1♂, 2♀, Okinawa Prefecture, Ishigaki-shi, Tomoshiro (Ishigakijima Island), 10 September 1999, M. Tsurumi, YIO-P-00035–37, from host YIO–63042.

Host specimens: Deposited at YIO; see above.

Etymology: Named after Mr. François Le Moine, Die, France, in recognition of his many years as an amateur bird-bander in France, Switzerland, and elsewhere, promoting the understanding of avian ecology and migration behavior, as well as the assistance and companionship provided during D.G.'s collection trip in Japan.

Remarks

Columbicola lemoinei n. sp. keys to couplet 54 in the key of Adams et al. (2005), placing it in the *clayae* species-group close to *Cb. elbeli* Tendeiro, 1965, and *Cb. sphenurus* Tendeiro, 1984. Mesosome of *Cb. lemoinei* n. sp. most similar to that of *Cb. elbeli*, in that both have antero-lateral thickenings and a median protuberance. However, while in *Cb. elbeli* the mesosome is extended distally toward the distal tips of the parameres, in *Cb. lemoinei* n. sp. the distal margin of the mesosome is gently rounded, not extended. Moreover, the mesomere is comparatively wider in *Cb. lemoinei* n. sp. than in *Cb. elbeli*. The parameres are indented slightly laterally in both *Cb. sphenurus* and *Cb. lemoinei* n. sp., whereas no such indentation is found in *Cb. elbeli*. However, *Cb. lemoinei* n. sp. lacks the hook-shaped antero-lateral processes found on the mesomere of *Cb. sphenurus*, and the mesosome of *Cb. lemoinei* n. sp. is rounded distally, not pointed as in *Cb. sphenurus*. Females of *Cb. lemoinei* n. sp. are indistinguishable from female *Cb. elbeli*. We have not seen any females of *Cb. sphenurus*. As these were not illustrated by Adam et al. (2005), and the single photo of a female *Cb. sphenurus* provided by Tendeiro (1984) is unclear, no comparisons can be made between the two at present.

Columbicola sphenurus Tendeiro, 1984, was reported from *Treron formosae medioximus* by Tendeiro (1984); however, male genitalia of *Cb. lemoinei* n. sp. differs from those described for *Cb. sphenurus* by Adams et al. (2005). We list both species in Table I, pending a more thorough investigation of louse fauna on the host in Japan.

Emended couplet 54 of the key of Adams et al. (2005)

54. Mesomere extended distally to approach distal tips of parameres. Parameres without lateral notch … *Columbicola elbeli* Tendeiro, 1965.

—Mesomere not extended distally, rounded or pointed. Parameres with lateral notch … 54a.

54a. Mesomere pointed distally, and with antero-lateral hook-shaped processes … *Columbicola sphenurus* Tendeiro, 1984.

—Mesomere rounded distally, without antero-lateral hook-shaped processes … *Columbicola lemoinei* n. sp.

ADDITIONAL CHEWING LOUSE RECORDS OF JAPAN

Hohorstiella sp.

Taxonomic summary

Host: Columba janthina janthina Temminck, 1830—Japanese wood pigeon

Voucher specimens: Non-types: 1♀: Tokyo, Miyake-shicho, Miyake-mura, Kamitsuki (Miyakejima Island), collection date unknown, coll. M. Tsurumi, YIO-P-00063 (YIO), from host YIO-05143. 1 nymph: Tokyo, Miyake-shicho, Miyake-mura, Nippana (Miyakejima Island), 5 October 1994, M. coll. Tsurumi, YIO-P-00064 (YIO), from host YIO-05140.

Host specimens: Deposited at YIO; see above.

Remarks

No *Hohorstiella* spp. have previously been recorded from this host, and this report thus constitutes a new host record.

Hohorstiella sp.

Taxonomic summary

Host: Treron formosae permagnus Stejneger, 1887—whistling green-pigeon (*permagnus*)

Voucher specimens: 2♀; Japan: Kagoshima Prefecture, Ohshima-gun, Isen-cho (Tokunoshima Island), 16 March 1999, coll. M. Tsurumi, YIO-P-00065–68 (YIO), from host YIO-62972.

Host specimens: Deposited at YIO; see above.

Remarks

No *Hohorstiella* spp. have previously been reported from this host, and this report thus constitutes a new host record.

Coloceras chinense (Kellogg and Chapman, 1902)

Taxonomic summary

Type host: Streptopelia chinensis (Scopoli, 1786)—spotted dove.

Host in Japan: Streptopelia orientalis orientalis (Latham, 1790)—oriental turtle dove.

Voucher specimens ex Steptopelia o. orientalis: 4♂; Japan: Chiba Prefecture, Abiko-shi, 12 May 2006, coll. M. Tsurumi, YIO-P-00056–59 (YIO).

Host specimens: Deposited at YIO; see above.

Remarks

This is the first report of *Coloceras chinense* from Japan. It was redescribed and illustrated by Tendeiro (1973) and is not illustrated here. Tendeiro (1973) previously reported this louse species from the host subspecies *Streptopelia orientalis agricola* (Tickell, 1833), which is the subspecies found in northeast India to south China. It is listed under *S. orientalis* (Latham, 1790) in the checklist of Price et al. (2003), but we have found no previous reports of this species from other host subspecies of *S. orientalis*. Thus, this report of *Cc. chinense* from *S. o. orientalis* constitutes a new host subspecies record.

Coloceras sp.

Taxonomic summary

Host: Treron sieboldii sieboldii (Temminck, 1835)—white-bellied green-pigeon (*sieboldii*).

Voucher specimens: 2♀; Japan: Niigata Prefecture, Toyosaka-shi, Fukushimagata, 26 October 1999, coll. Kiyoaki Ozaki, YIO-P-00060–61 (YIO).

Host specimens: Deposited at YIO; see above.

Remarks

The Japanese specimens from this host cannot be placed reliably in the key of Tendeiro (1973), as couplets 12 and 17 rely only on male characters, and no males were available to us. However, assuming minimal sexual dimorphism, *Coloceras* sp. keys out to couplet 24, where it seems to be most similar to *Cc. indicum* Tendeiro, 1973. The most prominent differences between *Cc. indicum* and *Coloceras* sp. are the presence of a wide, but medially diffuse, dorsal postantennal suture in *Coloceras* sp., lack of dorsal preantennal suture in *Coloceras* sp., the shape of the head (more flattened at frons in *Coloceras* sp.), and the gonapophysal setae of *Coloceras* sp., which appear more similar to those of Tendeiro's (1973) photo of *Coloceras funebreae* Tendeiro, 1973.

Uchida (1916) reported *Goniocotes aegypticus* [= *Coloceras aegypticum* (Kellogg and Paine, 1911)] from this host in Taiwan, but the head shape of the present material differs widely from that of *Cc. aegypticum*. We have not seen Uchida's material and cannot assess whether his material was actually *Cc. aegypticum*, or if it was identical to the present material.

Columbicola columbae (Linnaeus, 1758)

Taxonomic summary

Type host: Columba livia Gmelin, 1789—rock pigeon.

Voucher specimens: 4♂, 2♀; Japan: Chiba Prefecture, Matsudo-shi, date unknown, coll. Junya Nakamori, YIO-P-00041–46 (YIO).

Host specimens: Not collected.

Remarks

Reported by Uchida (1917) as *Lipeurus baculus* (Nitzsch, 1818) from *Columba livia domestica* from Shinano province (now Nagano Prefecture),

a synonym of *Columbicola columbae* (Linnaeus, 1758) (see Price et al., 2003). It was also reported from Japan by Adams et al. (2005), who provided a redescription and illustrations.

Columbicola guimaraesi Tendeiro, 1965

Taxonomic summary

Type host: Chalcophaps indica indica (Linnaeus, 1758)—common emerald dove (*indica*).

Voucher specimens: Non-types: 1♂, 1♀; Japan: Okinawa Prefecture, Miyako-gun, Shimoji-cho (Kurimajima Island), 6 May 1998, coll. M. Tsurumi, YIO-P-00038–39 (YIO), from host YIO-62871.

Host specimens: Deposited at YIO; see above.

Remarks

This report constitutes a new geographic record for Japan. A recent redescription of this species, with illustrations, can be found in Adams et al. (2005).

Columbicola turturis (Uchida, 1917)

Taxonomic summary

Type host: Streptopelia orientalis orientalis (Latham, 1790)—oriental turtle dove.

Voucher specimens: 1♂; Japan: Chiba Prefecture, Abiko-shi, 24 January 2006, coll. M. Tsurumi, YIO-P-00040 (YIO), from host 080–13232.

Host specimens: Deposited at YIO; see above.

Remarks

Columbicola turturis was described by Uchida (1917) as *Lipeurus turturis* from a *Turtur* (= *Streptopelia*) *orientalis* shot at Morioka, Rikuchuu Province (now Iwate Prefecture). A recent redescription of this species, with illustrations, can be found in Adams et al. (2005), who also studied Japanese material.

DISCUSSION

Twelve species of doves and pigeons are known from Japan (Ornithological Society of Japan, 2012), of which 2 (*C. versicolor* Kittlitz, 1832, and *C. jouyi* (Stejneger, 1887)) are extinct (Gibbs et al., 2001). No chewing lice are known from these extinct hosts (Price et al., 2003; Adams et al., 2005; Bush et al., 2009). Chewing lice have previously been recorded in Japan from only 2 columbiform species (*C. livia* and *S. orientalis*), to which we now add records from another 4 hosts (*Ch. indica, C. janthina, T. formosae permagnus*, and *T. sieboldii sieboldii*). Of the remaining 4 species, 3 (*C. oenas* Linnaeus, 1758, *S. decaocto* (Frivaldszky, 1838), and *S. tranquebarica* (Hermann, 1804)) are known to harbor lice outside Japan (Price et al., 2003; Bush et al., 2009), and it is likely that surveys in Japan including these hosts will encounter known species of lice. No lice are known from *Ptilinopus leclancheri taiwanus* Ripley, 1962 (Price et al., 2003; Adams et al., 2005; Bush et al., 2009), but lice of 3 genera are known from *Ptilinopus* spp. outside Japan (Price et al., 2003). None of the extant columbiforms are completely endemic to Japan, and records of lice from hosts in other geographical regions suggest that Japanese columbiforms are undersampled. Note, however, that lice are known to exhibit geographical specificity (Johnson et al., 2002; Weckstein, 2004). Thus, additional work is needed to confirm whether the absence of species of lice present on these hosts in other regions is a geographical phenomenon or a result of sampling bias.

Coloceras nakamurai n. sp., *Cb. asukae* n. sp., and the *Hohorstiella* sp. recorded from *C. janthina* come from a host that is considered near-threatened and that is vulnerable to deforestation and hunting pressure (Gibbs et al., 2001). These lice are likely as threatened as their host and should be added to the small but growing list of lice known from rare and threatened hosts (Pérez and Palma, 2001; Gustafsson and Olsson, 2012; Leonardi and Palma, 2013; Rózsa and Vas, 2015). Preservation of these lice should be factored into future work aiming to preserve this host (see Whiteman and Parker, 2005; Dunn et al., 2009; Pérez et al., 2013). Given the aggregated distribution of these parasites, the conservation of this species may require strategic preservation of habitats that are sufficiently large to maintain parasite populations, not just their host population (Bush et al., 2013).

ACKNOWLEDGMENTS

This project was funded by a Swedish Taxonomy Initiative grant 36/07 1.4 and NSF grant DEB 1050706. D.G.'s travel to Japan was funded by Wilhelm and Martina Lundgrens Vetenskapsfond 1 (vet1-379/2008). We would like to thank all the staff and volunteers of the Yamashina Institute for Ornithology and Japanese bird banders, who assisted with this effort, in particular Noboru Nakamura (YIO). Two anonymous reviewers offered helpful advice for this manuscript, for which we are very grateful.

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