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Four new species of *Guimaraesiella* (Phthiraptera: Ischnocera: *Brueelia*-complex) from China

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Abstract

Four new species of *Guimaraesiella* Eichler, 1949 are described and illustrated based on specimens collected in South China. They are: *Guimaraesiella* (*Cicchinella*) *citreisoma* **new species** ex *Leiothrix lutea kwangtungensis* Whistler, 1943 (Leiothrichidae); *Guimaraesiella* (*Cicchinella*) *corrugata* **new species** ex *Alcippe hueti hueti* David, 1874 (Leiothrichidae); *Guimaraesiella* (*Cicchinella*) *petilorica* **new species** ex *Alcippe nipalensis nipalensis* (Hodgson, 1837) (Leiothrichidae); and *Guimaraesiella* (*Cicchinella*) *yuhinae* **new species** from *Yuhina flavicollis rouxi* (Oustalet, 1896) (Zosteropidae); this is the first species of the *Brueelia*-complex recorded from a member of the Zosteropidae.

Key words: Phthiraptera, Ischnocera, new species, *Brueelia*-complex, *Guimaraesiella, Cicchinella*, lice, babblers *sensu lato*, Leiothrichidae, Zosteropidae, China

Introduction

The "babblers" constitute a group of three families (Leiothrichidae, Pellorneidae, Timaliidae) of small to medium-size passerines, most of which occur in southern Asia. Many other birds have traditionally been considered "babblers", but are now placed in different families (see *e.g.* Jønsson *et al*. 2007; Reddy & Cracraft 2007), including some that are closely related to the three babbler families, *i.e.* yuhinas (Zosteropidae) and parrotbills (Sylviidae) (Moyle *et al*. 2012). Here, we refer to this extended group of birds (Leiothrichidae, Pellorneidae, Timaliidae, Sylviidae and Zosteropidae) as "babblers *sensu lato*".

Among the babblers *sensu lato*, most of the louse genera of the *Brueelia*-complex appear to be widely distributed, and not restricted to any particular genus or family of hosts. Excluding monotypic genera, only two groups within the *Brueelia*-complex are limited to species of a single host genus of babblers *sensu lato*, *i.e.* the "*Painjunirmus*" group, currently included in *Brueelia* Kéler, 1936 *sensu stricto* (Gustafsson & Bush 2017: 35) and the subgenus *Priceiella* (*Torosinirmus*) Gustafsson & Bush, 2017. Both of these louse groups parasitise hosts of the genus *Turdoides* Cretzschmar, 1826. Species of all other louse genera known from babblers *sensu lato* parasitise members of more than one host family; however, for most bird genera, our knowledge of lice from hosts of the families Pellorneidae and Timaliidae is limited (Gustafsson & Bush 2017; Gustafsson *et al.* 2018a,b, 2019a,b).

The rich diversity and complicated host-association patterns of lice from babblers *sensu lato* have the potential

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to become a model system for understanding questions about co-speciation, host switching, and the influence of external factors, such as humidity, on the evolution of chewing lice and their hosts. However, despite increasing research on these lice in recent years (*e.g.* Gustafsson & Bush 2017; Mey 2017; Gustafsson *et al*. 2018a,b, 2019a,b), the number of known louse species is still low. Lice of the *Brueelia*-complex are presently known from only 10 of the 50 genera of babblers *sensu lato*. Moreover, since most of those species are known from single collection events, any morphological variation within a species over large geographical areas is unknown.

In this paper we describe four new species of *Guimaraesiella* (*Cicchinella*) from Chinese babblers. Two of these species belong to the *sehri* species-group, and two to the *gombakensis* species-group. Also, we include the first description of a louse of the *Brueelia*-complex from a species of *Yuhina*, representing the first species of this louse complex from a host in the Zosteropidae. In addition, we document the morphological variation between two populations of lice from two different mountain ranges in Guangdong Province (China), which we tentatively regard as a single species of *Guimaraesiella*.

Material and methods

All specimens are slide-mounted in Canada balsam and deposited at the Institute of Zoology, Guangdong Academy of Sciences, Guangzhou, China (IZGAS). Specimens were examined through a Nikon Eclipse N*i* microscope (Nikon Corporation, Tokyo Japan), and illustrated by hand through a fitted drawing tube. Illustrations were collated and edited in GIMP (www.gimp.org). Measurements (in mm) were taken from live images in NIS-Elements (Nikon Corporation, Tokyo, Japan) for the following dimensions: AW = abdominal width (at segment V); HL = head length (at midline), HW = head width (at temples); PRW = prothoracic width; PTW = pterothoracic width; TL = total length at midline).

Terminology and abbreviations of morphological and setal characters follow Gustafsson & Bush (2017) and Gustafsson *et al*. (2019a), including: *ads = anterior dorsal seta*; *ames = anterior mesosomal setae*; *dsms = dorsal submarginal seta*; *gpmes = gonoporal posterior mesosomal setae*; *lpmes = lateral posterior mesosomal setae*; *pmes = posterior mesosomal setae*; *pos = preocular seta*; *ps = pleural seta*; *pst1–2 = parameral setae 1–2*; *tps = tergal posterior seta*; *vms = vulval marginal setae*; *vos = vulval oblique setae*; *vss = vulval submarginal setae*. Host taxonomy is from Clements *et al*. (2019).

Systematics

PHTHIRAPTERA Haeckel, 1896

Phthiraptera Haeckel 1896: 703.

Ischnocera Kellogg, 1896

Ischnocera Kellogg, 1896: 63.

Philopteridae Burmeister, 1838

Philopteridae Burmeister, 1838: 422.

Brueelia-complex (*sensu* Gustafsson & Bush 2017)

Guimaraesiella Eichler, 1949

Nirmus Nitzsch, 1818: 291 (in partim).
Degeeriella Neumann, 1906: 60 (in partim).

Brueelia Kéler, 1936: 257 (in partim).
Guimaraesiella Eichler, 1949: 11.
Xobugirado Eichler, 1949: 13.
Allobrueelia Eichler, 1951: 36 (*in partim*).
Allobrueelia Eichler, 1952: 74 (near-verbatim redescription).
Allonirmus Złotorzycka, 1964: 263.
Nitzschnirmus Mey & Barker, 2014: 101.
Callaenirmus Mey, 2017: 92.
Philemoniellus Mey, 2017: 145.
Type species. *Docophorus subalbicans* Piaget, 1885: 6 [= *Guimaraesiella papuana* (Giebel, 1879: 475)], by original designation.

Subgenus *Cicchinella* Gustafsson *et al.* 2019

Cicchinella Gustafsson, Clayton & Bush, 2019b: 453.
Type species: *Guimaraesiella sehri* (Ansari, 1955), by original designation.

Guimaraesiella (*Cicchinella*) *corrugata* new species

(Figs 1–12)

Type host. *Alcippe hueti hueti* David, 1874 – Huet's fulvetta (Leiothrichidae) [see Remarks].

Type locality. Dinghushan, Dinghu District, Zhaoqing, Guangdong, China.

gnosis. In the key to species in Gustafsson *et al*. (2019a), *Guimaraesiella* (*Cicchinella*) *corrugata* keys out to *Guimaraesiella* (*Cicchinella*) *mcgrewi* Gustafsson *et al*., 2019a based on the extent of the dorsal preantennal suture, the structure of the male genitalia, and the fusion of female tergopleurites IX+X and XI. However, these two species can be separated by the following characters: lateral margins of preantennal head more convex in *G.* (*C.*) *corrugata* (Fig. 3) than in *G.* (*C.*) *mcgrewi*; parameral heads with single-pointed median ends of the median extensions in *G.* (*C.*) *corrugata* (Figs 5, 8), but with double-pointed median ends in *G.* (*C.*) *mcgrewi*; gonopore small with triangular lateral extensions in *G.* (*C.*) *mcgrewi*, but large and complicated, without triangular extensions but with large, rough areas bearing what appears to be 1–2 sensilla on each side in *G.* (*C.*) *corrugata* (Figs 7, 11); rugose nodi submarginal in *G.* (*C.*) *corrugata* (Figs 7, 11), but marginal in *G.* (*C.*) *mcgrewi*; patterns of thickenings of distal mesosome in *G.* (*C.*) *corrugata* (Figs 4, 7, 10, 11) different from those of *G.* (*C.*) *mcgrewi*; male tergopleurite VIII with two *tps* on each side in *G.* (*C.*) *mcgrewi*, but with 1 *tps* on each side in *G.* (*C.*) *corrugata* (Fig. 1); female subgenital plate with extensive reticulation in *G.* (*C.*) *corrugata* (Fig. 12), but without reticulation in *G.* (*C.*) *mcgrewi*.

Description. *Both sexes*. Head sub-triangular, frons concave (Fig. 3). Marginal carina interrupted laterally and medianly; width of carina irregular, widest near preantennal nodi. Dorsal preantennal suture reaches lateral margins of head and *ads*, but does not cut off dorsal anterior plate medianly. Head chaetotaxy as in Fig, 3; *pos* situated ventrally in male, more dorsally in female. Preantennal nodi large, bulging, somewhat pointed medianly, but shape variable among specimens. Antennae not sexually dimorphic or with scape only slightly stouter in male. Preocular nodi much larger than postocular nodi. Temporal marginal carina narrow, with undulating median margin. Gular plate pointed anteriorly. Thoracic and abdominal segments as in Figs 1–2. Measurements as in Table 1.

Male. Thoracic and abdominal chaetotaxy as in Fig. 1. One *tps* on each side of tergopleurite VII. The genitalia differ between two populations: specimens from Dinghushan (including holotype) as in Figs 4–7, and those from Dadongshan with parameres as in Figs 8–9 and mesosome as in Figs 10–11. Mesosome longer than wide, with rounded proximal end protruding laterally (Dinghushan specimens, Fig. 7); lateral margins deeply concave at about mid-section in specimens from Dinghushan (Fig. 7), but almost straight in specimens from Dadongshan (Figs 10–11); distal margin of mesosome flat or slightly convex, with wide dorsal thickening, curved at lateral ends (Figs 4, 10). Mesosome with a ventral, distal pair of submarginal elongated nodi associated with prominent rugose areas on antero-lateral ends on both sides, and 2 *pmes* microsetae on each side of elongated nodi (Figs 7, 11). Gonopore large, tube-like, arising in anterior end of mesosome; 1–2 *ames* sensilla on more or less protruding areas on each side of gonopore. Parameres with pointed heads (Figs 5–6, 8–9), ventrally with densely corrugated area on the distal base of head. Parameral blades bulky, curved in specimens from Dadongshan (Figs 8–9) but more straight in specimens

from Dinghushan (Figs 5–6); *pst1–2* as in Figs 5–6 and 8; *pst1* positioned ventrally in specimens from Dinghushan, but dorsally in specimens from Dadongshan. However, in both cases *pst2* seta is situated near the lateral margin, and may in fact be marginal in unmounted specimens.

Female. Thoracic and abdominal chaetotaxy as in Fig. 2. Subgenital plate rectangular anteriorly, with distal part gently narrowing to slender connection with complete cross-piece (Fig. 12). Irregular reticulation present in distal half of subgenital plate, less prominent in more anterior parts as in Fig. 12. Vulval margin with 4 short, slender *vms* and 6 short, thorn-like *vss* on each side; 4 short, slender *vos* on each side of subgenital plate; distal 1 *vos* one each side median to or slightly anterior to row of *vss*.

Etymology. The species epithet derived from *corrugatus*, Latin for "wrinkled", referring to the parameral heads.

Type material. Ex ***Alcippe hueti hueti*: Holotype** ♂, Dinghushan, Dinghu District, Zhaoqing, Guangdong, China, 18 March 2019, D.R. Gustafsson, L. Lei, C. Adam, G. Chisamera, Bird-ID J4116, Louse-ID GD-PHTH-00265 (IZGAS). **Paratypes.** 1♂, same data as holotype, Louse-ID GD-PHTH-00266 (IZGAS). 2♂, 2♀, same locality and collectors as holotype, 17 Mar. 2019, Bird-ID J4109, Louse-ID GD-PHTH-00267–70 (IZGAS).

Non-types: 2♂, 2♀, Dadongshan, Nanling Mountains, Guangdong, China, 11 Mar. 2019, D.R. Gustafsson, L. Lei, C. Adam, G. Chisamera, Bird-ID J4077, Louse-ID GD-PHTH-00271–4 (IZGAS).

Remarks. The six males examined differ between the two localities in overall size, particularly in the head, with specimens from Dadongshan being bigger than specimens from Dinghushan. Also, the shape of the male genitalia is different between specimens from the two localities, in particular the mesosome and parameres, which are illustrated separately from each population (Figs 4–7 and 8–11). The distal parameres of the male genitalia are partially everted, approximately to the same degree, in the two illustrated specimens; therefore, differences in their morphology are unlikely to be due to artifacts of position. However, the asymmetry of the gonopore in the Dinghushan specimens may be due to slide mounting, and this structure is likely more similar between specimens from the two populations.

It is unclear whether differences in the shape of the mesosome and parameres are taxonomically significant. Since the two collection localities are placed on different mountain ranges, it is possible that the lice on *Alcippe hueti hueti* differ between ranges, even if the host species and subspecies are the same. More collections in the mountain ranges of South China are needed to establish whether the louse populations from different ranges are effectively isolated from each other, even if the hosts may not be.

Moreover, at the time of collection, we had reason to suspect that some of the birds caught at Dadongshan may have originated from further north, as they were morphologically different (DRG pers. obs.). Species of *Alcippe* in South China form a complex of closely related and morphologically similar taxa. It is possible that some of the hosts at Dadongshan belonged to *Alcippe davidi* Styan, 1896, the species living in central China, north of the Nanling Mountains; however, this could not be established in the field. Since the specimens of *Guimaraesiella* described here were taken from birds identified as *A. hueti hueti* in the field at Dinghushan, this host and locality are regarded as type host and type locality of *G.* (*C.*) *corrugata*. However, if more than one species of *Alcippe* is regularly present in Dadongshan, at least during the winter, it is conceivable that *G.* (*C.*) *corrugata* may occur on both host species. More collections from birds on the north side of the Nanling Mountains, including birds positively identified as *A. davidi*, are needed to confirm this hypothesis.

Notably, intraspecific differences in size appear to be common among lice belonging to the *Brueelia*-complex. Gustafsson & Bush (2017: 66) noted that, in general, head dimensions were smaller in specimens of *Acronirmus gracilis* (Burmeister, 1838) from southern localities than specimens more northern localities, and that lice from migratory swallows collectively contained both small-headed and large-headed lice. Also, Gustafsson & Bush (2017: 172) noted that heads of *Traihoriella binhchauensis* (Najer & Sychra [in Najer *et al.*], 2014) showed the same pattern, lice from more southern localities had smaller heads than those from more northern localities. A similar pattern is also seen in a poorly differentiated complex of species in the genus *Sturnidoecus* Eichler, 1944 (Gustafsson & Bush 2017: 234). Collectively, these examples suggest that differences in size alone may not be a good indicator of species limits in the *Brueelia*-complex.

Furthermore, Gustafsson & Bush (2017: 267) noted that Southeast Asian populations of *Rostrinirmus ruficeps* (Nitzsch [in Giebel], 1866) were morphologically identical to populations from other parts of Eurasia, except for significant differences in the male genitalia. In particular, mesosomes of Southeast Asian lice are asymmetrical, whereas those from other parts of Eurasia are symmetrical. As most species in the *Brueelia*-complex are known

from only one or a few localities, even in cases where more than one host specimen has been examined, the extent of such male genitalic differences occurring among louse populations in different parts of the host's range is unknown.

Guimaraesiella (*Cicchinella*) *citreisoma* new species
(Figs 13–20)

Type host: *Leiothrix lutea kwangtungensis* Whistler, 1943 – red-billed leiothrix (Leiothrichidae).

Type locality: Gaijingliang Village, Daping Township, Malipo County, Wenshan Prefecture, Yunnan Province, China.

Diagnosis. *Guimaraesiella citreisoma* keys out to *Guimaraesiella hampuslybecki* Gustafsson *et al*., 2019a, in the key of Gustafsson *et al*. (2019a). These two species can be separated by the following characters: dorsal preantennal suture reaches lateral margin of head in *G.* (*C.*) *citreisoma* (Fig. 15), but not in *G.* (*C.*) *hampuslybecki*; female abdominal segments IV–V each with 2 *ps* on each side in *G.* (*C.*) *citreisoma* (Fig. 14), but with 3 *ps* on each side of *G.* (*C.*) *hampuslybecki*; proximal mesosome smaller and more rectangular in *G.* (*C.*) *citreisoma* (Fig. 19) than in *G.* (*C.*) *hampuslybecki*; mesosomal lobes with distally convergent posterior margins and small lateral concavity in *G.* (*C.*) *citreisoma* (Fig. 19), but with more or less flat posterior margins and proportionately larger lateral concavity in *G.* (*C.*) *hampuslybecki*; gonopore and structure around gonopore different between the two species (Fig. 19); female subgenital plate proportionately longer and slender, and clear reticulation more extensive in *G.* (*C.*) *citreisoma* (Fig. 20) than in *G.* (*C.*) *hampuslybecki*.

Description. ***Both sexes.*** Head trapezoidal (Fig. 15), lateral margins of preantennal area slightly convex, frons deeply concave. Dorsal preantennal suture reaches *dsms, ads* and lateral margin of head, where is extends posteriorly along margin of head (this is difficult to see in many specimens, depending on mounting). Marginal carina broad, with irregular median margin; preantennal nodi large, bulging. Head chaetotaxy as in Fig. 15. Antennae slightly sexually dimorphic (Figs 15–16). Pre-ocular nodi much larger than post-ocular nodi. Marginal temporal carina relatively narrow, of rather equal width throughout. Gular plate distally pointed. Thoracic, abdominal segments and chaetotaxy as in Figs 13–14. Measurements as in Table 1.

Male. Genitalia with basal apodeme broad, with concave lateral margins (Fig. 17). Proximal mesosome roughly rectangular, with slightly concave lateral margins. Ventral sclerite slender, finger-like, shaped as in Fig. 19, almost reaching anterior margin of mesosome. Mesosomal lobes with distally convergent lateral margins; marginal thickening continuous with more anterior nodi; lateral concavity small with proximal *pmes* situated in concavity and posterior *pmes* situated posterior to concavity. Gonopore roughly triangular; *ames* not associated with gonopore. Parameral heads of irregular shape (Fig. 18), parameral blades rather stout, slightly elongated; *pst1–2* as in Fig. 17.

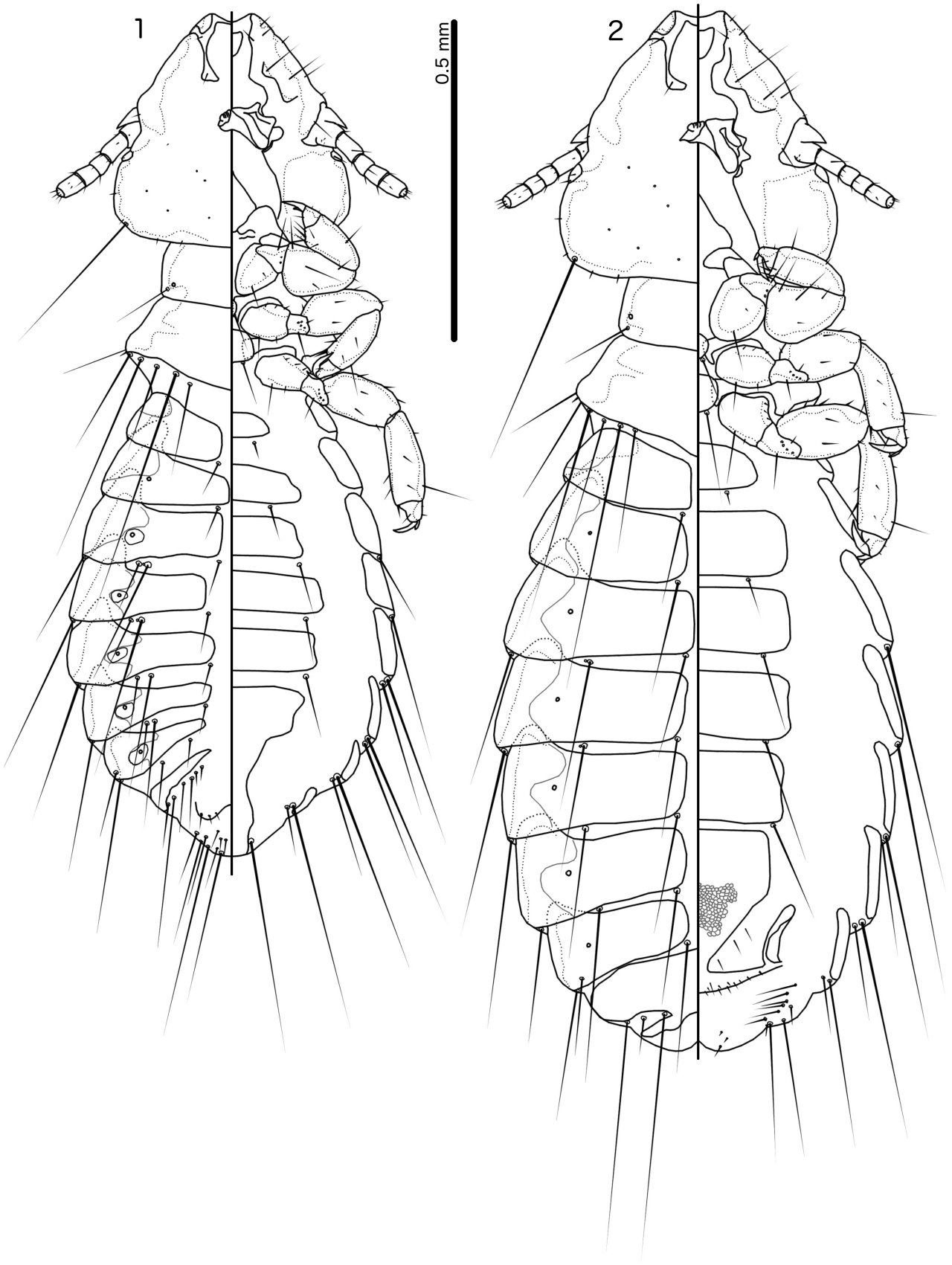
Female. Subgenital plate rather long and slender, with extensive reticulation covering most of central plate (Fig. 20); connection to cross-piece broad. Vulval margin gently rounded, with 2–3 short, slender *vms* and 5–8 short, thorn-like *vss* on each side; 4 short, slender *vos* on each side of subgenital plate; distal 1 *vos* on each side median to *vss*.

Etymology. The species epithet is formed by *citreus*, Latin for "lemon", and *soma*, Greek for "body", referring to the pale yellow colour of this species.

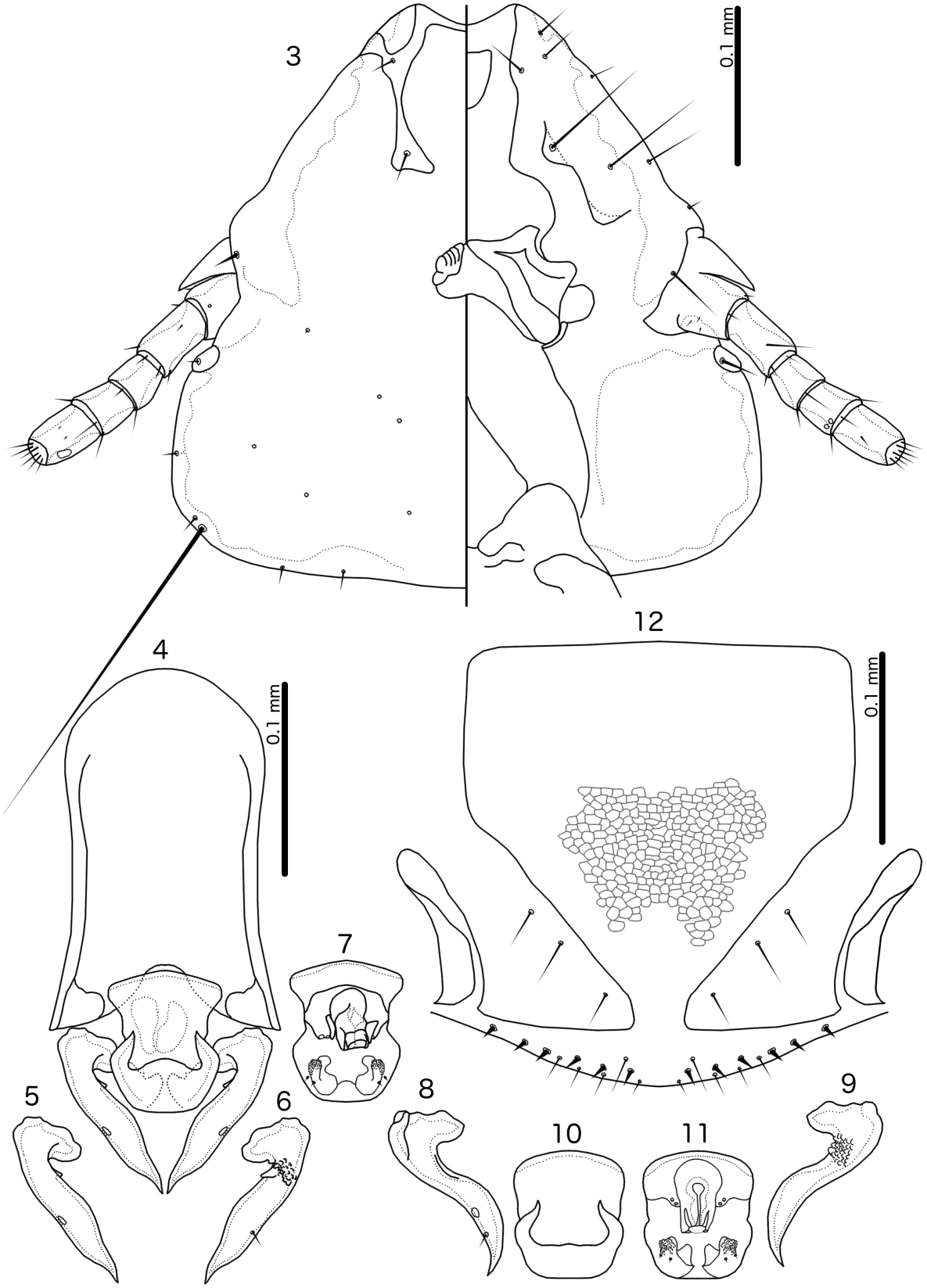
Type material. Ex ***Leiothrix lutea kwangtungensis*: Holotype** ♂, Gaijingliang Village, Daping Township, Malipo County, Wenshan Prefecture, Yunnan Province, China, 20 Jun. 2016, Yuchun Wu & Xingzhi Chu, bird ID J3177, GD-PHTH-00413 (IZGAS). **Paratypes:** 1♂, 6♀, same data as holotype, GD-PHTH-00414–00420 (IZGAS).

Non-types: 1♂, 4♀, Tongle Provincial Nature Reserve, Guangdong Province, China, 25 Jul. 2015, Yanyan Zhao & Wenming Xu, bird ID J2742, GD-PHTH-00421–00423 (IZGAS).

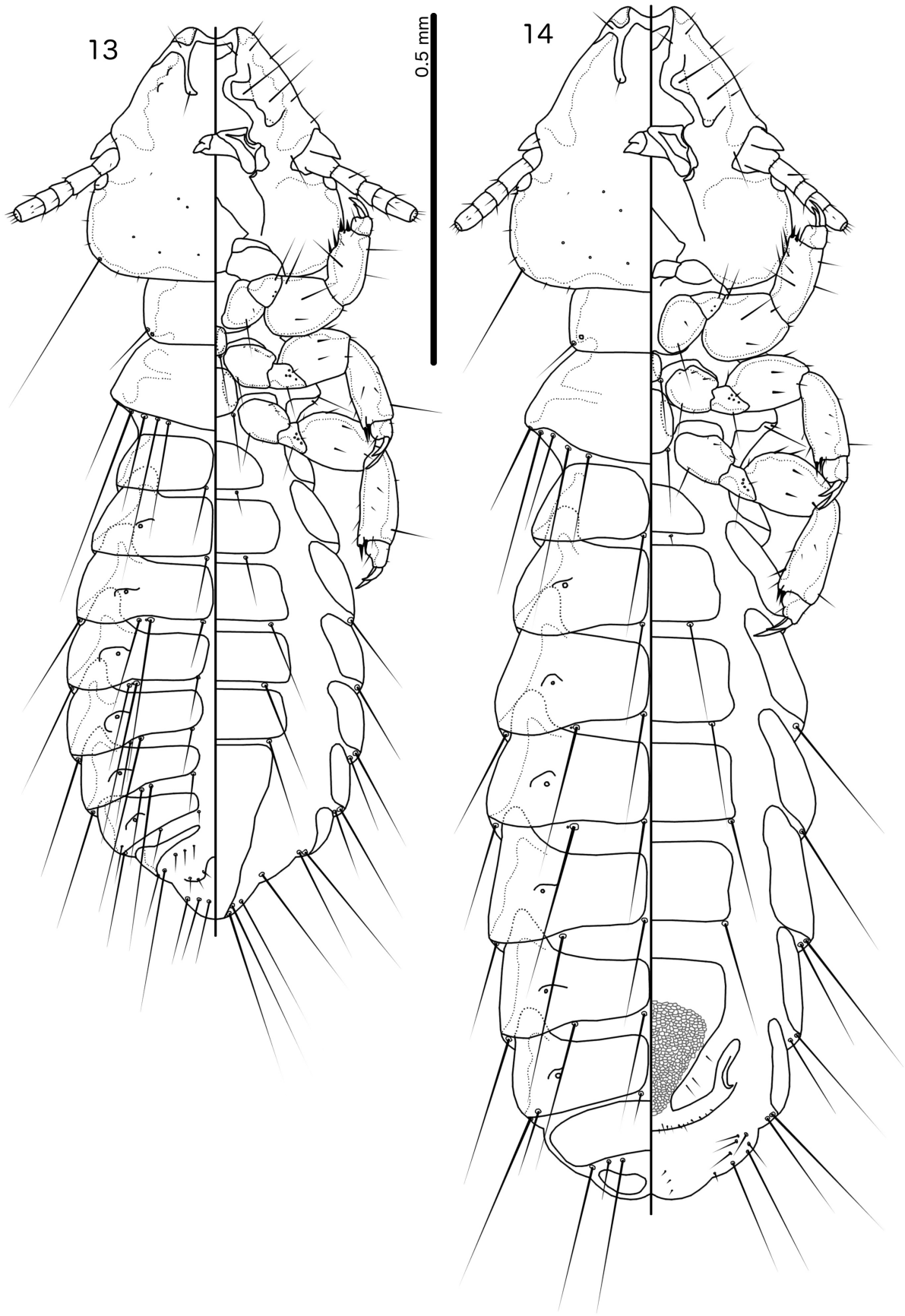
Remarks. The genitalia of the only male examined from Guangdong Province are partially obscured by gut content, so it cannot be conclusively established that they are the same as those of the holotype. No other visible characters contradict the assumption that the specimens from these two provinces are conspecific, and we tentatively treat them as such until more samples are collected and studied.



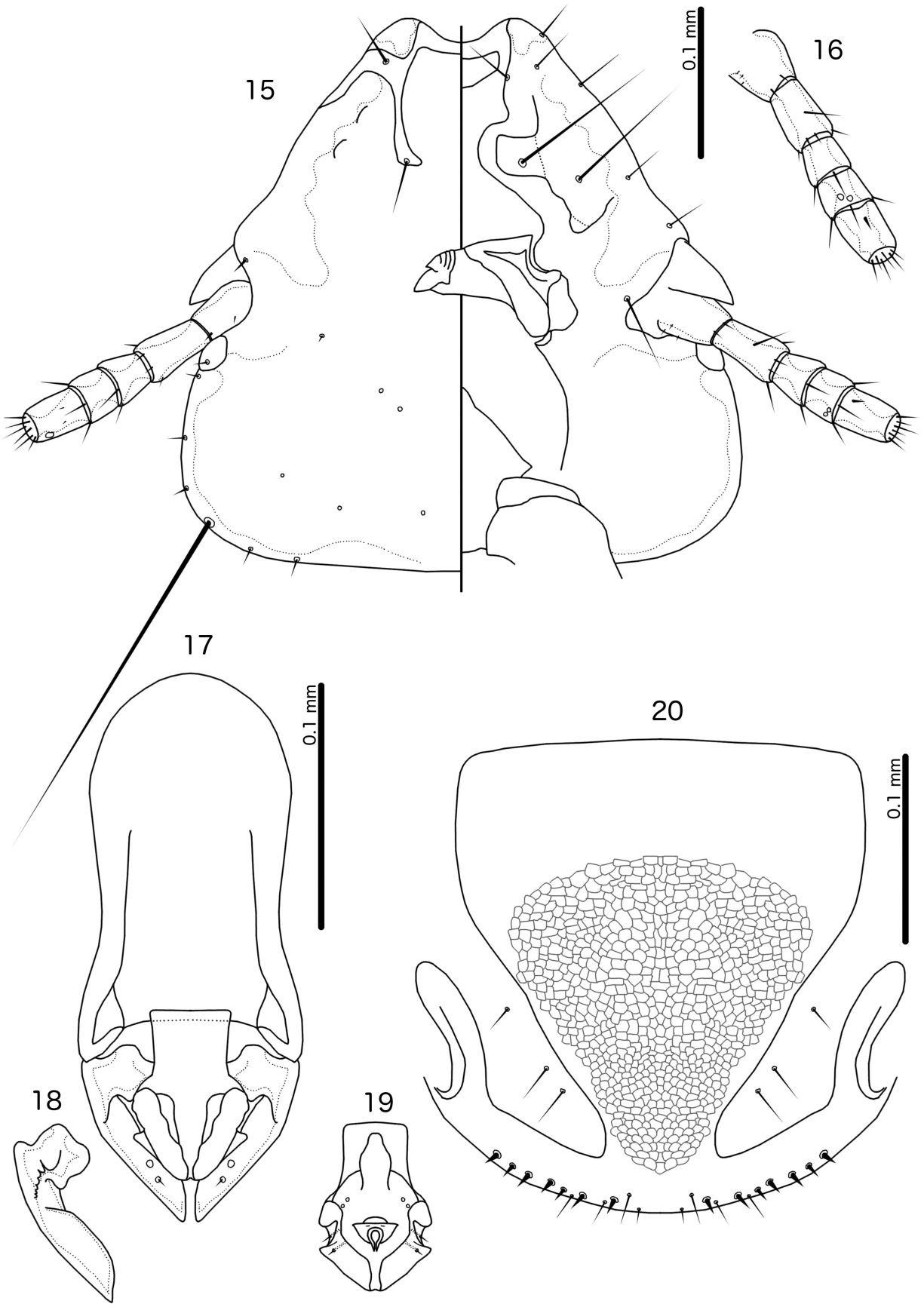
FIGURES 1–2. *Guimaraesiella* (*Cicchinella*) *corrugata* **n. sp. 1,** male habitus, dorsal and ventral views. **2,** female habitus, dorsal and ventral views.



FIGURES 3–12. *Guimaraesiella* (*Cicchinella*) *corrugata* **n. sp. 3,** male head, dorsal and ventral views. **4,** male genitalia, dorsal view. **5,** male paramere, dorsal view. **6,** male paramere, ventral view. **7,** male mesosome, ventral view. (**Figs 3–7** taken from Dinghushan specimens). **8,** male paramere, dorsal view **9,** male paramere, ventral view. **10,** male mesosome, dorsal view. **11,** male mesosome, ventral view (**Figs 8–11** taken from Dadongshan specimens). **12,** female subgenital plate and vulval margin, ventral view. Figures 4–12 to same scale.



FIGURES 13–14. *Guimaraesiella* (*Cicchinella*) *citreisoma* **n. sp. 13,** male habitus, dorsal and ventral views. **14,** female habitus, dorsal and ventral views.



FIGURES 15–20. *Guimaraesiella* (*Cicchinella*) *citreisoma* **n. sp. 15,** male head, dorsal and ventral views. **16,** female antenna, ventral view. **17,** male genitalia, dorsal view. **18,** male paramere, ventral view. **19,** male mesosome, ventral view. **20,** female subgenital plate and vulval margin, ventral view. Figures 15–16, and 17–19 to same scale, respectively.

***Guimaraesiella* (*Cicchinella*) *petilorica* new species**
(Figs 21–27)

Type host: *Alcippe nipalensis nipalensis* (Hodgson, 1837) – Nepal fulvetta (Leiothrichidae) [see Remarks].

Type locality: Wudian Village, Huyu Township, Ruili City, Dehong Prefecture, Yunnan Province, China.

Diagnosis. *Guimaraesiella* (*Cicchinella*) *petilorica* keys out to couplet 4 in the key of Gustafsson *et al*. (2019a), but contains a combination of characters that precludes further identification. These characters place *G.* (*C.*) *petilorica* near *G.* (*C.*) *mcgrewi* Gustafsson *et al*., 2019a and *G.* (*C.*) *iuga* Gustafsson *et al*., 2019a. However, *Guimaraesiella* (*Cicchinella*) *petilorica* can be separated from *G.* (*C.*) *mcgrewi* by the following characters: female tergopleurites IX+X and XI separate in *G.* (*C.*) *petilorica* (Fig. 22), but fused in *G.* (*C.*) *mcgrewi*; preantennal head proportionately longer in *G.* (*C.*) *petilorica* (Fig. 23) than in *G.* (*C.*) *mcgrewi*; antennae sexually monomorphic in *G.* (*C.*) *petilorica* (Fig. 23), but sexually dimorphic with scape longer in male than in female in *G.* (*C.*) *mcgrewi*; proximal mesosome widening proximally and with simple, unadorned ventral side in *G.* (*C.*) *mcgrewi*, but smaller, rounded, and with complex thickenings on ventral side in *G.* (*C.*) *petilorica* (Fig. 26); mesosomal lobes more pointedly convergent distally, and with more pronounced hook-shaped thickening in anterior end in *G.* (*C.*) *petilorica* (Fig. 26) than in *G.* (*C.*) *mcgrewi*; gonopore small, with lateral extensions in *G.* (*C.*) *mcgrewi*, but much larger, without such extensions in *G.* (*C.*) *petilorica* (Fig. 26).

Guimaraesiella (*Cicchinella*) *petilorica* can be separated from *G.* (*C.*) *iuga* by the following characters: female abdominal segments IV–VI with 3 *ps* on each side in *G.* (*C.*) *iuga*, but with 2 *ps* on each side in *G.* (*C.*) *petilorica* (Fig. 22); male tergopleurite VIII with 2 *tps* on each side in *G.* (*C.*) *petilorica* (Fig. 21), but with 1 *tps* on each side in *G.* (*C.*) *iuga*; dorsal preantennal suture reaches lateral margin of head in *G.* (*C.*) *petilorica* (Fig. 23), but not in *G.* (*C.*) *iuga*; proximal mesosome large, expanding proximally, in *G.* (*C.*) *iuga*, but small, rounded in *G.* (*C.*) *petilorica* (Fig. 24); patterns of thickenings and nodi on ventral side of mesosome differ between these two species (Fig. 26); gonopore broad, with anterior and posterior extensions in *G.* (*C.*) *iuga*, but more narrow, and without structures clearly identical to these extensions in *G.* (*C.*) *petilorica*.

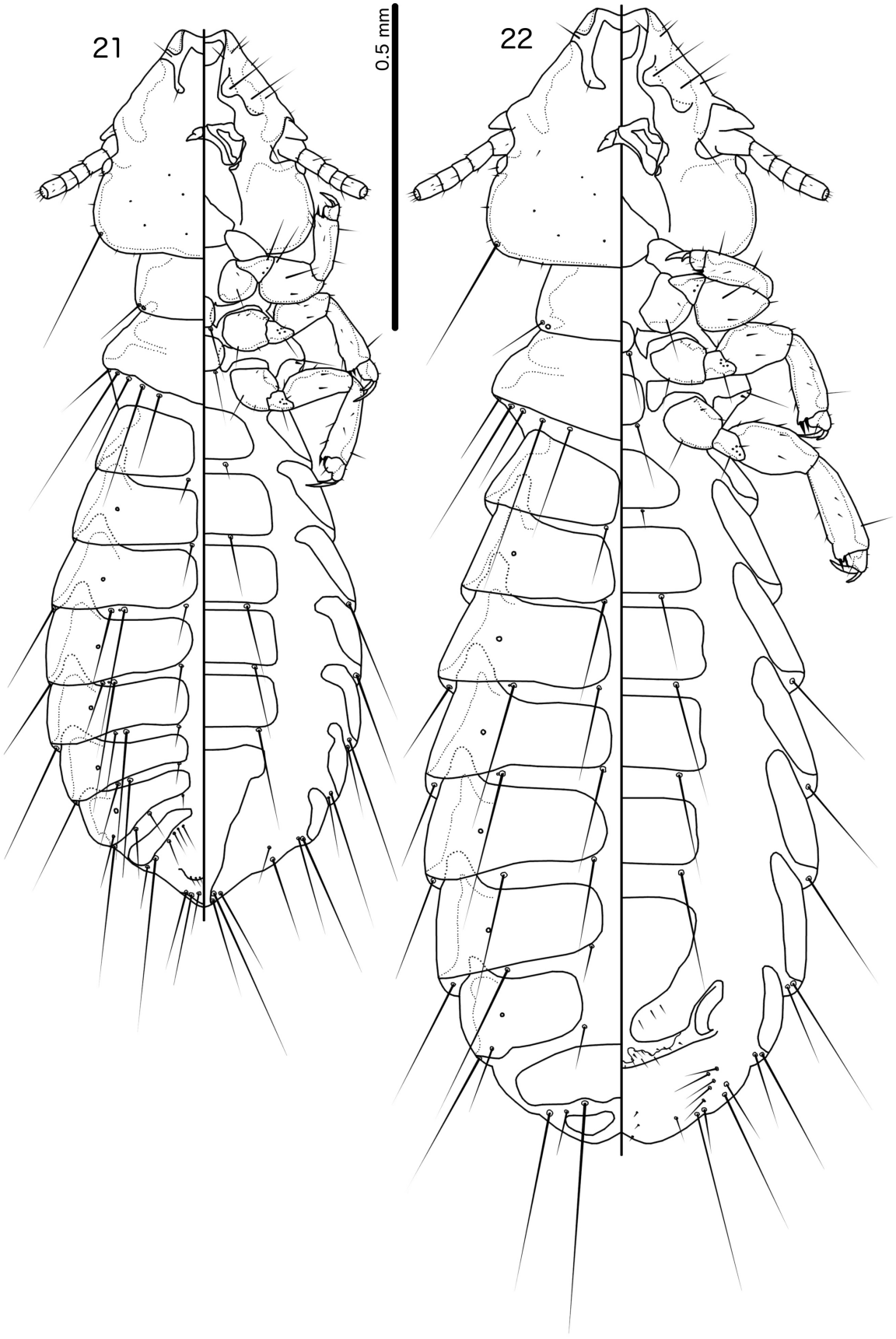
Description. ***Both sexes.*** Head trapezoidal (Fig. 23), lateral margins of preantennal area almost straight, frons concave. Dorsal preantennal suture reaches *ads, dsms* and lateral margin of head. Marginal carina broad, of roughly equal width throughout; preantennal nodi large, bulging. Head chaetotaxy as in Fig. 23. Antennae sexually monomorphic. Preocular nodi larger than postocular nodi. Marginal temporal carina slender, of more or less equal width throughout. Gular plate with median point, rather short. Thoracic and abdominal segments and chaetotaxy as in Figs 21–22. Measurements as in Table 1.

Male. Genitalia with basal apodeme relatively wide, with straight or only slightly concave lateral margins (Fig. 24). Mesosome seemingly not overlapping with basal apodeme; proximal mesosome small and rounded; dorsal thickenings prominent. Mesosomal lobes roughly triangular, converging to pointed distal end (Fig. 26), in anterior end with inwardly curved thickenings; rugose nodi present at about mid-length of lobes, but rugosity restricted to lateral margins of nodes; *lpmes* situated on lateral margin as in Fig. 26. Gonopore slender, with *gpmes* sensilla situated on small, rounded nodes lateral to distal gonopore. Anterior to the gonopore, there are folded or thickened sections of uncertain morphology, possibly similar to those seen in *G.* (*C.*) *corrugata* (Figs 7, 11); these features are unclear and variable, and here illustrated approximately. Parameral heads slanted with anterior bulge (Fig. 25). Parameral blades broad, seemingly tapering abruptly in distal end; however, distal paramere folded anteriorly in all examined males, and here illustrated approximately; *pst1–2* as in Fig. 24.

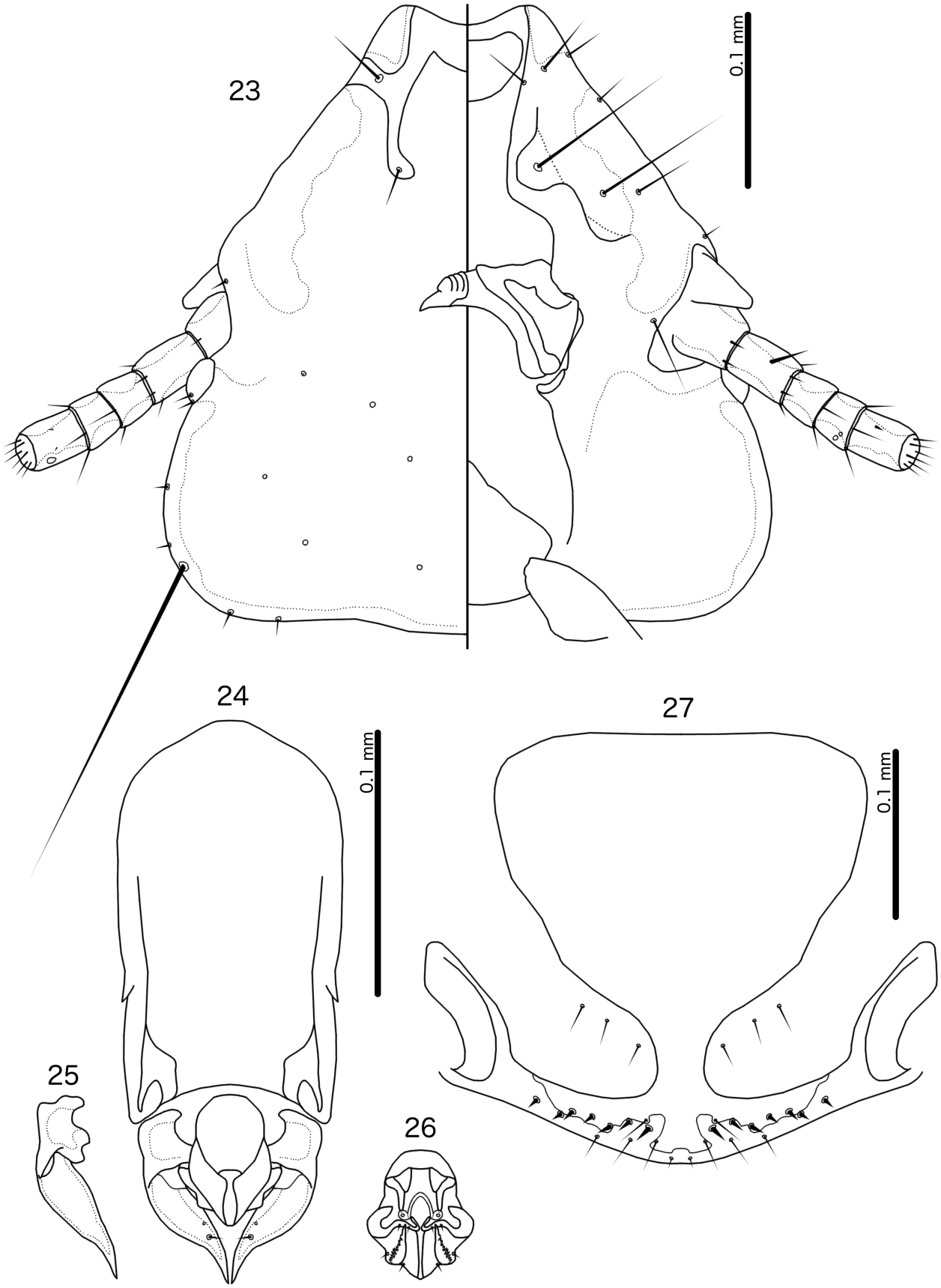
Female. Subgenital plate small, rounded (Fig. 27), with slender connection to cross-piece. Distal margin of cross-piece with less intense sclerotisation than proximal section, delimited by a grey line in Fig. 27. Vulval margin more or less gently rounded, with 3–4 short, slender *vms* and 6–8 short, thorn-like *vss* on each side; 4–5 short, slender *vos* on each side of subgenital plate; distal 1–2 *vos* median to *vss*.

Etymology. The species epithet is formed by "*petilus*", Latin for "slender", and *"lorica*", Latin for "cuirass" or "corselet", here referring to the connection between the female subgenital plate and the cross-piece, which is narrower in *G.* (*Cicchinella*) *petilorica* than in most other species of *G.* (*Cicchinella*).

Type material. Ex ***Alcippe nipalensis nipalensis*: Holotype** ♂, Wudian Village, Huyu Township, Ruili City, Dehong Prefecture, Yunnan Province, China, 7 Jan. 2013, Yuchun Wu & Yanhua Zhang, bird ID J0654 GD-PHTH-00470 (IZGAS). **Paratypes:** 1♀, Banyan King, Daonong Village, Nabang Township, Yingjiang County, Dehong Prefecture, Yunnan Province, China, 27 Dec. 2012, Yuchun Wu & Yanhua Zhang, bird ID J0525, GD-PHTH-00472 (IZGAS).



FIGURES 21–22. *Guimaraesiella* (*Cicchinella*) *petilorica* **n. sp. 21,** male habitus, dorsal and ventral views. **22,** female habitus, dorsal and ventral views.



FIGURES 23–27. *Guimaraesiella* (*Cicchinella*) *petilorica* **n. sp. 23,** male head, dorsal and ventral views. **24,** male genitalia, dorsal view. **25,** male paramere, ventral view. **26,** male mesosome, ventral view. **27,** female subgenital plate and vulval margin, ventral view. Figures 14–26 to same scale.

2♀, same locality and collectors, 28 Dec. 2012, bird ID J0537, GD-PHTH-00474–475 (IZGAS). 1♀, same locality and collectors, 30 Dec. 2012, bird ID J0574, GD-PHTH-00476 (IZGAS). 2♀, same locality and collectors, 27 May 2013, bird ID J1391, GD-PHTH-00479–480 (IZGAS). 1♀, same data as previous, except bird ID J1392, GD-PHTH-00481 (IZGAS).

Remarks. The name of the *Alcippe* species occurring where lice were collected differs among different sources (*e.g.* Arlott 2017; Zheng 2017; Clements *et al.* 2019; Liu & Chen 2021; Gill *et al*. 2021). No additional data from the hosts examined (*e.g.* feathers, photos, DNA) are available to confirm their identity, and none of the authors were present when the type material of *G.* (*Cicchinella*) *petilorica* was collected. Therefore, we accept the name of the type host as *Alcippe nipalensis nipalensis*, noting that further collections are necessary to confirm it.

Guimaraesiella (*Cicchinella*) *yuhinae* new species

(Figs 28–34)

Type host: *Yuhina flavicollis rouxi* (Oustalet, 1896) – whiskered yuhina (Zosteropidae).

Type locality: Pingshan Village, Husa Township, Longchuan County, Dehong Prefecture, Yunnan Province, China.

Diagnosis. *Guimaraesiella* (*Cicchinella*) *yuhinae* keys to couplet 8 in the key of Gustafsson *et al*. (2019a), but it has a combination of characters that does not fit with either choice in the couplet: the gonopore of *G.* (*C.*) *yuhinae* is not crescent-shaped, and the marginal thickening is displaced medianly at the concavity (Fig. 33). The choices in couplet 8 are *G.* (*C.*) *ambusta* Gustafsson *et al*., 2019a on one hand, and six other species on the other. Among these six species and from the characters listed in couplet 9, *G.* (*C.*) *yuhinae* is most similar to *G.* (*C.*) *retusa* Gustafsson *et al*., 2019a.

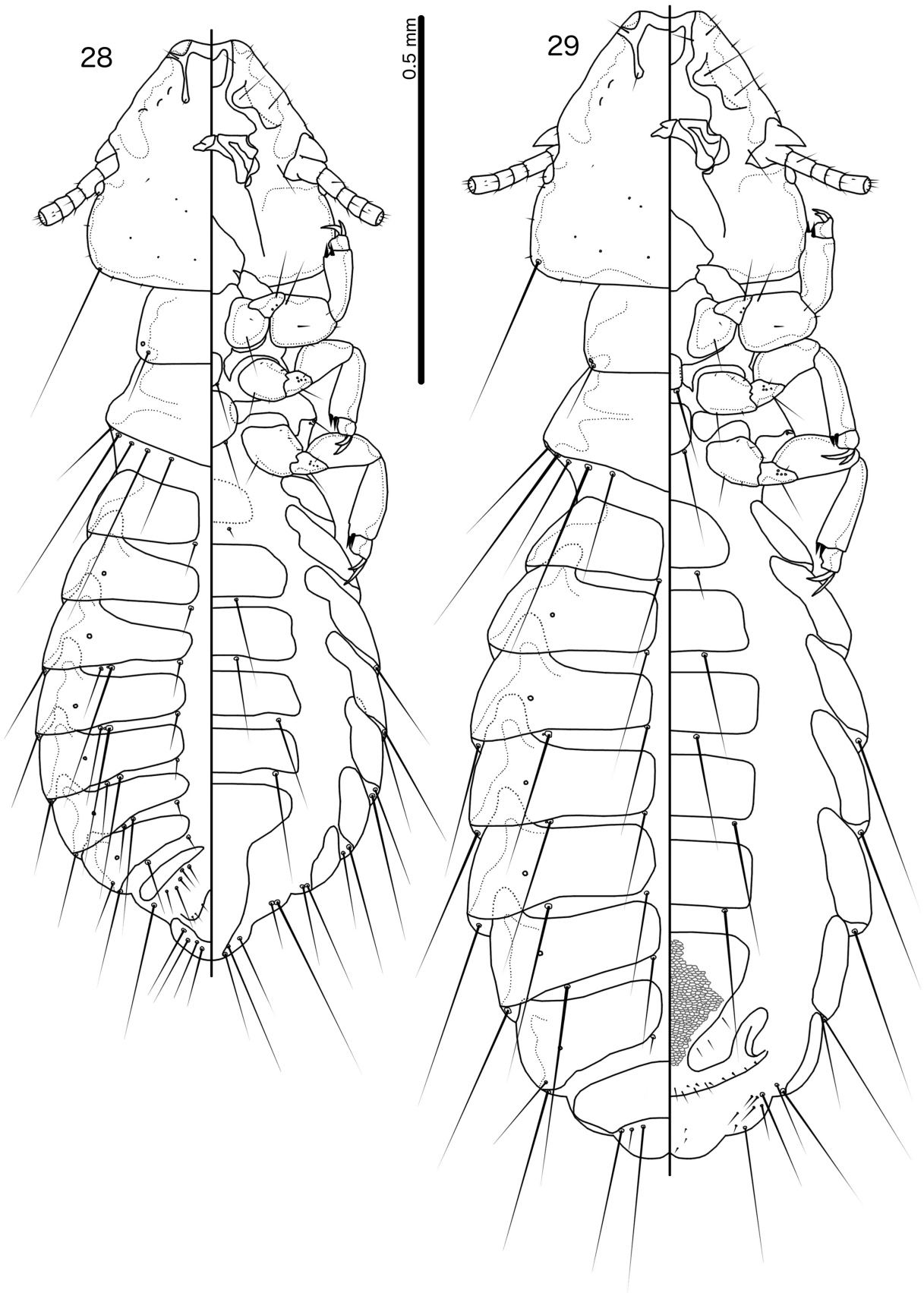
However, *Guimaraesiella* (*Cicchinella*) *yuhinae* can be separated from *G.* (*C.*) *ambusta* and *G.* (*C.*) *retusa* by the following combination of male genitalic characters: proximal mesosome rounded in *G.* (*C.*) *yuhinae* (Fig. 33), but rectangular in the other species; ventral sclerite of *G.* (*C.*) *yuhinae* seemingly detached from more distal part and flanked by sublateral thickenings (Fig. 33), but without such structures in the other species; gonopore of *G.* (*C.*) *yuhinae* shaped as in Fig. 33, with small oblique thickenings at distal end, but shaped differently in the other species.

In addition, *Guimaraesiella* (*Cicchinella*) *yuhinae* can be separated from *G.* (*C.*) *ambusta* by the following characters: head, especially preantennal area, proportionately wider in *G.* (*C.*) *yuhinae* (Fig. 30) than in *G.* (*C.*) *ambusta*; male tergopleurite V with 3 *ps* on each side in *G.* (*C.*) *yuhinae* (Fig. 28), but with 2 *ps* on each side in *G.* (*C.*) *ambusta*; dorsal thickenings of mesosome much longer than wide, essentially longitudinal, in *G.* (*C.*) *yuhinae* (Fig. 31), but wider than long and essentially latitudinal in *G.* (*C.*) *ambusta*; female subgenital plate relatively broader, reticulation more extensive, and vulval margin more flattened in *G.* (*C.*) *yuhinae* (Fig. 34) than in *G.* (*C.*) *ambusta*. Furthermore, *Guimaraesiella* (*Cicchinella*) *yuhinae* can be separated from *G.* (*C.*) *retusa* by the following characters: male abdominal segment IV with 2 *ps* on each side in *G.* (*C.*) *yuhinae* (Fig. 28), but with 1 *ps* on each side in *G.* (*C.*) *retusa*; lateral thickenings of mesosomal lobes displaced at concavity in *G.* (*C.*) *yuhinae* (Fig. 33), but not in *G.* (*C.*) *retusa*; connection between female subgenital plate and cross-piece narrower and vulval margin more flattened in *G.* (*C.*) *yuhinae* (Fig. 34) than in *G.* (*C.*) *retusa*.

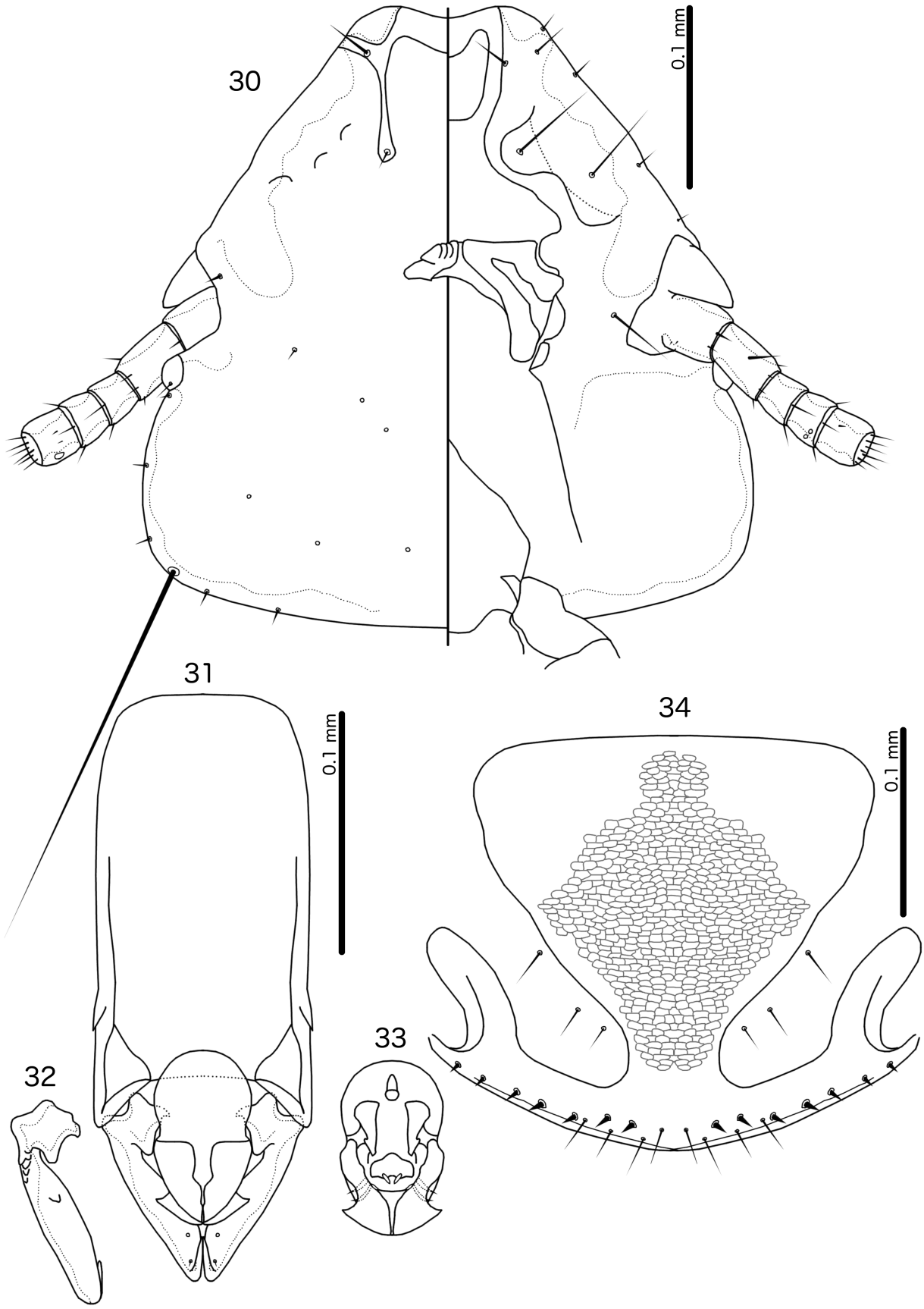
Description. ***Both sexes.*** Head trapezoidal, rather broad (Fig. 30), lateral margins of preantennal area more or less straight, frons broadly concave. Dorsal preantennal suture reaches *dsms, ads* and lateral margins of head. Marginal carina broad, with irregular inner margin, preantennal nodi large, bulging. Head chaetotaxy as in Fig. 30. Antennae sexually monomorphic. Preocular nodi larger than postocular nodi. Marginal temporal carina narrow, widening along posterior margin of head. Gular plate somewhat elongated. Thoracic and abdominal segments and chaetotaxy as in Figs 28–29. Measurements as in Table 1.

Male. Sternal plate II hidden by gut content in all examined specimens, and not illustrated. Genitalia with basal apodeme relatively broad, rectangular, with more or less straight lateral margins (Fig. 31). Proximal mesosome rounded (Fig. 33), ventral sclerite small, with pointed proximal end, and seemingly no connection to more distal thickenings of the mesosome; lateral to ventral sclerite are large thickenings of unclear homology. Gonopore as in Fig. 33, with small oblique sclerites in distal end. Mesosomal lobes with postero-lateral point distal to concavity, and more or less rounded distal margins; marginal thickening displaced medianly at concavity; *lpmes* situated marginally in concavity. Dorsal thickenings of mesosome long. Parameral heads as in Fig. 32; distal parameres folded

dorsally in all males examined, so exact shape difficult to ascertain; apparently elongated and attenuated distal to *pst2*; *pst1–2* as in Fig. 31.



FIGURES 28–29. *Guimaraesiella* (*Cicchinella*) *yuhinae* **n. sp. 28,** male habitus, dorsal and ventral views. **29,** female habitus, dorsal and ventral views.



FIGURES 30–34. *Guimaraesiella* (*Cicchinella*) *yuhinae* **n. sp. 30,** male head, dorsal and ventral views. **31,** male genitalia, dorsal view. **32,** male paramere, ventral view. **33,** male mesosome, ventral view. **34,** female subgenital plate and vulval margin, ventral view. Figures 31–33 to same scale.

Female. Subgenital plate roughly triangular, with extensive reticulation (Fig. 34) and moderately wide connection to cross-piece. Vulval margin more or less gently rounded, with 3 long, slender *vms* and 6–8 short, thorn-like *vss* on each side; 3–5 long, slender *vos* on each side of subgenital plate; distal 1 *vos* median to *vss*.

Etymology. The species epithet is derived from the genus of the type host. This name ultimately derives from "*yuhin*", the Nepali name for *Yuhina gularis* Hodgson, 1836, also known as the stripe-throated yuhina.

Type material. Ex ***Yuhina flavicollis rouxi*: Holotype** ♂, Pingshan Village, Husa Township, Longchuan County, Dehong Prefecture, Yunnan Province, China, 8 Aug. 2013, Yanhua Zhang & Chuying Cui, bird ID J1418, GD-PHTH-00410 [marked with black dot on slide] (IZGAS). **Paratypes:** 1♂, 5♀, same data as holotype, GD-PHTH-00410–412 (IZGAS).

Remarks. *Guimaraesiella* (*Cicchinella*) *yuhinae* is the first species of *Guimaraesiella* described from a species of *Yuhina*, and the first species of a louse in the *Brueelia*-complex recorded from a member of the family Zosteropidae. In figures 28 and 29, the setae of the femora, tibiae, and tarsi II–III of legs II and III have not been illustrated because they were not clearly visible due to the legs being shrunken and distorted during the slide-mounting of all specimens examined.

Discussion

The four new species described in this paper bring the number of known species in the subgenus *Guimaraesiella* (*Cicchinella*) to 20. Members of the subgenus are distributed across five host families: Leiothrichidae, Pellorneidae, Sylviidae, Timaliidae, and Zosteropidae (Table 2). Other species of *Guimaraesiella* are known from sylviid warblers, but they belong to the subgenus *Guimaraesiella* (*Guimaraesiella*).

Most of the 20 species of *Guimaraesiella* (*Cicchinella*) are known from members of the Leiothrichidae. This is probably a reflection of poor sampling from hosts belonging to other families, rather than a natural pattern. Recent louse surveys of members of other bird families included a few pellorneid and timaliid hosts (*e.g.* Sychra *et al*. 2009; Najer *et al*. 2012, 2014; Gustafsson *et al*. 2019), and surveys of African birds have not included any babblers (*e.g.* Light *et al*. 2016; Gajdosova *et al*. 2020). Examination of slide-mounted specimens held in most large museums across the world during the revision of the *Brueelia*-complex by Gustafsson & Bush (2017) revealed no samples of *Guimaraesiella* from any African babbler *sensu lato*. More sampling from hosts in the above families and from African species may increase the number of species of *G.* (*Cicchinella*) from non-leiothrichid hosts.

There is limited overlap in the host distributions of species of *Guimaraesiella* and *Priceiella* among babblers *sensu lato* (Table 2). This pattern is in line with more extensive surveys conducted in South China over the last decade (D.R. Gustafsson & F. Zou, unpublished data) where, in general, each species of babbler *sensu lato* is parasitised by a species of *Guimaraesiella* or a species of *Priceiella*, but not both. Possibly, lice of these two genera compete for the same resources and cannot co-exist on the same bird, but this hypothesis has not been tested. Two known exceptions to that pattern are known among species of the host genera *Alcippe* and *Turdinus* Blyth, 1844 (Najer *et al*. 2014; Gustafsson *et al*. 2018a, 2019a). In both cases, only small numbers of specimens have been found, and contamination or other errors cannot be excluded. More louse collections across Southeast Asia are needed to establish the extent species of *Priceiella* and *Guimaraesiella* may co-exist on the same host species.

More data are needed to clarify the host distribution of the three species-groups of *Guimaraesiella* (*Cicchinella*) (Table 2). Species of the *G.* (*C.*) *sehri* species-group are predominantly found on larger-bodied host species, such as those of the genera *Heterophasia* Blyth, 1842 and *Trochalopteron* Blyth, 1843, but also on small-bodied hosts such as species of *Yuhina* Hodgson, 1836 and *Schoeniparus* Hume, 1874. In contrast, members of the *G.* (*C.*) *tenella* species-groups and the *G.* (*C.*) *gombakensis* species-groups are known from small-bodied hosts only. Moreover, lice belonging to different species-groups may be found on birds in the same mixed-species flocks (*e.g.* Gustafsson *et al*. 2019b).

TABLE 1. Measurements (in mm) of the new species described in this paper.

Abbreviations: AW = abdominal width (at segment V); HL = head length (at midline), HW = head width (at temples); PRW = prothoracic width; PTW = pterothoracic width; TL = total length at midline). Data from the two populations of *Guimaraesiella* (*Cicchinella*) *corrugata* are given separately by locality.

Louse species	Host	Sex	No	TL	HL	**HW**	**PRW**	**PTW**	**AW**
Guimaraesiella (*C.*) *corrugata*	*Alcippe hueti hueti*	M	4	1.30–1.37	0.36	0.38–0.39	0.22	0.34–0.35	0.52–0.56
	(Dadongshan specimens)	F	4	1.57–1.76	0.37–0.41	0.40–0.44	0.23–0.25	0.37–0.39	0.55–0.62
	Alcippe hueti hueti	M	4[1]	1.23–1.30	0.33–0.35	0.35–0.37	0.21–0.28	0.31–0.33	0.47–0.52
	(Dinghushan specimens)	F	2	1.48–1.63	0.36–0.37	0.40–0.41	0.23	0.35	0.49–0.53
Guimaraesiella (*C.*) *citreisoma*	*Leiothrix lutea kwangtungensis*	M	4	1.24–1.38	0.35–0.36	0.36–0.38	0.19–0.23	0.31–0.33	0.42–0.49
		F	10	1.62–1.82	0.37–0.40	0.37–0.42	0.22–0.24	0.33–0.37	0.47–0.58
Guimaraesiella (*C.*) *petilorica*	*Alcippe nipalensis nipalensis*	M	1	1.34	0.34	0.35	0.211	0.31	0.48
		F	7	1.60–1.78	0.37–0.40	0.36–0.44	0.23–0.28	0.34–0.40	0.52–0.61
Guimaraesiella (*C.*) *yuhinae*	*Yuhina flavicollis rouxi*	M	2	1.24–1.29	0.33–0.35	0.33–0.34	0.20–0.22	0.30–0.32	0.47–0.50
		F	5	1.41–1.63	0.35–0.40	0.33–0.38	0.21–0.23	0.32–0.35	0.46–0.55

[1] N for HW = 3.

TABLE 2. Distribution of *Guimaraesiella* (subgenera) species-groups on genera of "babblers" *sensu lato*.

Dashes (---) means no species of *Guimaraesiella* have been described from members of the listed genera. Species-groups of *Guimaraesiella* are listed for the subgenus *Cicchinella* only. Host distribution of other *Brueelia*-complex lice follows Gustafsson & Bush (2017), Mey (2017), Gustafsson *et al*. (2018a,b) and Gustafsson *et al*. (2019a,b).

Host families and genera	***Guimaraesiella* (subgenera) species-groups**	**Other *Brueelia*-complex genera**
Sylviidae		
Fulvetta	*G.* (*Cicchinella*) *tenella* species-group	---
Lioparus	---	*Resartor*
Parrotbills (*Conostoma, Chleuasicus, Cholornis, Neosuthora, Paradoxornis, Psittiparus, Sinosuthora, Suthora*)	---	*Priceiella* (*Thescelovora*)
Warblers (*Sylvia* spp. *sensu lato*)	*G.* (*Guimaraesiella*) spp.	*Brueelia – Rostrinirmus*
Others (*Chamaea, Chrysomma, Myzornis, Parophasma, Rhopophilus*)	---	---
Timaliidae		
Cyanoderma	*G.* (*Cicchinella*) *tenella* species-group	---
Megapomatorhinus	---	*Priceiella* (*Thescelovora*)
Mixornis	---	*Timalinirmus*

.....continued on the next page

TABLE 2. (Continued)

Host families and genera	*Guimaraesiella* (subgenera) species-groups	Other *Brueelia*-complex genera
Pomatorhinus	---	*Priceiella* (*Thescelovora*)
Stachyris	---	*Priceiella* (*Thescelovora*)
Others (*Dumetia, Macronus, Rhopocichla, Spelaeornis, Timalia*)	---	---
Pellorneidae		
Malacopteron	---	*Priceiella* (*Thescelovora*)
Pellorneum	---	*Priceiella* (*Thescelovora*)
Schoeniparus	*G.* (*Cicchinella*) *sehri* species-group	---
Turdinus	*G.* (*Cicchinella*) *gombakensis* species-group	*Priceiella* (*Thescelovora*)
Others (*Gampsorhynchus, Graminicola, Illadopsis, Kenopia, Laticilla, Napothera, Ptilocichla*)	---	---
Leiothrichidae		
Alcippe	*G.* (*Cicchinella*) *gombakensis* species-group	*Priceiella* (*Camurnirmus*)
Grammatoptila	---	*Ceratocista* – *Priceiella* (*Camurnirmus*) – *Resartor*
Cutia	---	*Priceiella* (*Priceiella*)
Turdoides	---	*Brueelia* – *Priceiella* (*Torosinirmus*)
Garrulax	---	*Priceiella* (*Camurnirmus*) – *Priceiella* (*Priceiella*)
Ianthocincla	---	*Priceiella* (*Camurnirmus*) – *Priceiella* (*Priceiella*)
Trochalopteron	*G.* (*Cicchinella*) *sehri* species-group	*Resartor*
Heterophasia	*G.* (*Cicchinella*) *sehri* species-group	*Resartor*
Leiothrix	*G.* (*Cicchinella*) *sehri* species-group	*Resartor*
Minla	---	*Resartor*
Liocichla	*G.* (*Cicchinella*) *sehri* species-group	---
Actinodura	*G.* (*Cicchinella*) *sehri* species-group	*Resartor*
Others (*Crocias, Montecincla*)	---	---
Zosteropidae		
Yuhina	*G.* (*Cicchinella*) *sehri* species-group	---
Others (*Apalopteron, Chlorocharis, Cleptornis, Dasycrotapha, Heleia, Lophozosterops, Megazosterops, Rukia, Sterrhoptilus, Tephrozosterops, Woodfordia, Zosterops, Zosternornis*)	---	---

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