



## FIVE NEW SPECIES OF *GUIMARAESIELLA* (PHTHIRAPTERA: ISCHNOCERA) FROM BROADBILLS (AVES: PASSERIFORMES: CALYPTOMENIDAE: EURYLAIMIDAE)

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### KEY WORDS ABSTRACT

|                         |   |
|-------------------------|---|
| Phthiraptera            | Five new species of <i>Guimaraesiella</i> Eichler, 1949 are described and illustrated from hosts in the               |
| Ischnocera              | Eurylaimidae and Calyptomenidae. They are <i>Guimaraesiella corydoni</i> n. sp. from <i>Corydon</i>                   |
| Phlopteridae            | <i>sumatranus laoensis</i> Meyer de Schauensee, 1929; <i>Guimaraesiella latirostris</i> n. sp. from <i>Eurylaimus</i> |
| <i>Brueelia</i> complex | <i>ochromalus</i> Raffles, 1822; <i>Guimaraesiella cyanophoba</i> n. sp. from <i>Cymbirhynchus macrorhynchus</i>      |
| <i>Guimaraesiella</i>   | <i>malaccensis</i> Salvadori, 1874 and <i>C. m. siamensis</i> Meyer de Schauensee and Ripley, 1940;                   |
| Eurylaimidae            | <i>Guimaraesiella altunai</i> n. sp. from <i>Calyptomena viridis caudacuta</i> Swainson, 1838; and                    |
| Calyptomenidae          | <i>Guimaraesiella forcipata</i> n. sp. from <i>Eurylaimus steerii steerii</i> Sharpe, 1876. These represent the       |
| Broadbill               | first species of <i>Guimaraesiella</i> described from the Calyptomenidae and Eurylaimidae, as well as the             |
| New Species             | first species of this genus described from the Old World suboscines.  |

Ischnoceran chewing lice belonging to the *Brueelia* complex are widely distributed across the oscine passeriforms (Gustafsson and Bush, 2017). By contrast, suboscine passeriforms are generally parasitized by lice belonging to other complexes (e.g., the *Rallicola* or *Degeeriella* complexes; Carriker, 1956; Somadder and Tandan, 1977; summarized in Table I) or by lice belonging to genera closely related to, but not part of, the *Brueelia* complex (Bush et al., 2016; Gustafsson and Bush, 2017). Similarly, most of the chewing louse genera occurring on suboscine hosts are not known from oscine hosts. For instance, the genus *Debeauxoecus* Conci, 1941 is only known from pittas (Pittidae), and the genera *Furnaricola* Carriker, 1944; *Furnariphilus* Price and Clayton, 1995; *Formicaticola* Carriker, 1957; and *Formicaphagus* Carriker, 1957, are known only from New World suboscines. The only *Brueelia*-complex louse genus known from Old World suboscines is the monotypic *Psammonirmus* Gustafsson and Bush, 2017, from the eurylaimid (typical broadbill) host *Serilophus lunatus* (Gould, 1834). The single louse species in this genus, *Psammonirmus lunatipectus* Gustafsson and Bush, 2017, is morphologically very distinct and does not appear to be closely related to any other

genus within the *Brueelia* complex. In general, oscine and suboscine passeriforms are thus parasitized by lice belonging to different groups, reflecting the basal division between the oscines and the suboscines within Passeriformes (Prum et al., 2015).

Exceptions to this pattern are a few species of lice from the *Brueelia* complex that are known from some furnariid (ovenbird) and tyrannid (tyrant flycatcher) hosts (e.g., Carriker, 1963; Cicchino, 1981, 1983) in the New World. These lice are typical members of *Brueelia* Kéler, 1936 and *Guimaraesiella* Eichler, 1949, and thus may represent relatively recent host switches from oscine to these suboscine hosts. Host switches from oscine to suboscine hosts likely have occurred in the Old World too, but these taxa are understudied.

We here describe 5 species of chewing lice from the Eurylaimidae and the Calyptomenidae (African and green broadbills): *Guimaraesiella corydoni* n. sp. (Figs. 1–7), *Guimaraesiella latirostris* n. sp. (Figs. 8–14), *Guimaraesiella cyanophoba* n. sp. (Figs. 15–21), *Guimaraesiella altunai* n. sp. (Figs. 22–28), and *Guimaraesiella forcipata* n. sp. (Figs. 29–35). All 5 species are typical members of *Guimaraesiella* Eichler, 1949, and are morphologically similar to the type species of the genus, *Guimaraesiella papuana* (Giebel, 1879). These new species all likely originate from host switches from Old World oscine to suboscine hosts. Moreover, morphological features (see below)

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**Table I.** The distribution of ischnoceran chewing lice on suboscine hosts. We here tentatively consider *Furnaricola* separate from *Rallicola*, following Mey (2004), and *Debeauxoecus* separate from *Philoaterus*, based on preliminary examinations of specimens from this genus. Taxonomy of the *Brueelia* complex follows Gustafsson and Bush (2017); that of the *Philoaterus* complex follows Mey (2004). All genera here placed under “other groups” are closely related to the *Brueelia* complex (Bush et al., 2016), except *Pseudocophorus*, the phylogenetic placement of which is presently unknown. Dashes denote lack of published records. No ischnoceran chewing lice are known from birds in the families Melanopareiidae, Oxyruncidae, Philepittidae, or Sapayoidae. Data from Price et al. (2003), Mey (2004), Sychra et al. (2006), Cicchino and Valim (2008), Meyer et al. (2008), Enout et al. (2012), Valim and Weckstein (2012), Kuabara and Valim (2017), Gustafsson and Bush (2017), Sánchez-Montes et al. (2018), Soto-Patiño et al. (2018). Host classification follows Clements et al. (2018).

| Host family     | Geographical range         | <i>Brueelia</i> complex                      | <i>Degeeriella</i> complex | <i>Philoaterus</i> complex  | <i>Rallicola</i> complex | Other groups          |
|-----------------|----------------------------|--|----------------------------|-----------------------------|--------------------------|-----------------------|
| Calyptomenidae  | Indo-Malayan, Afrotropical | <i>Guimaraesiella</i>                        | <i>Picicola</i>            | –                           | –                        | –                     |
| Eurylaimidae    | Indo-Malayan, Afrotropical | <i>Guimaraesiella</i><br><i>Psammonirmus</i> | –                          | –                           | –                        | –                     |
| Sapayoidae      | Neotropical                | –  | –                          | –                           | –                        | –                     |
| Philepittidae   | Madagascar                 | –  | –                          | –                           | –                        | –                     |
| Pittidae        | Old World tropics          | –  | <i>Picicola</i>            | <i>Debeauxoecus</i>         | –                        | –                     |
| Thamnophilidae  | Neotropical                | –*   | –                          | <i>Tyranniphilopterus</i>   | <i>Furnaricola</i>       | <i>Formicaphagus</i>  |
| Melanopareiidae | Neotropical                | –  | –                          | –                           | –                        | –                     |
| Conopophagidae  | Neotropical                | –  | –                          | –                           | –                        | <i>Formicaphagus</i>  |
| Grallariidae    | Neotropical                | –  | –                          | –                           | –                        | <i>Formicaphagus</i>  |
| Rhinocryptidae  | Neotropical                | –  | –                          | –                           | <i>Furnaricola</i>       | –                     |
| Formicariidae   | Neotropical                | –  | –                          | –                           | –                        | <i>Formicariicola</i> |
| Furnariidae     | Neotropical                | <i>Brueelia</i>                              | <i>Picicola</i>            | <i>Tyranniphilopterus</i> † | <i>Furnaricola</i>       | <i>Furnariphilus</i>  |
| Tyrannidae      | Neotropical                | <i>Brueelia</i><br><i>Guimaraesiella</i>     | <i>Picicola</i>            | <i>Tyranniphilopterus</i> ‡ | –                        | –                     |
| Oxyruncidae     | Neotropical                | –  | –                          | –                           | –                        | –                     |
| Cotingidae      | Neotropical                | –  | <i>Cotingacola</i>         | <i>Tyranniphilopterus</i> ‡ | –                        | <i>Pseudocophorus</i> |
| Pipridae        | Neotropical                | –  | –                          | <i>Tyranniphilopterus</i> ‡ | –                        | –                     |
| Tityridae       | Neotropical                | –  | <i>Cotingacola</i>         | <i>Tyranniphilopterus</i>   | –                        | –                     |

\* Carriker (1957) mentioned 11 *Sturnidoecus* Eichler, 1944 collected from *Batara cinerea excubitor* Bond and Meyer de Schauensee, 1940. If correct, this is the only record of lice in the genus *Sturnidoecus* on any suboscine hosts. Information about the deposition of these specimens was not provided by Carriker (1957).

† Soto-Patiño et al. (2018) reported *Philoaterus* sp. from *Anabacerthia variegaticeps* (Sclater, 1857), which is the only record known to us of a head louse parasitizing a furnariid host. Unfortunately, the specimen has not yet been described, and it is unknown whether this truly represents *Philoaterus* Nitzsch, 1818, or some other genus in the *Philoaterus* complex.

‡ We assume that the specimens listed as “*Philoaterus* sp.” under various species of cotingid, piprid, and tyrannid hosts by Soto-Patiño et al. (2018) represent *Tyranniphilopterus*, as this genus is known from other hosts in these families. However, this needs to be confirmed by examination of the original specimens.

suggest that these species are each others’ closest relatives, which indicates that more than 1 host switch may be involved.

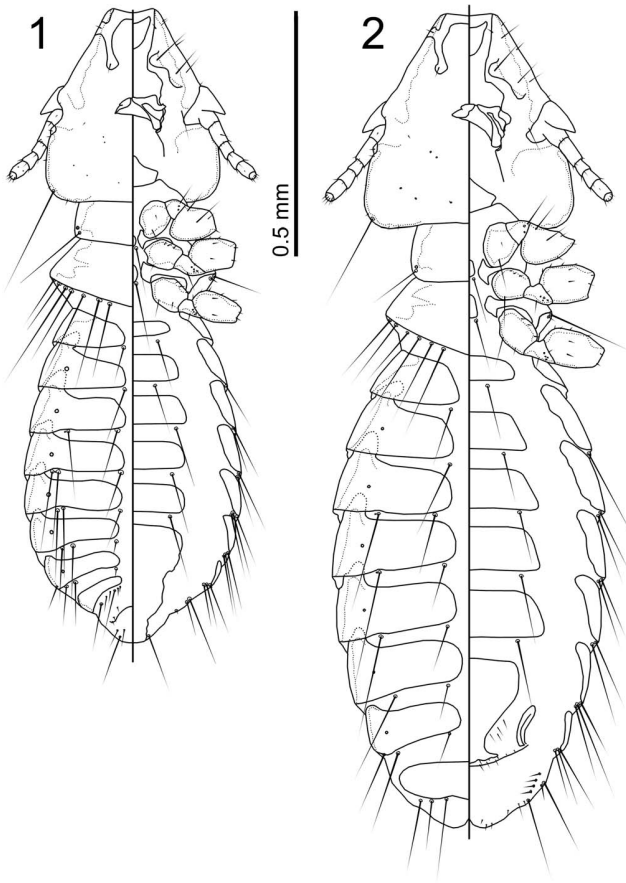
All species described here are members of the nominal subgenus, *Guimaraesiella* (*Guimaraesiella*). Within this subgenus, we here establish an informal “core *Guimaraesiella*” group, which consists of all those species found in clade A-1 of the phylogeny of Bush et al. (2016; fig. 3), as well as other species that were not included in the Bush et al. (2016) study, but that are morphologically close to these lice. These lice are united morphologically, based primarily on the head shape, extent of dorsal preantennal suture (reaching *anterior dorsal seta* but not separating the dorsal preantennal plate posteriorly), the shape of the male genitalia (particularly the presence of only 1 anterior extension of the ventral sclerite), and the lack of complete cross-piece in the female genitalia. All species described here are part of this “core” *Guimaraesiella* group.

The genus *Guimaraesiella* is in great need of revision. However, many of the known species have never been described or illustrated in sufficient detail to allow them to be identified accurately. Moreover, we have seen a large number of undescribed species that exhibit a great deal of morphological variation, and the future description of these species may help define logical species groups. We, therefore, do not give this group

a formal name. All species known to belong in this “core” group are listed in Table II; however, note that many species have not been described in sufficient detail to establish whether they are part of this group or not. Apart from species known from hosts in the Turdidae, most species in this group are found in the Indo-Malayan and Australo-Papuan regions. Further examples of the morphological variation within this “core” group can be found in Gustafsson et al. (2019a).

## MATERIALS AND METHODS

Examined specimens are deposited in the Berenice Pauahi Bishop Museum, Honolulu, Hawaii (BPBM), Natural History Museum, London, United Kingdom (NHML), Oklahoma State University, Stillwater, Oklahoma (OSUS), University of Minnesota, St. Paul, Minnesota (UMSP), and Zoological Institute of Russian Academy of Sciences (ZIN), as indicated within each species description. Specimens from Vietnam were collected at Cát Tiên National Park in 2011 and 2013, during a field expedition carried out by the Joint Russian–Vietnamese Tropical Research and Technological Center (Southern Branch, Ho Chi Minh City, Vietnam). Birds were captured by mist nets and checked for chewing lice by fumigation chamber (see



**Figures 1, 2.** *Guimaraesiella corydoni* n. sp. ex *Corydon sumatranus laoensis* Meyer de Schauensee, 1929. (1) Male habitus, dorsal and ventral views. (2) Female habitus, dorsal and ventral views.

Bushuev et al., 2018 for more detail). Collection in Vietnam was carried out under Resolution No. 26(6) of the ethics committee of the Lomonosov Moscow State University, Moscow, Russia.

Specimens were examined and measured with a Nikon Eclipse E600 microscope (Nikon, Belmont, California) fitted with an Olympus DP25 camera (Olympus, Center Valley, Pennsylvania) and digital measuring software (ImageJ 1.48v, Wayne Rasband, <https://imagej.nih.gov/>). Illustrations were drawn by hand, using a drawing tube. Line drawings were scanned, collated, and edited in GIMP ([www.gimp.org](http://www.gimp.org)).

Terminology and abbreviations for setal, structural, and genitalic characters follow Gustafsson and Bush (2017), and include *ads* = anterior dorsal seta; *aps* = accessory postspiracular seta; *dsms* = dorsal submarginal seta; *fI-v4* = ventral seta 4 of femur I; *ps* = paratergal seta; *pst1-2* = parameral setae 1-2; *vms* = vulval marginal setae; *vos* = vulval oblique setae; *vss* = vulval submarginal setae. Measurements (Table III) are given in millimeters for the following dimensions: TL = total length (along midline); HL = head length (along midline); HW = head width (at temples); PRW = prothoracic width; PTW = pterothoracic width; AW = abdominal width (at segment V). Host taxonomy follows Clements et al. (2018).

## DESCRIPTION

**Phthiraptera** Haeckel, 1896

**Ischnocera** Kellogg, 1896

**Phlopteridae** Burmeister, 1838

**The *Brueelia* complex**

***Guimaraesiella*** Eichler, 1949

*Nirmus* Nitzsch, 1818: 291 (in partim).

*Degeeriella* Neumann, 1906: 60 (in partim).

*Brueelia* Kéler, 1936: 257 (in partim).

*Xobugirado* Eichler 1949: 13.

*Allobrueelia* Eichler, 1951: 36 (in partim).

*Allobrueelia* Eichler, 1952: 74 (near-verbatim redescription).

*Allonirmus* Zlotorzycska, 1964: 263.

*Nitzschnirmus* Mey and Barker, 2014: 101.

*Callaenirmus* Mey, 2017: 92.

*Philemoniellus* Mey, 2017: 145.

Type species: *Docophorus subalbicans* Piaget, 1885: 6 [= *Docophorus papuanus* Giebel, 1879: 475], by original designation.

***Guimaraesiella corydoni* n. sp.**

(Figs. 1–7)

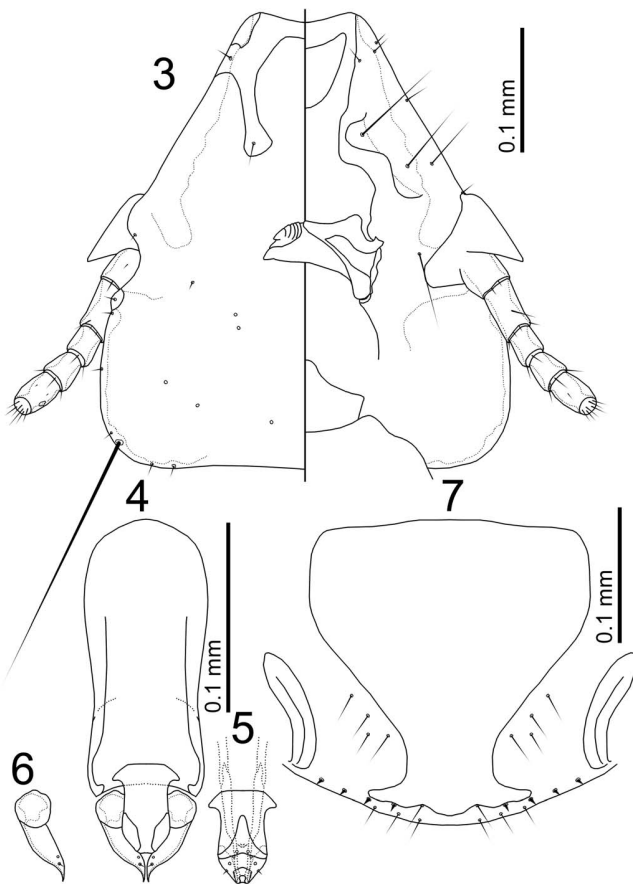
*Description both sexes:* Head broadly trapezoidal (Fig. 3), lateral margins of preantennal head slightly concave, frons broadly concave. Marginal carina of moderate, irregular width, interrupted submedianly. Dorsal preantennal suture reaching *dsms*, *ads*, and lateral head margins, extending slightly median to *ads*. Ventral anterior plate somewhat elongated. Dorsal anterior plate not separate, longer than wide. Head chaetotaxy as in Figure 3. Preantennal nodi moderate, bulging. Preocular nodi much larger than minute postocular nodi. Marginal temporal carina narrow, of even width. Gular plate broad with median point. Thoracic and abdominal segments as in Figures 1 and 2. Leg seta *fI-v4* absent.

*Male:* Thoracic and abdominal chaetotaxy as in Figure 1; *ps* present on segment III; *aps* present on tergopleurite IV in some specimens, but not illustrated here; *aps* present on tergopleurite V; tergopleurite VIII with 3 setae on each side (not counting trichobothrium). Basal apodeme with slightly concave lateral margins (Fig. 4). Proximal mesosome substantially overlapping basal apodeme, anterior margin flat, antero-lateral corners with blunt hooks. Ventral sclerite with 1 anterior extension; chaetotaxy as in Figure 5. Distal mesosome with lateral margins almost parallel, without noticeable lateral lobes. Gonopore roughly quadratic, lateral margins serrated. Parameral heads rounded; parameral blades short, convergent, distal ends slightly elongated; *pst1-2* as in Figure 6.

*Female:* Thoracic and abdominal chaetotaxy as in Figure 2; abdominal segment III with 1 *ps* on each side. Vulval margin (Fig. 7) slightly convex. Subgenital plate broad distally, with narrow submarginal bulges; 0–4 short, slender *vms* and 4–6 short, thorn-like *vss* on each side; 3–5 short, slender *vos* on each side of subgenital plate, the most distal *vos* median to *vss*.

## Taxonomic summary

*Type host:* *Corydon sumatranus laoensis* Meyer de Schauensee, 1929—dusky broadbill.



**Figures 3–7.** *Guimaraesiella corydoni* n. sp. ex *Corydon sumatranus laeensis* Meyer de Schauensee, 1929. (3) Male head, dorsal and ventral views. (4) Male genitalia, dorsal view. (5) Male mesosome, ventral view. (6) Male paramere, dorsal view. (7) Female subgenital plate and vulval margin, ventral view. (Figs. 3–5 share lower left scale bar.)

*Type locality:* Ban Hua Thanon, Khlong Khlung, Kamphaeng-Phet, Thailand.

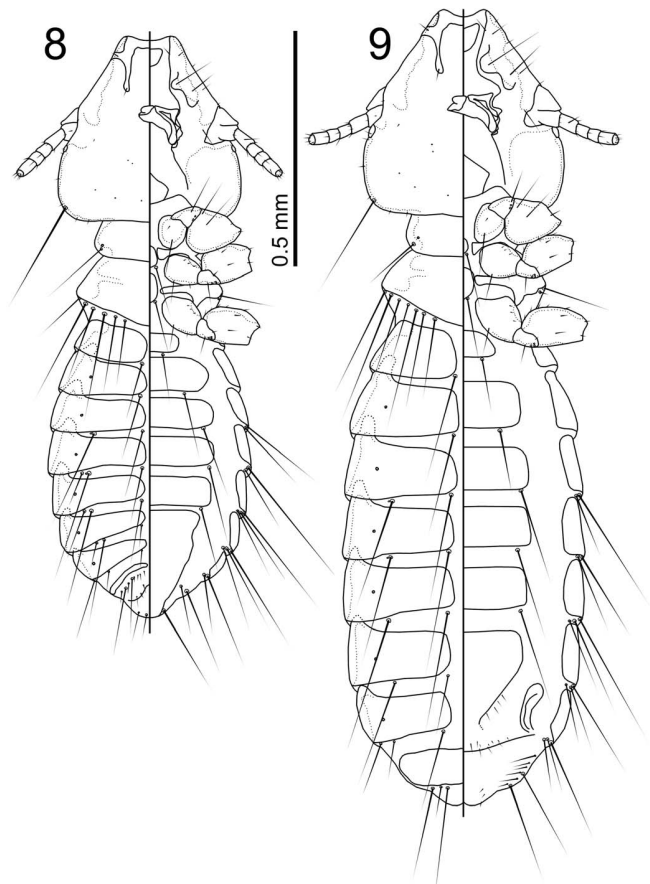
*Specimens deposited:* Holotype male, Ban Hua Thanon, Khlong Khlung, Kamphaeng-Phet, Thailand, 3 April 1953, R. E. Elbel and H. G. Deignan, RE-2357, RT-B-17855 (OSUS). Paratypes. Three males, 4 females, same data as holotype (OSUS). Three males, three females, Nam Cat Tien, Dong Nai, Vietnam, 4 April 2013, O.O. Tolstenkov, 433-OM–438-OM (ZIN).

*ZooBank registration:* urn:lsid:zoobank.org:act:8AAE8DAD-6AE5-4384-A34D-A1547D0B5AD8.

*Etymology:* The specific epithet is derived from the genus of the type host.

## Remarks

*Guimaraesiella corydoni* is most similar to *Guimaraesiella altunai* n. sp. and *Guimaraesiella latirostris* n. sp., with which it shares the following characters: preantennal area broad *aps* present on male tergopleurite V; proximal mesosome substantially overlapping with basal apodeme. *Guimaraesiella corydoni* can be separated from both of these species by the following characters: *ps* present on male abdominal segment III in *G. corydoni* (Fig. 1), but absent in *G. latirostris* (Fig. 8) and *G. altunai* (Fig. 22); male



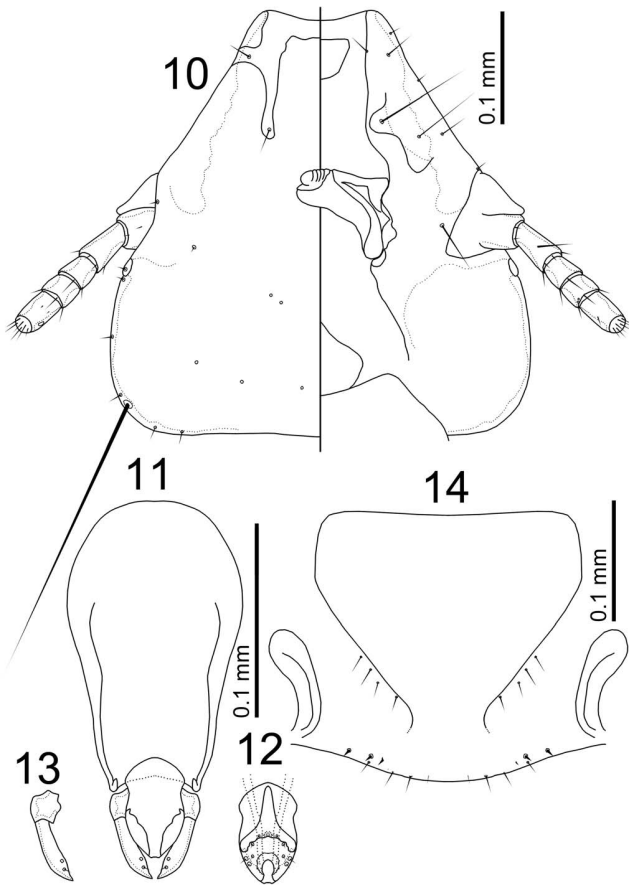
**Figures 8, 9.** *Guimaraesiella latirostris* n. sp. ex *Eurylaimus ochromalus* Raffles, 1822. (8) Male habitus, dorsal and ventral views. (9) Female habitus, dorsal and ventral views.

tergopleurite VIII with 3 posterior setae on each side, not counting trichobothrium (Fig. 1), but with only 2 setae on each side in *G. latirostris* (Fig. 8) and *G. altunai* (Fig. 22); *ps* present on female abdominal segment III in *G. corydoni* (Fig. 2), but absent in *G. latirostris* (Fig. 9) and *G. altunai* (Fig. 23); proximal mesosome with flat anterior margin and bluntly hooked anterolateral corners in *G. corydoni* (Fig. 5), but with convergent anterior margin and rounded anterolateral corners in *G. latirostris* (Fig. 12) and *G. altunai* (Fig. 26).

## *Guimaraesiella latirostris* n. sp.

(Figs. 8–14)

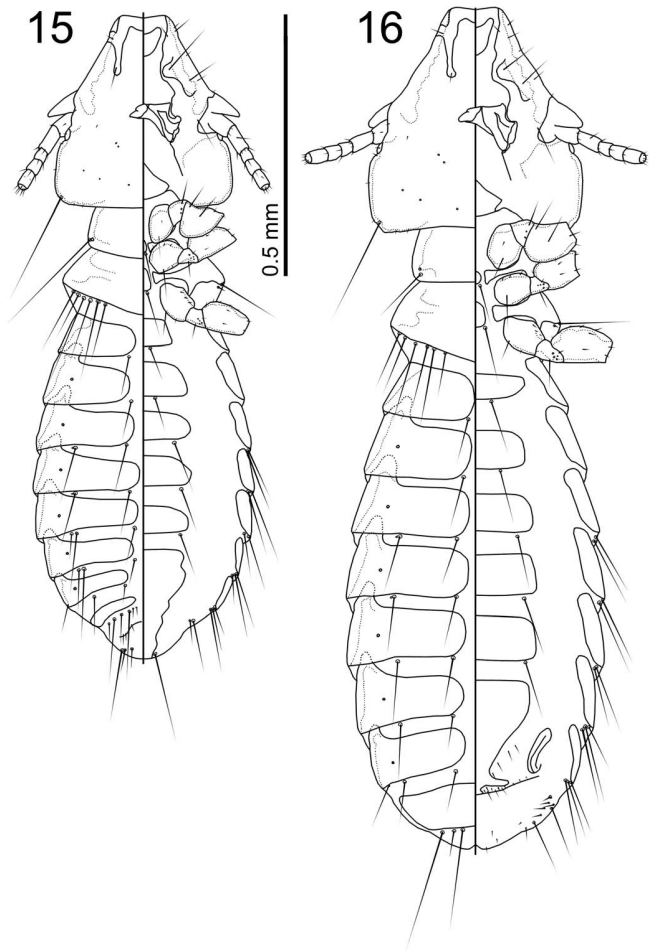
*Description both sexes:* Head broadly trapezoidal (Fig. 10), lateral margins of preantennal head convex posteriorly and slightly concave anteriorly, frons broadly concave. Marginal carina of broad, irregular width, interrupted submedianly and narrowed laterally near site of *dsms*. Dorsal preantennal suture reaching *dsms*, *ads*, and lateral head margins, not extending median to *ads*. Ventral anterior plate roughly trapezoidal. Dorsal anterior plate not separate, longer than wide. Head chaetotaxy as in Figure 10. Preantennal nodi large, bulging. Preocular nodi much larger than minute postocular nodi. Marginal temporal carina very narrow, of even width. Gular plate with median point. Thoracic and abdominal segments as in Figures 8 and 9. Leg seta *fl-v4* absent.



**Figures 10–14.** *Guimaraesiella latirostris* n. sp. ex *Eurylaimus ochromalus* Raffles, 1822. (10) Male head, dorsal and ventral views. (11) Male genitalia, dorsal view. (12) Male mesosome, ventral view. (13) Male paramere, dorsal view. (14) Female subgenital plate and vulval margin, ventral view. (Figs. 11–13 share lower left scale bar.)

**Male:** Thoracic and abdominal chaetotaxy as in Figure 8; *ps* absent on abdominal segment III; *aps* present on tergopleurite V; tergopleurite VIII with 2 setae on each side (not counting trichobothrium). Basal apodeme broad, with slightly concave lateral margins (Fig. 11). Proximal mesosome substantially overlapping basal apodeme, rounded to median point (more pronounced than illustrated here in some specimens), with rounded anterolateral corners. Distal mesosome with gently rounded margins, distinct mesosomal lobes not obvious. Ventral sclerite with single anterior extension, almost reaching anterior margin of mesosome (Fig. 12) and small rugose area medianly near distal margin; chaetotaxy as in Figure 12. Gonopore displaced anteriorly, roughly rounded in outline, lateral margins serrated. Parameral heads irregular; parameral blades short, slender; *pst1–2* as in Figure 13.

**Female:** Thoracic and abdominal chaetotaxy as in Figure 9; *ps* absent on abdominal segment III. Distal subgenital plate poorly visible in examined specimens, not illustrated; distal end broad (Fig. 14). Vulval margin gently rounded, slightly flattened medianly, with 3 short, slender *vms* and 5–7 short, thorn-like *vss* on each side; 4–6 short, slender *vos* on each side of subgenital plate; distal 1–2 *vos* median to *vss*.



**Figures 15, 16.** *Guimaraesiella cyanophoba* n. sp. ex *Cymbirhynchus macrorhynchus malaccensis* Salvadori, 1874. (15) Male habitus, dorsal and ventral views. (16) Female habitus, dorsal and ventral views.

**Taxonomic summary**

**Type host:** *Eurylaimus ochromalus* Raffles, 1822—black-and-yellow broadbill.

**Type locality:** Khao Phappa, Banna, Phatthalung, Thailand.

**Material deposited:** Holotype male, Khao Phappa, Banna, Phatthalung [as Phatalung], Thailand, 20 August 1955, B. Lekagul, SE2591 [marked with black dot on slide] (BPBM). Paratypes: 5 males, 4 females, same data as holotype (BPBM).

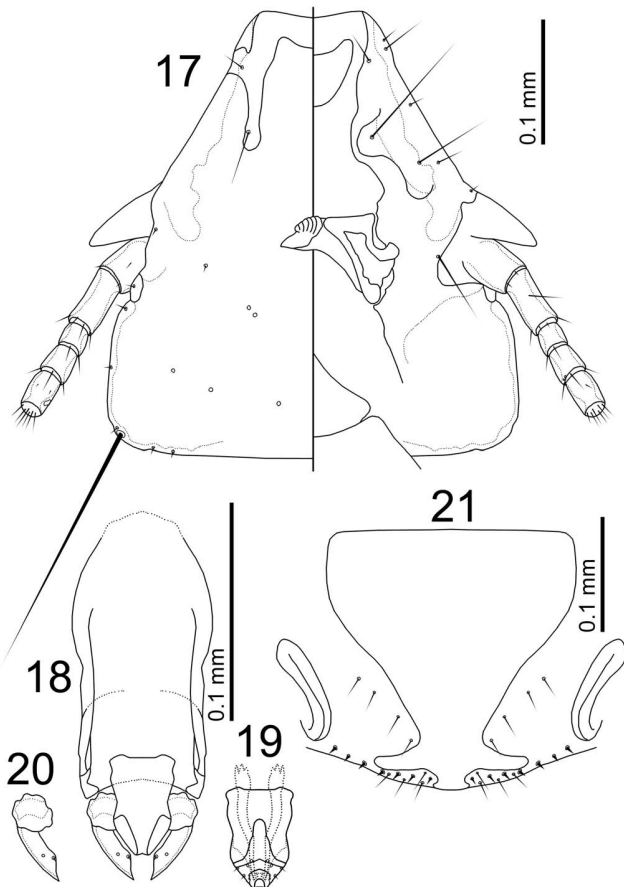
**ZooBank registration:** urn:lsid:zoobank.org:act:EE495A18-E10F-4842-B97E-74AA6357E035.

**Etymology:** The specific name is derived from Latin “*lata*” for “broad” and “*rostres*” for “beak,” referring to the broad preantennal area of this species.

**Remarks**

Host identification is uncertain on the slide labels; we tentatively accept the given host as the type host.

*Guimaraesiella latirostris* is most similar to *G. altunai* n. sp., with which it shares the following characters: *aps* present on male tergopleurite V (Figs. 8, 22); *ps* absent on male abdominal segment III (Figs. 8, 22); male tergopleurite VIII with 2 posterior

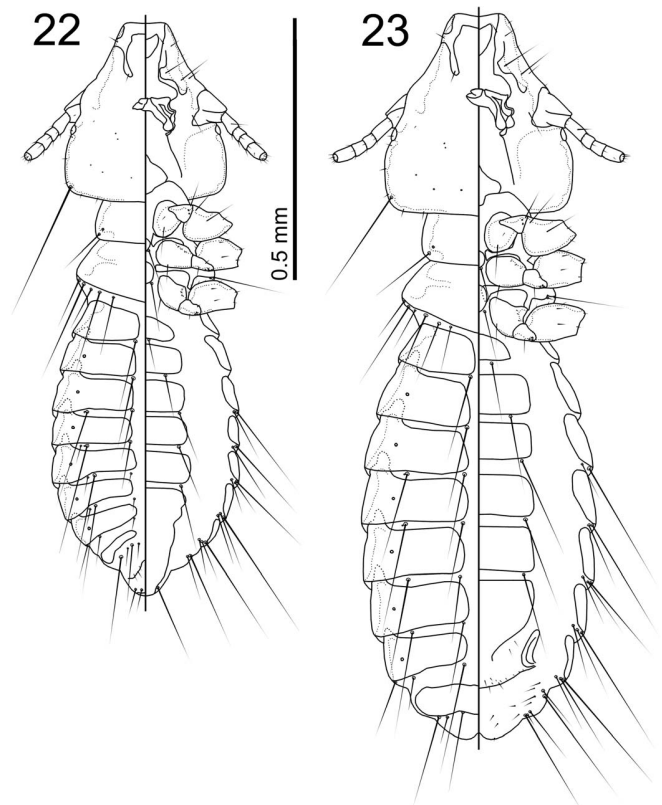


**Figures 17–21.** *Guimaraesiella cyanophoba* n. sp. ex *Cymbirhynchus macrorhynchus malaccensis* Salvadori, 1874. (17) Male head, dorsal and ventral views. (18) Male genitalia, dorsal view. (19) Male mesosome, ventral view. (20) Male paramere, dorsal view. (21) Female subgenital plate and vulval margin, ventral view. (Figs. 18–20 share lower left scale bar.)

setae on each side (not counting trichobothrium; Figs. 8, 22); female abdominal segment IV with 2 *ps* on each side (Figs. 9, 23); proximal mesosome convergent to median point (Figs. 12, 26). These 2 species can be separated by the following characters: ventral sclerite of male mesosome almost reaches anterior margin of mesosome in *G. latirostris* (Fig. 12), but not in *G. altunai* (Fig. 26); lateral margins of mesosome gently rounded in *G. latirostris* (Fig. 12), but with distinct bulge at midlength in *G. altunai* (Fig. 26); distal margin of ventral sclerite rugose in *G. latirostris* (Fig. 12), but not in *G. altunai* (Fig. 26); gonopore more rounded and situated farther anterior in *G. latirostris* (Fig. 12) than in *G. altunai* (Fig. 26). Females best separated on head shape, as vulval chaetotaxy overlaps between the 2 species.

***Guimaraesiella cyanophoba* n. sp.**  
(Figs. 15–21)

**Description both sexes:** Head broadly trapezoidal (Fig. 17), lateral margins of preantennal head slightly concave, frons broadly concave. Marginal carina of moderate, irregular width, interrupted submedianly. Dorsal preantennal suture reaching *dsms*, *ads*, and lateral head margins. Ventral anterior plate large,



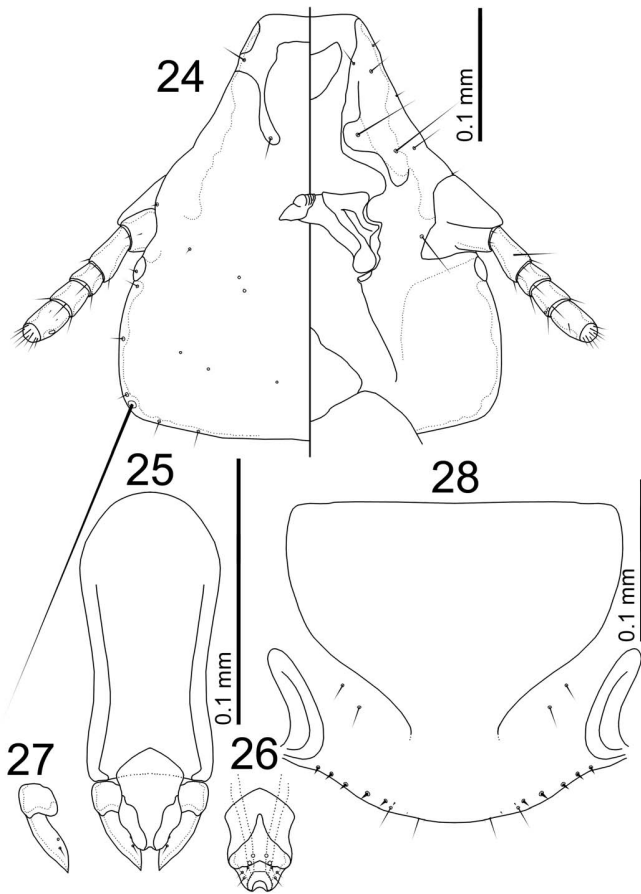
**Figures 22, 23.** *Guimaraesiella altunai* n. sp. ex *Calyptomena viridis caudacuta* Swainson, 1838. (22) Male habitus, dorsal and ventral views. (23) Female habitus, dorsal and ventral views.

rounded triangular. Dorsal anterior plate not separate, longer than wide. Head chaetotaxy as in Figure 17. Preantennal nodi large, bulging. Preocular nodi much larger than minute postocular nodi. Marginal temporal carina very narrow, of even width. Gular plate with median point. Thoracic and abdominal segments as in Figures 15 and 16. Leg seta *fI-v4* absent.

**Male:** Thoracic and abdominal chaetotaxy as in Figure 15; posterior margin of mesometathorax normally with 5–6 setae on each side, but in 1 specimen with 9 setae on each side; *ps* absent on abdominal segment III; *aps* absent in tergopleurites IV–V; tergopleurite VIII with 2 setae on each side (not counting trichobothrium). Anterior end of basal apodeme not clearly visible in examined specimens; lateral margins more or less parallel, but bulging proximally (Fig. 18). Proximal mesosome substantially overlapping with basal apodeme (Fig. 18); anterior margin roughly flat, anterolateral corners with slight rectangular bulges (exact shape differs between specimens). Ventral sclerite with single anterior extension only reaching midlength of mesosome; distal end not rugose; chaetotaxy as in Figure 19. Distal mesosome with convex mesosomal lobes. Gonopore roughly quadratic, anteromedian part slightly rugose, lateral margins serrated. Parameral heads with several small bulges (Fig. 20); parameral blades short, stout; *pst1–2* as in Figure 20.

**Female:** Thoracic and abdominal chaetotaxy as in Figure 16; posterior margin of mesometathorax with 5–7 setae on each side; *ps* absent on abdominal segment III. Subgenital plate broad distally, with slender submarginal extensions (Fig. 21). Vulval





**Figures 24–28.** *Guimaraesiella altunai* n. sp. ex *Calyptomena viridis caudacuta* Swainson, 1838. (24) Male head, dorsal and ventral views. (25) Male genitalia, dorsal view. (26) Male mesosome, ventral view. (27) Male paramere, dorsal view. (28) Female subgenital plate and vulval margin, ventral view. (Figs. 25–27 share lower left scale bar.)

margin gently rounded, with 3–4 short, slender *vms* and 4–8 short, thorn-like *vss* on each side; 6–8 short, slender *vos* on each side of subgenital plate; 1–2 distal *vos* median to *vss*.

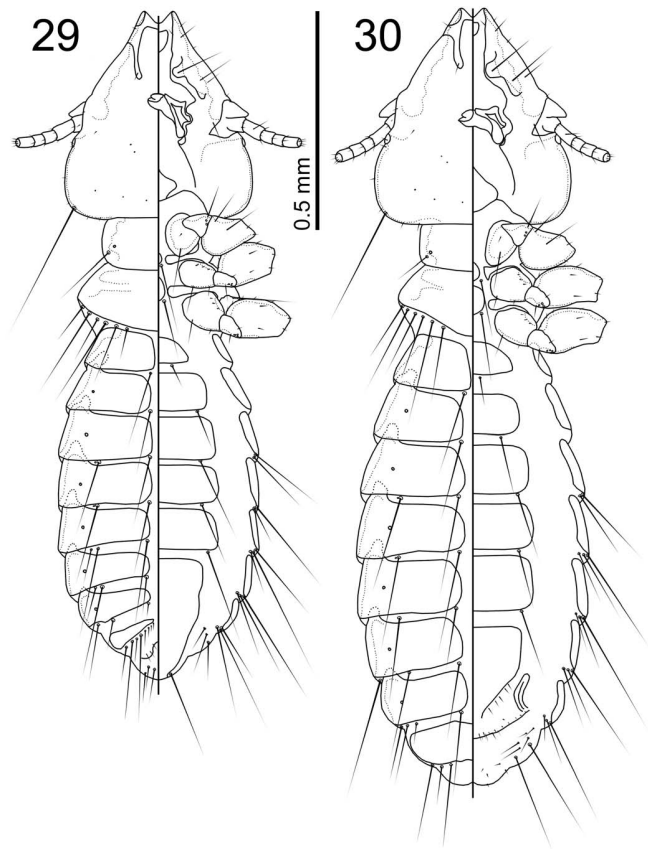
**Taxonomic summary**

*Type host:* *Cymbirhynchus macrorhynchus malaccensis* Salvadori, 1874—black-and-red broadbill.

*Type locality:* Thung Nui, Satun, Thailand.

*Other host:* *Cymbirhynchus macrorhynchus siamensis* Meyer de Schauensee and Ripley, 1940—black-and-red broadbill.

*Specimens deposited:* Ex *Cymbirhynchus macrorhynchus malaccensis*: Holotype male, Thung Nui, Satun, Thailand, 1 September 1963, W. Songprakob and W. S. Laong, WS459 [marked with black dot on slide] (BPBM). Paratypes 2 males, 1 female, same data as holotype (BPBM); 4 male, 12 females, Muang Kluang, Kapoe, Ranong, Thailand, 17 January 1963, W. Songprakob, RE7013 (BPBM); 2 males, Thadindang, Phat Phayun [as Phatphayan], Phatthalung, Thailand, 25 July 1962, W. Songprakob, RE6339 (BPBM). Nontypes ex *Cymbirhynchus macrorhynchus siamensis*: 1 male, 3 females, Ban Hua Thanon, Khlong Khlung, Kamphaeng-Phet, Thailand, 6 April 1953, R. E. Elbel and H. G. Deignan, RE-2384, RT-B-17871 (BPBM).



**Figures 29, 30.** *Guimaraesiella forcipata* n. sp. ex *Eurylaimus steerii* Steyer, 1876. (29) Male habitus, dorsal and ventral views. (30) Female habitus, dorsal and ventral views.

Two males, 2 females, Nam Cat Tien, Dong Nai, Vietnam, 20 May 2011, O. O. Tolstenkov, 339-OM–342-OM (ZIN).

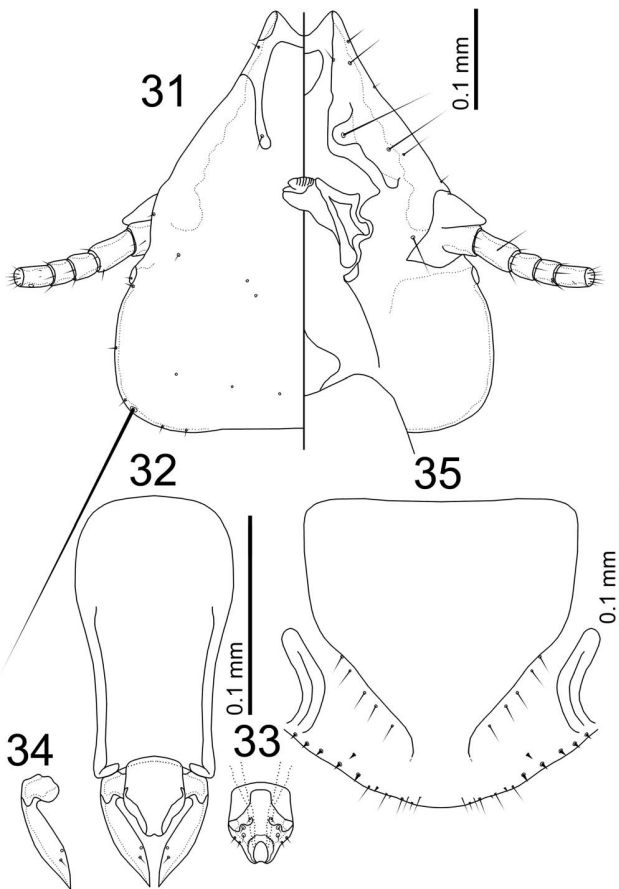
*ZooBank registration:* urn:lsid:zoobank.org:act:832BCE57-988D-4D0F-BB14-387EECEE539F.

*Etymology:* The specific name is derived from “*kúanos*,” Greek for “blue,” and “*phóbos*,” Greek for “fear.” This refers to the large, cyan bill of the host that this louse species would have reason to fear.

**Remarks**

No significant differences have been found between material from the 2 host subspecies.

*Guimaraesiella cyanophoba* is not very similar to any other species of *Guimaraesiella*, but may be most similar to *G. corydoni*, with which it shares the flat anterior margin of the mesosome and the roughly quadratic gonopore (Figs. 5, 19). These 2 species can be separated by the following characters: *ps* present on male abdominal segment III in *G. corydoni* (Fig. 1), but absent in *G. cyanophoba* (Fig. 15); *aps* present on male tergopleurite V (and in some specimens also IV) in *G. corydoni* (Fig. 1), but absent on these segments in *G. cyanophoba* (Fig. 15); male tergopleurite VIII with 2 setae on each side (not counting trichobothrium) in *G. cyanophoba* (Fig. 15), but with 3 setae on each side in *G. corydoni* (Fig. 1); anterolateral corners of mesosome with bluntly



**Figures 31–35.** *Guimaraesiella forcipata* n. sp. ex *Eurylaimus steerii* *steerii* Sharpe, 1876. (31) Male head, dorsal and ventral views. (32) Male genitalia, dorsal view. (33) Male mesosome, ventral view. (34) Male paramere, dorsal view. (35) Female subgenital plate and vulval margin, ventral view. (Figs. 32–34 share lower left scale bar.)

rectangular corners in *G. cyanophoba* (Fig. 19; in some specimens broader than illustrated here), but with bluntly hooked corners in *G. corydoni* (Fig. 5).

***Guimaraesiella altunai* n. sp.**

(Figs. 22–28)

**Description both sexes:** Head broadly trapezoidal (Fig. 24), lateral margins of preantennal head slightly concave, frons broadly concave. Marginal carina of moderate, irregular, width, interrupted submedianly. Dorsal preantennal suture reaching *dsms*, *ads*, and lateral head margins, not extending median to *ads*. Ventral anterior plate large, rounded triangular. Dorsal anterior plate not separate, longer than wide. Head chaetotaxy as in Figure 24. Preantennal nodi moderate, bulging. Preocular nodi larger than minute postocular nodi. Marginal temporal carina narrow, of even width. Gular plate with median point. Thoracic and abdominal segments as in Figures 22 and 23. Leg seta *fl-v4* absent.

**Male:** Thoracic and abdominal chaetotaxy as in Figure 22; *ps* absent on abdominal segment III; *aps* present on tergopleurite IV; tergopleurite VIII with 2 setae on each side (not counting trichobothrium). Basal apodeme with concave lateral margins

**Table II.** Tentative list of species included in the “core” group of *Guimaraesiella*. Inclusion is based either on genetic similarity (Bush et al., 2016) or comparisons of original descriptions or specimens (Gustafsson and Bush, 2017). Additional described species may be included, for instance, species that are inadequately described or species where only 1 sex has been described.

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|   |
|---|
| <i>Guimaraesiella addolotaroi</i> (Cicchino, 1986)                              |
| <i>Guimaraesiella altunai</i> n. sp.  |
| <i>Guimaraesiella ansel</i> (Eichler, 1951)                                     |
| <i>Guimaraesiella callaeincola</i> (Valim and Palma, 2015)                      |
| <i>Guimaraesiella capitus</i> (Ansari, 1955)                                    |
| <i>Guimaraesiella chiguanca</i> (Cicchino, 1986)                                |
| <i>Guimaraesiella corydoni</i> n. sp.   |
| <i>Guimaraesiella cucphuongensis</i> (Najer and Sychra [in Najer et al., 2012]) |
| <i>Guimaraesiella cyanophoba</i> n. sp.   |
| <i>Guimaraesiella flavala</i> Najer and Sychra [in Najer et al., 2012])         |
| <i>Guimaraesiella forcipata</i> n. sp.  |
| <i>Guimaraesiella ilmasae</i> (Ansari, 1956)                                    |
| <i>Guimaraesiella lais</i> (Giebel, 1874)                                       |
| <i>Guimaraesiella latirostris</i> n. sp.  |
| <i>Guimaraesiella magellanica</i> (Cicchino, 1986)                              |
| <i>Guimaraesiella marginata</i> (Burmeister, 1838)                              |
| <i>Guimaraesiella menuraelyrae</i> (Coinde, 1859)                               |
| <i>Guimaraesiella nitzschii</i> (Ponton, 1871)                                  |
| <i>Guimaraesiella oudhensis</i> (Ansari, 1956)                                  |
| <i>Guimaraesiella pallida</i> (Piaget, 1880)                                    |
| <i>Guimaraesiella papuana</i> (Giebel, 1879)                                    |
| <i>Guimaraesiella pentlandiensis</i> (Mey, 2017)                                |
| <i>Guimaraesiella persimilis</i> (Cicchino, 1987)                               |
| <i>Guimaraesiella pointu</i> (Ansari, 1955)                                     |
| <i>Guimaraesiella saghirae</i> (Ansari, 1955)                                   |
| <i>Guimaraesiella samoensis</i> (Mey, 2017)                                     |
| <i>Guimaraesiella satelles</i> (Nitzsch [in Giebel, 1866])                      |
| <i>Guimaraesiella setifer</i> (Piaget, 1885)                                    |
| <i>Guimaraesiella similis</i> (Cicchino, 1986)                                  |
| <i>Guimaraesiella timorensis</i> (Mey, 2017)                                    |
| <i>Guimaraesiella tristis</i> (Giebel, 1874)                                    |
| <i>Guimaraesiella turdimulae</i> (Ansari, 1956)                                 |
| <i>Guimaraesiella viscivori</i> (Denny, 1842)                                   |
| <i>Guimaraesiella wallacei</i> (Mey and Barker, 2014)                           |

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(Fig. 25). Proximal mesosome substantially overlaps basal apodeme, anterior margin convergent to median point, anterolateral corners rounded. Ventral sclerite reaching midlength of mesosome; distal section not rugose; chaetotaxy as in Figure 26. Mesosomal lobes bulging. Gonopore broader than long, roughly trapezoidal, lateral margins serrated. Parameral heads irregular (Fig. 27); parameral blades stout, short; *pst1–2* as in Figure 27.

**Female:** Thoracic and abdominal chaetotaxy as in Figure 23; *ps* absent on abdominal segment III. Distal subgenital plate poorly visible in examined specimens, not illustrated (Fig. 28); distal end broad. Vulval margin bulging medianly, with 2–3 short, slender *vms* and 6–7 short, thorn-like *vss* on each side; 3–4 short, slender *vos* on each side of subgenital plate; distal 1–2 *vos* median to *vss*.

**Taxonomic summary**

**Type host:** *Calyptomena viridis caudacuta* Swainson, 1838—green broadbill.

**Type locality:** Terengganu, Malaysia.



**Table III.** Measurements of the 5 species of *Guimaraesiella* described here. Measurements are given in millimeters for the following dimensions: TL = total length (along midline); HL = head length (along midline); HW = head width (at temples); PRW = prothoracic width; PTW = pterothoracic width; AW = abdominal width (at segment V). Mean values (in parentheses) given for samples where n > 10.

| Species   | Sex              | TL               | HL               | HW               | PRW              | PTW              | AW               |
|---|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| <i>Guimaraesiella altunai</i> n. sp.  | Male (n = 4)*    | 1.00–1.11        | 0.33–0.35        | 0.31–0.33        | 0.19–0.20        | 0.25–0.28        | 0.30–0.34        |
|   | Female (n = 5)   | 1.29–1.46        | 0.36–0.38        | 0.34–0.38        | 0.21–0.22        | 0.29–0.32        | 0.42–0.44        |
| <i>Guimaraesiella cyanophoba</i> n. sp. ex <i>Cymbirhynchus macrorhynchus malaccensis</i> | Male (n = 7)†    | 1.20–1.36        | 0.36–0.41        | 0.33–0.39        | 0.20–0.23        | 0.28–0.33        | 0.41–0.48        |
|   | Female (n = 15)‡ | 1.46–1.69 (1.57) | 0.40–0.43 (0.41) | 0.37–0.41 (0.39) | 0.22–0.25 (0.23) | 0.32–0.36 (0.34) | 0.47–0.56 (0.51) |
| <i>Guimaraesiella cyanophoba</i> n. sp. ex <i>Cymbirhynchus macrorhynchus siamensis</i>   | Male (n = 4)     | 1.21–1.28        | 0.36–0.39        | 0.36–0.37        | 0.21–0.22        | 0.29–0.32        | 0.38–0.46        |
|   | Female (n = 6)   | 1.52–1.68        | 0.40–0.43        | 0.38–0.43        | 0.23–0.25        | 0.32–0.35        | 0.44–0.55        |
| <i>Guimaraesiella forcipata</i> n. sp.  | Male (n = 9)§    | 1.35–1.49        | 0.42–0.44        | 0.39–0.44        | 0.23–0.26        | 0.32–0.34        | 0.42–0.51        |
|   | Female (n = 7)   | 1.64–1.84        | 0.46–0.48        | 0.44–0.47        | 0.25–0.27        | 0.34–0.37        | 0.51–0.61        |
| <i>Guimaraesiella corydoni</i> n. sp.   | Male (n = 6)     | 1.20–1.34        | 0.35–0.38        | 0.35–0.38        | 0.21–0.24        | 0.30–0.32        | 0.43–0.45        |
|   | Female (n = 6)   | 1.42–1.67        | 0.38–0.44        | 0.39–0.42        | 0.23–0.25        | 0.34–0.35        | 0.49–0.55        |
| <i>Guimaraesiella latirostris</i> n. sp.  | Male (n = 6)#    | 1.18–1.33        | 0.37–0.40        | 0.36–0.41        | 0.21–0.24        | 0.30–0.33        | 0.43–0.51        |
|   | Female (n = 4)   | 1.63–1.65        | 0.42             | 0.42–0.44        | 0.25–0.26        | 0.36             | 0.51–0.56        |

\* n = 3 for TL.

† n = 6 for TL and AW.

‡ n = 13 for TL and AW.

§ n = 8 for TL and PTW.

|| n = 6 for TL.

# n = 5 for AW.

*Specimens deposited:* Ex *Calyptomena viridis caudacuta*: Holotype male, 102°40'E, 5°28'N, elevation 140 ft, Terengganu [as Trengganu], Malaysia, 24 March 1974, Gn. Lawit Expedition, British Museum 1974-2 (NHML). Paratypes 1 male, 4 females, same data as holotype (NHML). Nontypes: Ex *Calyptomena viridis* ssp.: 2 males, no locality ["Java" stated on slide, but this is outside the range of the host], M.M. (NHML). Ex *C. v. caudacuta*: 1 male, Thung Nui, Satun [as Saton], Thailand, 12 September 1963, W. Songprakob and W. S. Laong, WS503 (UMSP).

*ZooBank registration:* urn:lsid:zoobank.org:act:8A155786-B89C-47FE-83D0-4A2AF7E23F99.

*Etymology:* The specific name is in honor of Juan Altuna (a former member of the Clayton/Bush Lab, University of Utah), in recognition of his contributions to our understanding of the biology and evolution of chewing lice.

## Remarks

*Guimaraesiella altunai* is most similar to *G. latirostris*, with which it shares the following characters: *aps* present on male tergopleurite V (Figs. 8, 22); *ps* absent on male abdominal segment III (Figs. 8, 22); male tergopleurite VIII with 2 posterior setae on each side (not counting trichobothrium; Figs. 8, 22); female abdominal segment IV with 2 *ps* on each side (Figs. 9, 23); proximal mesosome convergent to median point (Figs. 12, 26). These 2 species can be separated by the following characters: ventral sclerite of male mesosome almost reaches anterior margin of mesosome in *G. latirostris* (Fig. 12), but not in *G. altunai* (Fig. 26); lateral margins of mesosome with distinct bulge in *G. altunai* (Fig. 26), but gently rounded in *G. latirostris* (Fig. 12); distal margin of ventral sclerite with rugose area in *G. latirostris* (Fig. 12), but smooth in *G. altunai* (Fig. 26); gonopore more rounded and situated farther anterior in *G. latirostris* (Fig. 12) than in *G.*

*altunai* (Fig. 26). Females best separated on head shape, as vulval chaetotaxy overlaps between the 2 species.

## *Guimaraesiella forcipata* n. sp.

(Figs. 29–35)

*Description both sexes:* Head rounded triangular (Fig. 31), lateral margins of preantennal area convex, frons very narrowly but deeply concave. Marginal carina broad, of irregular width, interrupted submedianly. Dorsal preantennal suture reaching *dsms*, *ads*, and lateral head margins, not extending median to *ads*. Ventral anterior plate large, elongated. Dorsal anterior plate not separate, longer than wide. Head chaetotaxy as in Figure 31. Preantennal nodi large, bulging. Preocular nodi larger than minute postocular nodi. Marginal temporal carina very narrow, of even width. Gular plate with median point. Thoracic and abdominal segments as in Figures 29 and 30. Leg seta *fI-v4* absent.

*Male:* Thoracic and abdominal chaetotaxy as in Figure 29; *ps* absent on abdominal segment III; *aps* absent on tergopleurite V; tergopleurite VIII with 2 setae on each side (not counting trichobothrium). Basal apodeme broad, narrowing distally (Fig. 32). Proximal mesosome almost flat, barely or not overlapping with basal apodeme. Ventral sclerite broad, with flattened anterior end almost reaching proximal margin; distal section diffuse medially, and with undulating posterolateral margins; chaetotaxy as in Figure 33. Mesosomal lobes slight, distal third of mesosome much narrower than proximal section. Gonopore large, roughly oval, with serrated lateral margins. Parameral heads small (Fig. 34); parameral blades long, stout, slightly extended distally; *pst1–2* as in Figure 34.

*Female:* Thoracic and abdominal chaetotaxy as in Figure 30; *ps* absent on segment III. Subgenital plate diffuse distally in all examined material, not illustrated (Fig. 35). Vulval margin gently rounded, with 3–4 short, slender *vms* and 8–10 short, thorn-like

vss on each side; 6–7 short, slender vos 1 each side of subgenital plate; 1–2 distal vos median to vss.

### Taxonomic summary

*Type host:* *Eurylaimus steerii steerii* Sharpe, 1876—wattled broadbill.

*Type locality:* Malaita, Mindanao, Philippines.

*Specimens deposited:* Holotype male, Malaita, Mindanao, Philippines, SUBBM-1099 (BPBM). Paratypes 6 males, 3 females, same data as holotype (BPBM); 2 males, 4 females, same locality, SUBBM-1102 (BPBM).

*ZooBank registration:* urn:lsid:zoobank.org:act:55498343-FA82-4E9A-B977-529A9071D3EB.

*Etymology:* The species name is derived from “*forcipatus*,” Latin for “pincer-shaped,” referring to the narrow and highly convergent frons of this species.

### Remarks

In some specimens there appears to be a slight thickening of the median section of the hyaline margin, similar to that seen in, for example, *Philopteroides* Mey, 2004. This thickening is absent in other specimens, and may be due to a folding of the hyaline margin during mounting. Fresh specimens are needed to establish the true nature of this character.

No described species of *Guimaraesiella* appear to be morphologically similar to *G. forcipata*, and we have not seen any similar species among the approximately 100 undescribed species we have examined. This species can be separated from all described species of *Guimaraesiella* by the unique head shape (Fig. 31) and the short, almost quadratic mesosome (Fig. 33), which does not or barely overlaps with the basal apodeme (Fig. 32).

### DISCUSSION

The hosts of all 5 species described here are representatives of the Old World suboscines. As such, they are more closely related to groups of birds that typically are not parasitized by *Brueelia*-complex lice (Table I), than to the other hosts of the core *Guimaraesiella* (Prum et al., 2015). The 5 species described here are all morphologically typical for the core *Guimaraesiella* (Gustafsson and Bush, 2017; Clade A-1 in fig. 3 of Bush et al., 2016).

The placement of *Guimaraesiella* specimens from eurylaimid hosts deep inside a clade comprising *Guimaraesiella* from oscine hosts (Bush et al., 2016) indicates that these are the descendants of a successful host switch from an oscine to a suboscine host. Although all hosts of the species described here are broadbills, the African and green broadbills are more closely related to the pittas than to the typical broadbills (Moyle et al., 2006; Selvatti et al., 2016). No *Brueelia*-complex lice are known from pittas, suggesting that the switch from oscine to calyptomenid hosts occurred after the calyptomenids split from the pittids. This indicates that at least 2 host switches may be involved, 1 to each broadbill host family. However, as some of the species described here are morphologically quite distinct from each other (in particular *G. forcipata*), more than 2 oscine to suboscine host switch may have been involved.

The majority of core *Guimaraesiella* are known from canopy-feeding birds, many of which participate in mixed-species feeding

flocks. Participation in mixed-species feeding flocks may facilitate host switching; however, the effect of mixed-species feeding flocks on chewing louse distribution has not been well studied. Additional research on the louse fauna of Southeast Asian hosts is sorely needed to determine whether or not host switching—including between distantly related hosts—is common in the Old World tropics. The occurrence of the same species of *Myrsidea* on bulbuls (Pycnonotidae) and *C. macrorhynchus* may indicate that host switches are common in Southeast Asia (Sychra et al., 2014). Notably, pittas are ground-foraging, and do not participate in mixed-species feeding flocks (e.g., Chen and Hsieh, 2002; Kotagama and Goodale, 2004; Zou et al., 2011); this may explain why no *Brueelia*-complex lice are known from pittid hosts.

Finally, the description of these species is a reminder that very few species of lice in the *Brueelia* complex have been described. The Passeriformes comprises well over half the diversity of birds, including over 5,000 potential host species of *Brueelia*-complex lice. In addition, lice belonging to this complex are found on several other host orders, and many host species are parasitized by more than 1 species of louse in the *Brueelia* complex (Gustafsson and Bush, 2017). Yet, only approximately 500 species have been described in the *Brueelia* complex (Gustafsson and Bush, 2017), which corresponds to less than 10% of the expected diversity. A recent estimate suggested that in Africa alone, less than 5% of the potential diversity of species of the genus *Brueelia* have been described (Gustafsson et al., 2019b). Thus, we are still at a very early stage in understanding the diversity and evolutionary history of the *Brueelia*-complex.

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