



Two new species of *Paraphilopterus* Mey, 2004 (Phthiraptera: Ischnocera: Philopteridae) from New Guinean bowerbirds (Passeriformes: Ptilonorhynchidae) and satinbirds (Passeriformes: Cnemophilidae)

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Abstract

Two new species of *Paraphilopterus* Mey, 2004 are described and named. *Paraphilopterus knutiae* n. sp. is described from two subspecies of Macgregor's bowerbirds: *Amblyornis macgregoriae nubicola* Schodde & McKean, 1973 and *A. m. kombok* Schodde & McKean, 1973, and Sanford's bowerbird: *Archboldia sanfordi* (Mayr & Gilliard, 1950) (Ptilonorhynchidae). *Paraphilopterus meyi* n. sp. is described from two subspecies of crested satinbirds: *Cnemophilus macgregorii macgregorii* De Vis, 1890 and *C. m. sanguineus* Iredale, 1948 (Cnemophilidae). These new louse species represent the first records of the genus *Paraphilopterus* outside Australia, as well as from host families other than the Corcoracidae. The description of *Paraphilopterus* is revised and expanded based on the additional new species, including the first description of the male of this genus. Also, we provide a key to the species of *Paraphilopterus*.

Key words: Phthiraptera, Ischnocera, Philopteridae, *Paraphilopterus*, chewing lice, new species, Ptilonorhynchidae, Cnemophilidae, New Guinea

Introduction

Mey (2004: 188) described the new genus *Paraphilopterus* based on a single female louse from the Australian host *Corcorax melanoramphos* (Vieillot, 1817) (Corcoracidae). He named the type species *Paraphilopterus styloideus*, and the genus has since remained monotypic. We have examined lice from two species of Ptilonorhynchidae and one species of Cnemophilidae, all from Papua New Guinea. These specimens key out to *Paraphilopterus* in Mey's (2004: 195) key, and fit the description of this genus. This material represents two new species of *Paraphilopterus*, which are described herein. The description of the genus by Mey (2004) is expanded to include morphological features of the new species and those of the male. The male genitalia of this genus were unknown to Mey (2004), and males of *P. styloideus* remain unknown. We provide a tentative generic-level description of male genitalia based on two of the three species in this genus. A male *P. styloideus* is needed for a definitive description of the genitalia of this genus.

Material and methods

Material used for this paper included specimens on microscope slides deposited in the Price Institute of Parasite Research, Department of Biology, University of Utah (PIPeR), the Natural History Museum, London (NHML), and the U.S. National Museum of Natural History, Washington (USNM). Dimensions taken and their abbreviations are: TL = total length along midline; HL = head length (measured along the midline, including hyaline margin); HW = head width at temples; AS3: length of anterior seta 3; ADS = length of anterior dorsal seta; DAPL = dorsal anterior plate length (at midline); DAPW = dorsal anterior plate width (at widest point); DAPLL = dorsal anterior plate lateral length (from base of ADS to antero-lateral corner); PRW = prothorax width; PTW = pterothorax width; AW

= abdominal width at 5th abdominal segment. All measurements are in millimeters. Mean values are indicated in parentheses.

Head chaetotaxy is based on Clay (1951), as modified by Mey (1994) for the MTS. Our interpretation of these setae is illustrated in Fig. 1; note that Mey (1994: 76) renamed Clay's (1951) MTS1 as the "*praeocularborste*" (= preocular seta), but we do not agree with this term, as these setae are clearly located behind the eye (see POS in Fig. 1), and here we refer to them as the "post-ocular setae". Terminology of pronotal setae follows Mey (1994: 77). Tergal setal counts do not include post-spiracular setae or trichobothria. Sternal setal counts refer to sternomedian setae only, even in cases where pleural setae are located on ventral side. Pleural setae are given for each side; counts given for female segment XI not including three setae on each side associated with pseudostylus. Host taxonomy follows Clements *et al.* (2014).

Taxonomy

Philopteridae Burmeister, 1838

Paraphilopterus Mey, 2004

Type species: *Paraphilopterus styloideus* Mey, 2004 (by original designation).

Host distribution. With the new records detailed below, the genus *Paraphilopterus* is now known from three different host families: Corcoracidae (one louse species), Cnemophilidae (one louse species), and Ptilonorhynchidae (one louse species). These host families are not closely related (Aggerbeck *et al.* 2014) which, given the sparse sampling in the region, suggests that *Paraphilopterus* may be under-sampled. Additional material from other birds in the Australo-Papuan region is needed to further evaluate the host specificity of this genus.

Geographical range. Australia and Papua New Guinea. All known host families are endemic to the Australo-Papuan region.

Diagnosis. Largely as described by Mey (2004: 188). Head trapezoidal, postantennal area slightly wider than preantennal area (Figs 1, 5). Preantennal area of type D2 (*sensu* Mey 2004). Marginal carina widely interrupted medianly and indented, but not interrupted, laterally. Hyaline margin wide, extending laterally, not thickened medianly. Hyaline margin and anterior margin of dorsal anterior plate shallowly concave. Ventral carina interrupted medianly, recurved in hairpin-loop (Fig. 1). Dorsal preantennal suture encircles dorsal anterior plate completely. ADS on posterior margin of dorsal anterior plate. AS3 and AS1 dorsal. Dorsal anterior plate with posterior median projection prominent (Figs 11–13). Coni slender. Trabecula present, large. Antennae not sexually dimorphic. Scape with one thick, long seta on anterior margin. Pedicel with two thick, long setae on ventral surface. POS on or just behind eye. Setae: OS, MTS1, and MTS3 long.

Pronotum (Figs 3–4, 7–8) with one pronotal post-spiracular seta (PPSS see Mey 1994: 77) median to spiracle opening on each side. 0–2 posterior submarginal setae on pronotum, near midline. Pteronotal row of setae interrupted sublaterally (Figs 3–4) or continuous (Figs 7–8).

Tergites II–VIII medianly divided (Figs 3–4, 7–8); tergite IX+X medianly continuous in both sexes, arched anteriorly. Postero-lateral extensions of tergites II–III large, blunt. Tergal setae in medianly continuous rows. Post-spiracular setae present on tergites III–VII. Sternites and male subgenital plate not visible. No spine-like setae on sternal plates. Female subgenital plate present on segments VI–VII, irregularly shaped, weakly sclerotized, margins indistinct. No sternal plates posterior to vulval margin.

Male genitalia typical of the *Philopterus* complex (Figs 2, 6): basal plate long, slender, tongue-like, but widening distally. Distal margin of basal plate thickened. Mesomere fused to basal plate, protruding beyond distal margin of basal plate. Two pores on lateral margins of mesomere, generally visible only from the lateral side on specimens with distorted genitalia. Three minute setae visible on each side of mesomere, near bases of parameres. Parameres short, lobe-like, with no visible division from distal end of basal plate. Distal parameres with one large pore postero-laterally and one minute seta apically. Genital opening with three minute setae on each side.

Females of all known *Paraphilopterus* species have paired pseudostyli (Mey 2004: 196 = "paarigem griffelartigem Fortsatz" *sensu* Mey 2004: 188) on the 11th abdominal segment (Figs 9–10). Each pseudostylus is

associated with three minute setae (setae *a–c*, Figs 9–10): seta *a* positioned at the base of the pseudostylus, seta *b* either at the base (as in *P. styloideus*) or on the median margin (as in species described here), and seta *c* distally on median the margin of the pseudostylus.

Discussion. The preantennal area of *Paraphilopterus* is structurally similar to those of some species of *Philopteroides* Mey, 2004 but broader, with lateral margins almost parallel. The hyaline margin is shallowly concave as in *Ph. beckeri* species-group of *Philopteroides*, but median section not sclerotized. Unlike in *Philopteroides*, the hyaline margin of *Paraphilopterus* is not confined medianly, but extends to lateral margins of the preantennal head. Seta MTS2 is short, and MTS1 and MTS3 are long (MTS2 only long MTS in *Philopteroides*). Submarginal pronotal setae (PSMS, see Mey 1994: 77) present on all species except *P. meyi* **n. sp.** (but see this species). There are no thorn-like setae on ventral abdomen. Male genitalia with minute setae on the distal margin of basal plate and distal end of parameres, unlike those of *Philopteroides*. Females *Paraphilopterus* separated from those of *Philopteroides* by the lack of sternal plates posterior to vulval margin and the presence of conspicuous pseudostyli in *Paraphilopterus* (see Valim & Palma 2013 for features of *Philopteroides*).

***Paraphilopterus knutieae* Gustafsson & Bush, new species**

(Figs 1–4, 9, 11–12)

Type host: *Amblyornis macgregoriae nubicola* Schodde & McKean, 1973 (Ptilonorhynchidae)—Macgregor's bowerbird.

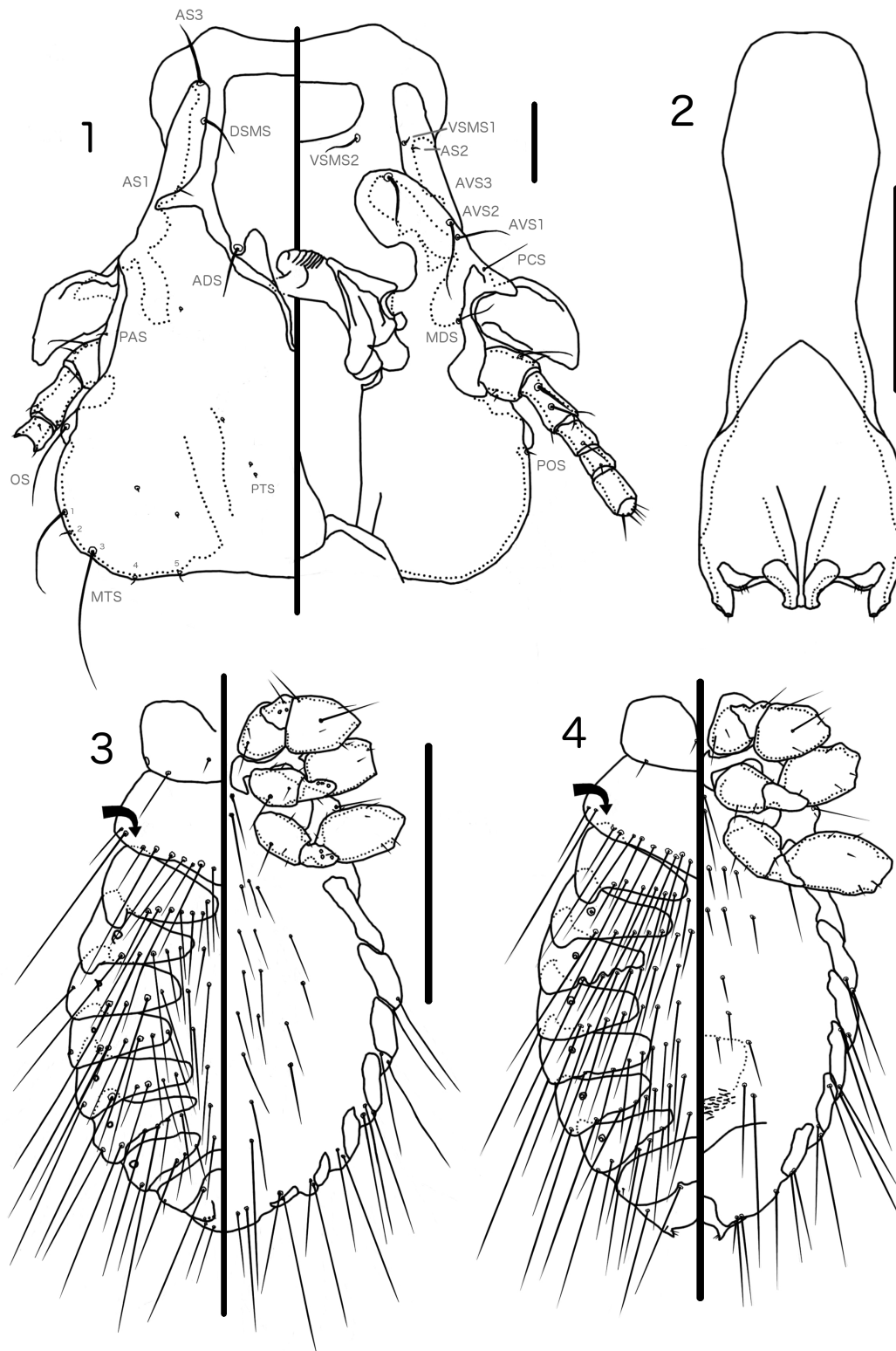
Other hosts: *Amblyornis macgregoriae kombok* Schodde & McKean, 1973; *Archboldia sanfordi* (Mayr & Gilliard, 1950) (Ptilonorhynchidae)—Sanford's bowerbird.

Diagnosis. The female *Paraphilopterus knutieae* **n. sp.** is separated from that of *P. styloideus* by having fewer pteronotal setae, with the two most lateral setae on each side being separated from the others by a gap (Fig. 4). Female terminalia are similar in the two species, but *P. knutieae* has two setae on each pseudostylus (one in *P. styloideus*) and six minute setae (two in *P. styloideus*) near the vulval margin. The male of *P. knutieae* is separated from that of *P. meyi* **n. sp.** by the shape of the dorsal preantennal plate (Figs 11–13), and by the presence of a sublateral gap in the pteronotal setal row. As the male of *P. styloideus* is unknown, no comparison can be made.

Description. Head shape and chaetotaxy as in Fig. 1. Hyaline margin wide, long, bulging laterally; median section shallowly concave. Dorsal anterior plate largely rectangular, medianly extended to mandibles (Figs 11–12). Ventral anterior plate roundly rectangular. Coni short and slender. Trabecula very large, much broader than scape, anterior margin much convex. Post-ocular nodi small, rounded; postocular setae (POS) located near posterior margin of eye. Gular plate diffuse, slender, drop-shaped.

Thoracic and abdominal segments as in Figs 3–4. Pronotal post-spiracular setae (PPSS) do not extend to posterior margin of pteronotum. One PSMS on each side in both sexes. Pteronotum with 17–20 (one specimen each with 21 and 23) setae on posterior margin in male, and 19–22 (one specimen each with 18 and 23) in female. Gap in pteronotal setae as in Figs 3–4 (arrowed); second and fourth setae from lateral margin typically longer than other setae.

Male. Abdominal chaetotaxy as in Fig. 3. Tergocentral setae: segment II: 12–15 (+2 in anterior end); III–V: 19–12; VI: 8–10; VII: 8–11; VIII: 7–9; IX+X: 2; XI: 4. Sternal setae: II–III: 6–8; IV–VI: 5–7; VII–VIII: 2; IX+X: 0; XI: 4. Pleural setae: II–III 0; IV: 2–3; V: 3; VI: 4; VII–VIII: 3; IX+X: 3 (one pair very short); XI: 0. Genitalia as in Fig. 2. Mesomere medianly divided into two separate plates shaped as in Fig. 5. Measurements: *ex Amblyornis macgregoriae nubicola* (n = 15): TL = 1.41–1.63 (1.52); HL = 0.53–0.60 (0.56); HW = 0.49–0.53 (0.51); AS3 = 0.07–0.11 (0.09); ADS = 0.03–0.05 (0.05); DAPL = 0.27–0.32 (0.29); DAPLL = 0.17–0.18 (0.18); DAPW = 0.18–0.20 (0.18); PRW = 0.27–0.32 (0.30); PTW = 0.40–0.46 (0.43); AW = 0.56–0.65 (0.61). *Ex A. m. kombok* (n = 6): TL = 1.49–1.57 (1.52); HL = 0.53–0.56 (0.54); HW = 0.45–0.49 (0.48); AS3 = 0.08–0.09 (0.08); ADS = 0.04–0.05 (0.04); DAPL = 0.28–0.31 (0.30); DAPLL = 0.18–0.21 (0.19); DAPW = 0.18–0.20 (0.19); PRW = 0.28–0.29 (0.29); PTW = 0.42–0.43 (0.42); AW = 0.61–0.67 (0.63). *Ex Archboldia sanfordi* (n = 10): TL = 1.51–1.66 (1.59); HL = 0.55–0.58 (0.57); HW = 0.47–0.52 (0.51); AS3 = 0.09–0.11 (0.10); ADS = 0.04–0.06 (0.05); DAPL = 0.28–0.31 (0.29); DAPLL = 0.19–0.21 (0.20); DAPW = 0.19–0.19 (0.19); PRW = 0.26–0.32 (0.29); PTW = 0.41–0.48 (0.44); AW = 0.63–0.68 (0.65).



FIGURES 1–4. *Paraphilopterus knutiae* n. sp. ex *Amblyornis macgregoriae nubicola*. 1, male head, dorsal and ventral views (pulvinus omitted for clarity); scale bar = 0.1 mm. 2, male genitalia, dorsal view; scale bar = 0.1 mm. 3, male thorax and abdomen, dorsal and ventral views (distal leg segments omitted); scale bar = 0.5 mm. 4, female thorax and abdomen, dorsal and ventral views (distal leg segments omitted). *Note:* Arrow denotes gap in pteronotal row of setae. *Abbreviations:* 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 setae; POS = postocular seta; VSMS1–2 = ventral submarginal setae 1–2. Dorsal sensilla not named, and variable between individuals.

Female. Abdominal chaetotaxy as in Fig. 4. Tergocentral setae: segment II: 13–15 (+2 in anterior end); III–IV: 12–14; V–VII: 11–13; VIII: 8–10; IX+X: 2; XI: 0. Sternal setae: II–III: 4–7; IV–VII: 2–4 (one female with 7–11 sternal setae on segments II–VI). Pleural setae: II–III 0; IV–V: 3; VI: 4; VII–VIII: 3; IX+X: 3 (one pair very short, thorn-like); XI: 4. Pseudostyli each with two setae distally, and one seta basally. Terminalia as in Fig. 9. Minor lateral seta of tergite IX+X short and stout (arrowed in Fig. 9a) or long and threadlike (arrowed in Fig. 9b). Six (rarely seven) short distal setae on each side near the vulval margin, and 2–4 (typically 3) short proximal setae on each side of the subgenital plate (Fig. 9a). Measurements: *ex Amblyornis macgregoriae nubicola* (n = 15): TL = 1.64–2.01 (1.80); HL = 0.58–0.65 (0.62); HW = 0.54–0.58 (0.56); AS3 = 0.09–0.12 (0.10); ADS = 0.04–0.06 (0.05); DAPL = 0.32–0.34 (0.33); DAPLL = 0.19–0.23 (0.21); DAPW = 0.19–0.21 (0.20); PRW = 0.29–0.35 (0.33); PTW = 0.46–0.53 (0.50); AW = 0.63–0.79 (0.70). *Ex A. m. kombok* (n = 9): TL = 1.60–1.81 (1.70); HL = 0.58–0.61 (0.60); HW = 0.52–0.54 (0.53); AS3 = 0.07–0.10 (0.09); ADS = 0.03–0.05 (0.04); DAPL = 0.30–0.34 (0.32); DAPLL = 0.21–0.22 (0.21); DAPW = 0.20–0.21 (0.21); PRW = 0.29–0.32 (0.31); PTW = 0.45–0.49 (0.47); AW = 0.65–0.72 (0.69). *Ex Archboldia sanfordi* (n = 6): TL = 1.73–2.02 (1.86); HL = 0.60–0.63 (0.62); HW = 0.55–0.57 (0.56); AS3 = 0.10–0.12 (0.10); ADS = 0.04–0.06 (0.05); DAPL = 0.30–0.34 (0.32); DAPLL = 0.20–0.21 (0.21); DAPW = 0.19–0.22 (0.20); PRW = 0.31–0.34 (0.32); PTW = 0.47–0.52 (0.50); AW = 0.67–0.81 (0.74).

Comments. Material from *Archboldia sanfordi* slightly differs from that from *Amblyornis macgregoriae* ssp. in (1) the number of pteronotal setae (19–22 in males and 22–24 in females *versus* 17–20 in males and 19–22 in females, respectively); (2) the length of PPSS, reaching the posterior margin of pteronotum in specimens from *Archboldia sanfordi*; (3) the length of dorsal anterior plate, especially in males, where those in lice from *Archboldia sanfordi* are more similar to those of *P. meyi* n. sp. (Fig. 13) than those in lice from *Amblyornis macgregoriae* ssp. (Fig. 11); and (4) most notably, in 8 of 10 females examined from *Archboldia sanfordi*, the shorter dorso-lateral seta of tergites IX+X reaches the posterior half of tergite, and 4 even reach beyond the posterior margin of the tergite (Fig. 9b), while in only 8 out of 35 from *A. macgregoriae* ssp. that seta reaches the posterior half of the tergite, and none reaches beyond the posterior margin (Fig. 9a). There is also a tendency for lice of both sexes from *Archboldia sanfordi* to have fewer tergocentral setae. In all these characters there is overlap between the material from different host species and subspecies; therefore, until more is known about morphological variation within *Paraphilopterus* and more samples from these hosts have been collected, we do not feel confident that the material from these two host genera can reliably be separated on morphological grounds. Therefore, we tentatively keep material from both hosts together in a single species.

Material examined. Types: *Ex Amblyornis macgregoriae nubicola*: Holotype ♀, Bulldog Road, 6 miles from Edie Creek, elev. 2,200 m, Morobe District, Papua New Guinea, 3 Dec. 1970, A.B. Mirza coll. (host # BBM-NG-99469) (NHML). Paratypes: 4♂, 10♀, same data as holotype (NHML); 7♂, 8♀, same data as holotype (USNM); 11♂, 9♀, same data as holotype (PIPeR).

Non-types: *Ex Amblyornis macgregoriae nubicola*: 10 nymphs, same data as holotype (PIPeR).

Ex Amblyornis macgregoriae kombok: 5♂, 7♀, 2 nymphs, Tari, elev. 5,300 ft, Southern Highlands District, Papua New Guinea, 14 Sep. 1963, P. Temple coll. (host BBM-NG-23001) (PIPeR). 1♂, 1 nymph, Mount Piura, elev. 2,100 m, Eastern Highlands District, Papua New Guinea, 14 Jun. 1966, O.R. Wilkes coll. (host BBM-NG-52119) (PIPeR).

Ex Archboldia sanfordi [given as “*Archboldia papuensis*” on slides, but collection localities indicate that this is *A. sanfordi*, sometimes considered a subspecies of *A. papuensis* (e.g. Gill & Donsker 2014)]: 5♂, 4♀, Mur Mur Pass, 10 km NNE Tambul, elev. 2,800 m, Western Highlands District, Papua New Guinea, 25 Sep. 1968, N. Wilson coll. (host BBM-NG-97337) (NHML). 2♂, 3♀, 1 nymph, same data as previous sample (USNM). 6♂, 4♀, 2 nymphs, same data as previous sample (PIPeR). 3♂, 3♀, Kagaba, 40 km road N Mendi, elev. 2,800 m, Southern Highlands District, Papua New Guinea, 16 Dec. 1967, [M.] Nadchatram, [A.B.] Mirza coll. (host BBM-NG-60462) (PIPeR). 2 nymphs, Kagaba, 40 km road N Mendi, elev. 2,800 m, Southern Highlands District, Papua New Guinea, 16 Dec. 1967, [M.] Nadchatram, [A.B.] Mirza coll. (host BBM-NG-60462) (PIPeR).

Etymology. We name this species in honor of Sarah A. Knutie (University of Utah, Salt Lake City, Utah, U.S.A.), in recognition of her work on the ecology of host-parasite interactions.

***Paraphilopterus meyi* Gustafsson & Bush, new species**

(Figs 5–8, 10, 13)

Type host: *Cnemophilus macgregorii macgregorii* De Vis, 1890 (Cnemophilidae)—crested satinbird.

Other host: *Cnemophilus macgregorii sanguineus* Iredale, 1948.

Diagnosis. Similar to *P. knutiae*, but separated by the lack of a sublateral gap in the pteronotal row of setae and the shape of the dorsal anterior plate, and by the configuration of the male genitalia (Figs 2, 6). Abdominal chaetotaxy overlaps between the two species, and is not diagnostic. *Paraphilopterus meyi* is separated from *P. styloideus* by the same characters as it is from *P. knutiae*, (see above), except for the male genitalia.

Description. Head shape and chaetotaxy as in Fig. 5. Similar to *P. knutiae*, but with the following differences: head smaller; dorsal anterior plate of different shape (Fig. 13); postocular setae clearly posterior to eye, not near posterior margin of eye; gular plate broadly rhombic, with angular lateral margins.

Thoracic and abdominal segments as in Figs 7–8. Pronotal post-spiracular setae (PPSS) do not reach posterior margin of pronotum. Most specimens (7 of 10 males and 13 of 19 females) with no PSMS; 3 males and 5 females with one PSMS; one female with one PSMS on each side. Pteronotum with 18–22 setae on posterior margin in males, and 19–25 (one with 17, one with 18) setae in females. Second and fourth setae from lateral margin typically longer than other setae.

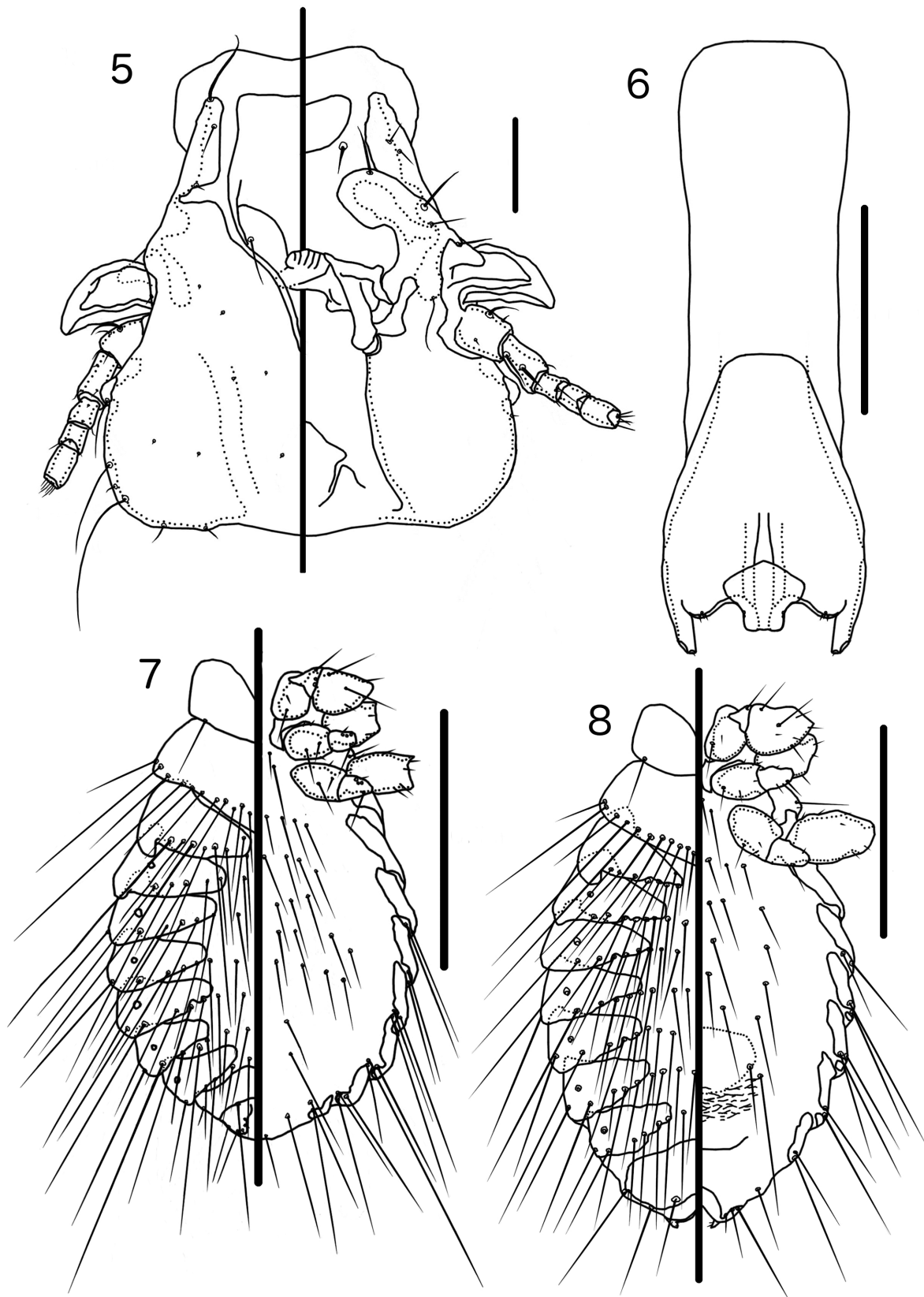
Male. Abdominal chaetotaxy as in Fig. 7. Tergocentral setae: segment II: 12–14 (+2 in anterior end); III–V: 10–11; VI–VII: 9–10; VIII: 8–10; IX+X: 2; XI: 4. Sternal setae: II: 6–8; III: 7–8; IV: 3–6; V–VI: 5–8; VII–VIII: 2; IX+X: 0; XI: 4. Pleural setae: II–III: 0; IV: 2–3; V: 3; VI–VIII: 4; IX+X: 3 (one pair very short); XI: 0. Genitalia as in Fig. 6. Median thickening of mesomere not as clearly defined as in *P. knutiae*, and not visible in many specimens. Measurements: *ex C. m. macgregorii* (n = 9): TL = 1.34–1.51 (1.41); HL = 0.51–0.58 (0.54); HW = 0.46–0.51 (0.48); AS3 = 0.06–0.10 (0.08); ADS = 0.03–0.05 (0.04); DAPL = 0.26–0.28 (0.28); DAPLL = 0.17–0.20 (0.18); DAPW = 0.16–0.19 (0.18); PRW = 0.27–0.31 (0.28); PTW = 0.40–0.46 (0.42). AW = 0.53–0.62 (0.59). *Ex C. m. sanguineus* (n = 5): TL = 1.33–1.36 (1.34); HL = 0.51–0.55 (0.52); HW = 0.45–0.47 (0.45); AS3 = 0.07–0.09 (0.08); ADS = 0.04–0.07 (0.05); DAPL = 0.27–0.29 (0.28); DAPLL = 0.18–0.19 (0.18); DAPW = 0.17–0.19 (0.18); PRW = 0.27–0.29 (0.27); PTW = 0.39–0.41 (0.40); AW = 0.57–0.60 (0.59).

Female. Abdominal chaetotaxy as in Fig. 8. Tergocentral setae: segment II: 12–15 (+2 in anterior end); III: 12–14; IV–VII: 11–14; VIII: 8–11; IX+X: 2; XI: 0. Sternal setae: II: 5–7; III: 4–6; IV–V: 2–4; VI–VII: 3–4. Pleural setae: II–III: 0; IV–V: 2–3; VI: 4; VI–VIII: 3; IX+X: 3 (one pair very short); XI: 4. Pseudostyli each with two setae distally, and one seta basally. Terminalia as in Fig. 10. Six to seven short distal setae on each side near the vulval margin, and 2–3 short proximal setae on each side of the subgenital plate. Measurements: *ex C. m. macgregorii* (n = 6): TL = 1.61–1.83 (1.74); HL = 0.56–0.61 (0.59); HW = 0.51–0.56 (0.53); AS3 = 0.06–0.08 (0.07); ADS = 0.04–0.05 (0.04); DAPL = 0.18–0.22 (0.20); DAPLL = 0.19–0.20 (0.19); DAPW = 0.18–0.19 (0.19); PRW = 0.28–0.33 (0.30); PTW = 0.44–0.49 (0.47); AW = 0.65–0.75 (0.70). *Ex C. m. sanguineus* (n = 10): TL = 1.61–1.82 (1.69); HL = 0.56–0.62 (0.58); HW = 0.51–0.56 (0.52); AS3 = 0.07–0.09 (0.08); ADS = 0.03–0.06 (0.04); DAPL = 0.28–0.33 (0.30); DAPLL = 0.18–0.21 (0.19); DAPW = 0.17–0.10 (0.19); PRW = 0.28–0.32 (0.30); PTW = 0.42–0.50 (0.47); AW = 0.63–0.77 (0.70).

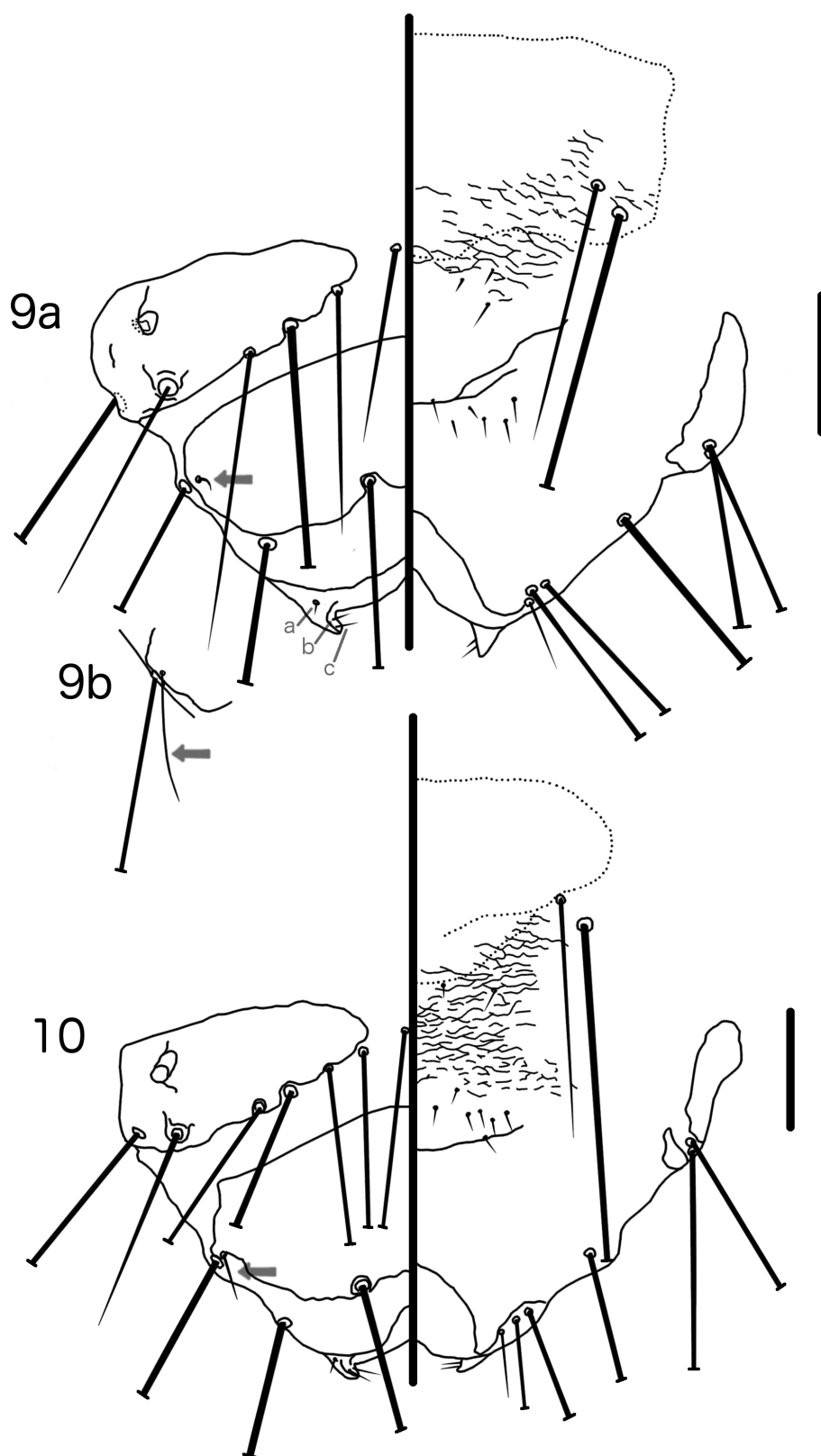
Comments. We have found no significant differences between materials from the two host subspecies.

Material examined. Types: *Ex Cnemophilus macgregorii macgregorii*: Holotype ♀, Vicinity of Guari, Smith's Gap, elev. 2,500 m, Central District, Papua New Guinea, 9 Aug. 1968, A.B. Mirza coll. (host BBM-NG-97041) (NHML). Paratypes: 1♂, same data as holotype (NHML); 1♂, 1♀, same data as holotype (USNM); 2♂, 2♀, same data as holotype (PIPeR). 2♂, 1♀, Bulldog Road, 12 miles from Edie Creek, elev. 2,500 m, Morobe District, Papua New Guinea, 1 Nov. 1967, P.H. Colman coll. (host BBM-NG-54807) (NHML). 1♀, Bulldog Road, 12 miles S of Edie Creek, elev. 2,405 m, Morobe District, Papua New Guinea, 12 Jul. 1966, O.R. Wilkes coll. (host BBM-NG-52441) (PIPeR). 1♂, Bulldog Road, 12 miles S of Edie Creek, elev. 2,405 m, Morobe District, Papua New Guinea, 14 Jul. 1966, O.R. Wilkes coll. (host BBM-NG-52482) (PIPeR).

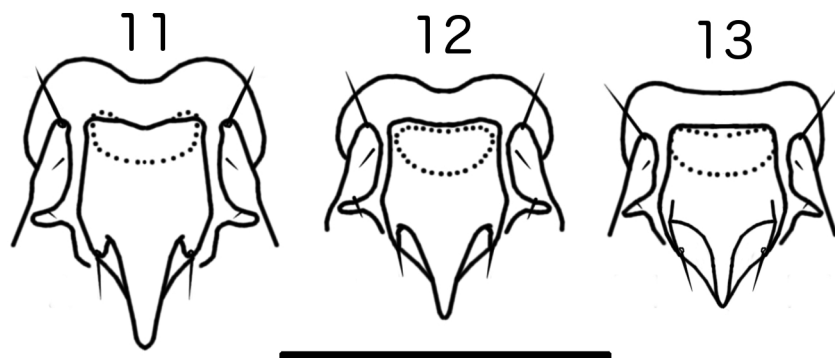
Non-types: *Ex Cnemophilus macgregorii sanguineus*: 1 nymph, same data as holotype (NHML); 1 nymph, same data as holotype (PIPeR). 1♂, 1♀, Tambul, elev. 9,000 ft, Western Highlands District, Papua New Guinea, 5 Jun. 1963, H. Clissold coll. (host BBM-NG-28019) (one slide also contains unidentified *Philopteroides* female) (USNM). 2♀, Tambul, elev. 9,000 ft, Western Highlands District, Papua New Guinea, 5 Jun. 1963, H. Clissold coll. (host BBM-NG-28018) (PIPeR). 3♂, 5♀, 2 nymphs, Tambul, elev. 2,200 m, Western Highlands District, Papua



FIGURES 5–8. *Paraphilopterus meyi* n. sp. ex *Cnemophilus macgregorii macgregorii*. **5.** male head, dorsal and ventral views (pulvinus omitted for clarity); scale bar = 0.1 mm. **6.** male genitalia, dorsal view; scale bar = 0.1 mm. **7.** male thorax and abdomen, dorsal and ventral views (distal leg segments omitted); scale bar = 0.5 mm. **8.** female thorax and abdomen (distal leg segments omitted); scale bar = 0.5 mm.



FIGURES 9–10. Female terminalia, dorsal and ventral views. **9**, *Paraphilopterus knutiae* **n. sp.** ex *Amblyornis macgregoriae nubicola*; **9a**, dorsal lateral setae of tergite IX+X of *P. knutiae* ex *Archboldia sanfordi* (**9b**). **10**, *P. meyi* **n. sp.** Scale bars = 0.5 mm. *Notes:* Subgenital plates are poorly sclerotized and delimited in both species, and included here only approximately. Arrows indicate shorter dorso-lateral seta on segments IX+X. The letters a, b, and c indicate the three setae on each pseudostylus.



FIGURES 11–13. Male dorsal anterior plates and hyaline margins. **11**, *Paraphilopterus knutiae* **n. sp.** ex *Amblyornis macgregoriae nubicola*. **12**, *P. knutiae* **n. sp.** ex *Archboldia sanfordi*. **13**, *Paraphilopterus meyi* **n. sp.** ex *Cnemophilus macgregorii macgregorii*. Scale bars = 0.1 mm.

New Guinea, 4 Jun. 1963, J.H. Sedlacek coll. (host BBM-NG-20276) (PIPeR). 3♀, Tambul, elev. 9,000 ft, Western Highlands District, Papua New Guinea, 5 Jun. 1963, H. Clissold coll. (host BBM-NG-28021) (PIPeR). 1 nymph, Tambul, elev. 9,000 ft, Western Highlands District, Papua New Guinea, 9 Jun. 1963, H. Clissold coll. (host BBM-NG-28023) (PIPeR). 1♀, Tomba, elev. 8,000 ft, Western Highlands District, Papua New Guinea, 25 May 1963, H. Clissold coll. (host BBM-NG-27927) (PIPeR). 2♂, 2♀, 1 nymph, Mount Giluwe, elev. 12,000 ft, Southern Highlands District, Papua New Guinea, 8 Jun. 1963, H. Clissold coll. (host BBM-NG-28049) (PIPeR). 2♀, Mount Giluwe, elev. 10,000 ft, Southern Highlands District, Papua New Guinea, 11 Jun. 1963, H. Clissold coll. (host BBM-NG-28078) (PIPeR). 1♀, 40 road km N of Mendi, Kagaba, elev. 2,800 m, Southern Highlands District, Papua New Guinea, 16 Dec. 1967, M. Nadchatram & A.B. Mirza coll. (host BBM-NG-50446) (PIPeR).

Etymology. This species is named in honour of phthirapterist Eberhard Mey (Naturhistorisches Museum im Thüringen, Rudolstadt, Germany), who erected the genus *Paraphilopterus* in his revision of the *Philopterus* complex (Mey 2004).

Discussion

Including the two new species described here, there are now three known species of *Paraphilopterus* occurring on three different host families. The new species are from New Guinea, which extends the known geographical distribution of the genus beyond Australia, the locality of the type species, *P. styloideus*. All three host families are restricted to Australo-Papuan region (Clements *et al.* 2014). *Paraphilopterus knutiae*, and *P. meyi* are morphologically more similar to each other than either of them is to *P. styloideus*. In the New Guinean species the pseudostylus seta *b* is located on the median margin of the pseudostylus, there are numerous minute setae near the vulval margin, and PSMS, if present, does not reach the posterior margin of the pronotum. This suggests that there may be a divide between the Papuan and Australian species of *Paraphilopterus*. However, since only one species is known from Australia, this hypothesis is premature.

The three known host families of *Paraphilopterus* are not closely related (Jönsson *et al.* 2008; Norman *et al.* 2009; Zuccon & Ericson 2012; Aggerbeck *et al.* 2014). Other closely related hosts occur in the Australo-Papuan region, and additional sampling may discover *Paraphilopterus* parasitizing related host species. However, host phylogeny does not seem to be a good predictor of host-lice associations in other members of the *Philopterus* complex (Mey 2004). The related louse genus *Philopterus* is found on oscine birds from several distantly related families (Mey 2004), and *Philopteroides* also parasitizes birds from distantly related families (Mey 2004; Valim & Palma 2013). Additional sampling may show that the geographic distribution, rather than host relatedness, is a better predictor of the distribution of lice in the *Philopterus* complex.

Key to species of *Paraphilopterus* Mey, 2004

(male of *Paraphilopterus styloideus* unknown)

1. Female Pseudostyli each with one pair of setae distally (see Mey 2004: fig. 33b). Vulval margin with two pairs of setae distally. PSMS reach to or beyond posterior margin of pteronotum. Pterothorax with 52 or more setae on the posterior margin. On Corcoracidae *Paraphilopterus styloideus* Mey, 2004
- Female pseudostyli each with two pairs of setae distally (Figs 9–10). Vulval margin with more than two pairs of setae distally (Figs 9–10). PSMS absent or, when present, do not reach posterior margin of pteronotum (Figs 3–4, 7–8). Pterothorax with less than 52 setae on the posterior margin (Figs 3–4, 7–8). On other families 2
2. Pteronotal row of setae interrupted sublaterally (Figs 3–4). Male dorsal anterior plate as in Fig. 11 or 12. PSMS present. On Ptilonorhynchidae *Paraphilopterus knutieae* n. sp.
- Pteronotal row of setae not interrupted sublaterally (Figs 7–8). Male dorsal anterior plate as in Fig. 13. PSMS generally absent. On Cnemophilidae *Paraphilopterus meyi* n. sp.

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