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Resurrection of *Painjunirmus* Ansari, 1947 (Phthiraptera: Ischnocera) as a subgenus of *Brueelia* Kéler, 1936, with description of one new species

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Abstract. The genus *Painjunirmus* Ansari, 1947 is resurrected from synonymy with *Brueelia* Kéler, 1936, and considered a subgenus of *Brueelia* Kéler, 1936. A formal redescription and diagnosis for *Painjunirmus* is given. Four of the five previously described species of *Painjunirmus* are redescribed and illustrated: *Brueelia* (*Painjunirmus*) *brevipennis* Ansari, 1956, from *Argya squamiceps squamiceps* (Cretzschmar, 1826); *Brueelia* (*Painjunirmus*) *chilchil* Ansari, 1955, from *Argya caudata eclipes* (Hume, 1877); *Brueelia* (*Painjunirmus*) *magnini* Ansari, 1956a, from *Argya fulva acaciae* (Lichtenstein, 1823); *Brueelia* (*Painjunirmus*) *pengya* (Ansari, 1947) from *Argya striata sindiana* (Ticehurst, 1920) and *A. s. striata* (Dumont, 1823). The species *Brueelia* (*Painjunirmus*) *parvus* (Mey, 2017) is discussed. The species *Brueelia* (*Painjunirmus*) *alba* sp. nov. is described from a Nepalese population of *Argya striata striata* (Dumont, 1823). A neotype is designated for *Brueelia chilchil* Ansari, 1956. A key to almost all species of the subgenus *Painjunirmus* is provided.

Keywords. *Brueelia*-complex, *Painjunirmus,* Philopteridae, new species, Passeriformes, Leiothrichidae.

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Introduction

The "babblers" (Passeriformes Linnaeus, 1758: Leiothrichidae Swainson, 1832, Pellorneidae Delacour, 1946, Timaliidae Vigors & Horsfield, 1827, parts of Zosteropidae Bonaparte, 1853 and Sylviidae Leach, 1820) are parasitized by a wide diversity of lice belonging to the *Brueelia*-complex (Gustafsson & Bush 2017; Mey 2017; Gustafsson *et al.* 2018a, 2018b, 2019a, 2019b, 2021a, 2021b, 2021c, 2022). In total, nine different genera and subgenera of lice in this complex are known from babbler hosts.

However, this diversity is mainly limited to the babblers of more humid areas in Southeast and South Asia. Only two groups of lice in the *Brueelia*-complex are known exclusively from the generally dry-adapted babblers and chatterers in the genera *Argya* Lesson, 1831, and *Turdoides* Cretzschmar, 1826: the subgenus *Priceiella* (*Torosinirmus*) Gustafsson & Bush, 2017, and the "*Painjunirmus*" Ansari, 1947, group within the genus *Brueelia* Kéler, 1936. The former of these is presently known only from African hosts (Gustafsson & Bush 2017), whereas the latter is known from both African and Asian species (see below).

The genus *Painjunirmus* was originally erected to contain the same species as *Brueelia*: the group Piaget (1880) circumscribed as the "*interrupto-fasciata*" group within *Nirmus* Nitzsch, 1818. As such, the genus as originally circumscribed contained a number of species parasitizing non-babbler hosts (Ansari 1947). Apart from the original description of the genus, it has been treated as a synonym of *Brueelia*, including in most checklists (e.g., Hopkins & Clay 1952; Ledger 1980; Price *et al.* 2003). In contrast, Mey & Barker (2014) considered *Painjunirmus* to be separate from *Brueelia*, but later (Mey 2017) considered them synonymous. Gustafsson & Bush (2017) noted that species of *Painjunirmus* are "atypical", and could constitute "a species group or subgenus within *Brueelia*".

We here redescribe and illustrate four of the five known species of *Brueelia* parasitizing *Turdoides* hosts, and describe a sixth species, *Brueelia* (*Painjunirmus*) *alba* sp. nov. Based on our observations and comparisons with hundreds of other species of *Brueelia* (Gustafsson & Bush 2017; unpublished data), we consider this group to be distinct enough to warrant the resurrection of *Painjunirmus* as a subgenus of *Brueelia*; a redescription of this subgenus is therefore also provided. All other species placed in the genus *Brueelia* by Gustafsson & Bush (2017) or described subsequently (e.g., Gustafsson & Bush 2019a, 2019b; Gustafsson *et al.* 2018c, 2019c) are therefore hereby placed in the nominate subgenus, *Brueelia* (*Brueelia*) Kéler, 1936.

Material and methods

The material examined is deposited at the Natural History Museum, London, United Kingdom (NHMUK). Specimens were examined and measured with a Nikon Eclipse E600 fitted with an Olympus DP25 camera and digital measuring software (ImageJ ver. 1.48, Wayne Rasband). Illustrations were made by hand, using a drawing tube attached to the same microscope. Illustrations were scanned, collated and edited in GIMP (www.gimp.org).

Abbreviations for measurements (in mm)

AW = abdominal width (at fifth segment)
HL = head length (along midline)
HW = head width (at temples)
PRW = prothoracic width
PTW = pterothoracic width
TL = total length (along midline)

Abbreviations for morphological terms (following Gustafsson & Bush 2017)

ames = anterior mesosomal setae
aps = accessory post-spiracular setae
as3 = anterior seta 3
fI-v1 = ventral seta 1 of femur I
fI-v4 = ventral seta 4 of femur I
fII-v2 = ventral seta 2 of femur II
fIII-v2 = ventral seta 2 of femur III

mms = marginal mesometanotal setae
mts3 = marginal temporal seta 3
pmes = posterior mesosomal setae
pns = post-nodal setae
pos = preocular setae
ps = paratergal (pleural) setae
psps = principal post-spiracular setae
pts1–2 = parameral setae 1–2
s4 = sensillus 4
ss = sutural setae
tps = tergal posterior setae
vms = vulval marginal setae
vos = vulval oblique setae
vss = vulval submarginal setae

Host taxonomy follows Clements *et al.* (2023).

Results

Taxonomy

Class Insecta Linnaeus, 1758
Order Phthiraptera Haeckel, 1896
Superfamily Ischnocera Kellogg, 1896
Family Philopteridae Burmeister, 1838
Brueelia-complex sensu Gustafsson & Bush, 2017
Genus *Brueelia* Kéler, 1936

Subgenus ***Painjunirmus*** Ansari, 1947

Brueelia Kéler, 1936: 257 (in partim).
Painjunirmus Ansari, 1947: 285.

Type species

Painjunirmus pengya Ansari, 1947: 285, by original designation.

Diagnosis

Brueelia (*Painjunirmus*) is close to *Brueelia* (*Brueelia*) based on the following shared characters: *as3, pns* and *s4* absent; dorsal preantennal suture absent and marginal carina uninterrupted [except in *Br.* (*Br.*) *phasmasoma* Gustafsson & Bush, 2017]; *mts3* only temporal macroseta; *fII*-v2 and *fIII-v2* absent; parameral heads not folded medianly; female subgenital plate forming cross-piece at vulval margin; post-spiracular sensilla present on abdominal segments II–VII in both sexes.

These two subgenera are separated by the following characters: antennae at least slightly sexually dimorphic in *Br.* (*Painjunirmus*) (Figs 3–4), but monomorphic in *Br.* (*Brueelia*); *fI-v4* clearly shorter than *fI-v1* in *Br.* (*Painjunirmus*) (Fig. 1), but as long as *fI-v1* in *Br.* (*Brueelia*); *aps* present on male tergopleurite IV in *Br.* (*Painjunirmus*) (Fig. 1; also on tergopleurite III in some species; Fig. 9), but absent on male tergopleurite IV in *Br.* (*Brueelia*) [except in *Brueelia* (*Br.*) *nebulosa* (Burmeister, 1838)]; *ames* sensilla present on gonopore in *Br.* (*Painjunirmus*) (Fig. 6), but absent in *Br.* (*Brueelia*); mesosomal lobes with antero-lateral "horns" in *Br.* (*Painjunirmus*) (Fig. 6), but no such "horns" in *Br.* (*Brueelia*).

Brueelia (*Painjunirmus*) is also rather similar to the genus *Teinomordeus* Gustafsson & Bush, 2017. These two groups share the antero-lateral "horns" of the mesosome, the slightly sexually dimorphic antennae, and the patterns of abdominal chaetotaxy of the male. However, these two groups can be separated by the following characters: cross-piece present in *Br.* (*Painjunirmus*) (Fig. 8), but absent in *Teinomordeus*; head sensillus *s4* present in *Teinomordeus*, but absent in *Br.* (*Painjunirmus*) (Fig. 3); *ps* are present on female abdominal segment II in *Teinomordeus*, but absent in *Br.* (*Painjunirmus*) (Fig. 2); *pmes* present on gonopore in *Br.* (*Painjunirmus*) (Fig, 6), but absent in *Teinomordeus*.

Description

Both sexes

Head dome-shaped (Fig. 3), slightly variable between species. Lateral margins of preantennal head slightly convex to more or less straight. Frons concave, hyaline. Marginal carina uninterrupted, displaced and much widened at osculum. Head chaetotaxy as in Fig. 3; *as3, pns, s4* absent; *pos* on or near eye. Antennae sexually dimorphic, with male scape (Fig. 3) at least slightly swollen and elongated compared to female scape (Fig. 4), but varying degree of difference among species. Temporal and occipital carinae not visible. Prothorax rectangular, *psps* on postero-lateral corner (Figs 1–2). Pterothorax roughly trapezoidal, but with rounded or slightly convergent posterior margin; *mms* moderately separated medianly. Meso- and metasterna not fused, each with 1 seta on each side on postero-lateral corners. Male tergopleurites II–IX+X and female tergopleurites II–VIII divided medianly (Figs 1–2). Tergopleurites with no or only very small antero-lateral re-entrant heads (Figs 1–2). Sternal plates with concave lateral margins (Fig. 26), in some species with lateral modifications (Figs 1–2). Accessory sternal plates absent. Pigmentation largely translucent except for sternal and subgenital plates of abdomen, gular plate, and lateral margins of head; extent of dark pigmentation variable between species, and indicated with grey lines in illustrations.

Male

Abdominal chaetotaxy rich (Fig. 1), variable among species; *aps* on at least tergopleurites IV–VII; *tps* on at least tergopleurites VI–VIII, in some species on V. Basal apodeme variable in size and shape (Figs 5, 13, 21, 29, 37). Proximal mesosome extended to overlap with basal apodeme. Antero-lateral corners of mesosomal lobes extended into "horns" (Fig. 6); distal mesosome intensely rugose; 2 *pmes* sensilla on each side of gonopore, associated with paler area of mesosomal lobes. Gonopore roughly crescent-shaped, with 3 *ames* sensilla on each side. Penile arms slender (Fig. 6). Parameral heads broad, blunt (Fig. 7). Parameral blades much elongated; *pst1* sensillus, central; *pst2* microsetae, on lateral margin.

Female

Abdominal chaetotaxy sparse (Fig. 2); *aps*, *tps,* and *ss* absent on all segments; *psps* present only on tergopleurites VI–VII. Subgenital plate with more or less sinuous lateral margins (Fig. 8), connected to cross-piece. Few slender *vms* and many thorn-like *vss* along vulval margin; few *vos* on each side of subgenital plate; distal 1 *vos* median to *vss* and separated from other *vos* by pronounced gap.

Host distribution

Only known from hosts in the genus *Argya* (Passeriformes: Leiothrichidae).

Geographical range

Africa, Middle East, India, Myanmar[?].

Included species

- *Brueelia* (*Painjunirmus*) *alba* sp. nov.
- *Brueelia* (*Painjunirmus*) *brevipennis* Ansari, 1956a: 159.

- *Brueelia* (*Painjunirmus*) *chilchil* Ansari, 1955: 53.
- *Brueelia* (*Painjunirmus*) *magnini* Ansari, 1956a: 161.
- *Brueelia* (*Painjunirmus*) *parva* (Mey, 2017: 164) [in *Garrulaxeus*] [tentatively included]
- *Brueelia* (*Painjunirmus*) *pengya* (Ansari, 1947: 285) [in *Painjunirmus*]

Brueelia* (*Painjunirmus*) *chilchil (Ansari, 1955)
Figs 1–8

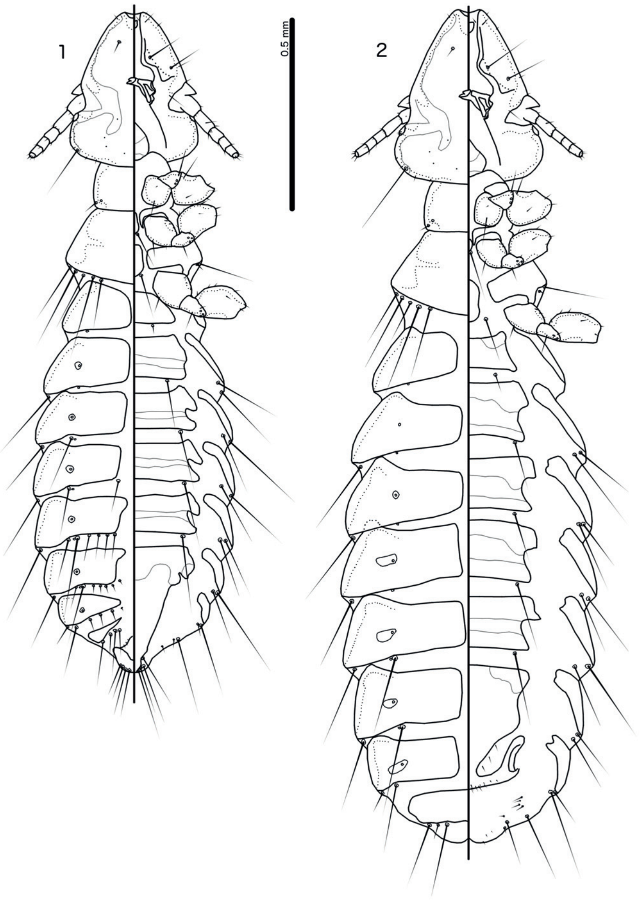
Brueelia chilchil Ansari, 1955: 53–54.
Brueelia chilchil Ansari, 1956b: 394; primary homonym.
Brueelia chilchil Ansari, 1958: 48–49, figs 9–15; primary homonym.

Brueelia chilchil – Ansari 1956a: 160, figs 63–66. — Price *et al*. 2003: 154. — Gustafsson & Bush 2017: 37–38. — Mey 2017: 158.

Type material

Neotype

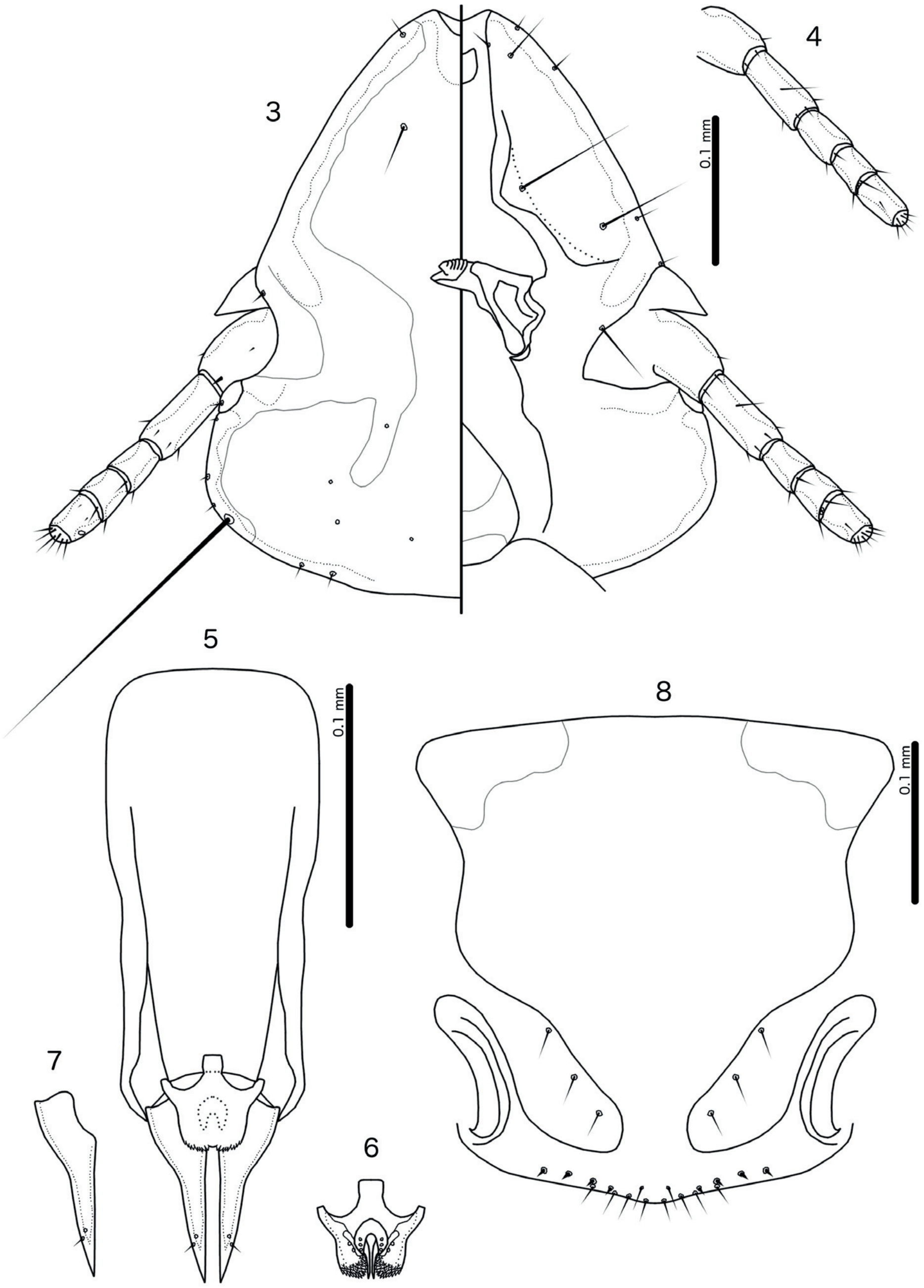
PAKISTAN • ♂; Faisalabad [as Lyallpur]; 11 May 1932; M.A.R. Ansari leg.; ex *Argya caudata eclipes* (Hume, 1877); NHMUK010670544; NHMUK.



Figs 1–2. *Brueelia* (*Painjunirmus*) *chilchil* Ansari, 1955. **1**. ♀, dorsal and ventral views. **2**. ♀, habitus, dorsal and ventral views.

Other material examined

INDIA • 1 ♂, 2 ♀♀; Rajputana; Mar. 1937; R. Meinertzhagen leg.; ex *Argya caudata eclipes* [as *Turdoides c. caudata* or *Argya caudata caudata*]; 8922; NHMUK010709538; NHMUK • 1 ♂, 2 ♀♀; 3 Jan. 1952; Bharatpur [Rajasthan]; R. Meinertzhagen leg.; ex *Argya caudata eclipes* [as *Turdoides c. caudata* or *Argya caudata caudata*]); 19670, Brit. Mus. 1952-143; NHMUK010708235; NHMUK.



Figs 3–8. *Brueelia* (*Painjunirmus*) *chilchil* Ansari, 1955. **3**. ♂, head, dorsal and ventral views. **4**. ♀, antenna, ventral side. **5**. ♂, genitalia, dorsal view. **6**. ♂, mesosome, ventral view. **7**. ♂, paramere, dorsal view. **8**. ♀, subgenital plate and vulval margin, ventral view.

PAKISTAN • 2 ♀♀; same data as for neotype; ex *Argya caudata eclipes* [as *Turdoides c. caudata* or *Argya caudata caudata*]); NHMUK010670544; NHMUK • 6 ♂♂, 9 ♀♀; Peshawar; Mar. 1937; R. Meinertzhagen leg.; ex *Argya caudata eclipes* [as *Turdoides c. caudata* or *Argya caudata caudata*]); 9193–94, 9501; NHMUK010709539; NHMUK • 4 ♂♂, 16 ♀♀; same data as for preceding; 9445–47; NHMUK010709540; NHMUK.

Type host

Argya caudata eclipes (Hume, 1877) – common babbler.

Type locality

Faisalabad, Pakistan.

Description

Both sexes

Head convex dome-shaped (Fig. 3), lateral margins of preantennal area convex, frons concave. Marginal carina moderately displaced and much widened at osculum, lateral sections slender, with slightly irregular median margin. Ventral anterior plate visible. Head chaetotaxy as in Fig. 3. Extent of head pigmentation variable, extreme illustrated in Fig. 3; in many specimens area around anterior to *s3* not darkly pigmented. Thoracic and abdominal segments as in Figs 1–2; proepimera with dark brown pigmentation; metepisterna, meso- and metasterna, lateral margins of tergopleurites II–VIII, and anterior and posterior sections of sternal plates with medium brown pigmentation in males and paler brown pigmentation in females.

Male

Scape as in Fig. 3. Thoracic and abdominal chaetotaxy as in Fig. 1; *aps* absent from tergopleurite III; *tps* present on tergopleurites VI–VIII; 3 *ps* on each of segments III–VII. Sternal plates with variable lateral extensions. Subgenital plate largely translucent, except antero-lateral corners or anterior section, which is medium brown. Basal apodeme roughly rectangular (Fig. 5). Proximal mesosome slender, rectangular, anterior margin more or less flat (Fig. 6). Mesosomal lobes with near-parallel lateral margins distally, antero-lateral horns wide, curved slightly medianly. Rugose area of distal mesosomal lobes extensive, *pmes* as in Fig. 6. Gonopore large, distal margin deeply concave; *ames* as in Fig. 6; penile arms reach to or slightly beyond distal margin of mesosomal lobes. Parameres elongated, *pst1–2* as in Fig. 7.

MEASUREMENTS (n = 9, except TL where n = 8). TL = 1.45–1.68; HL = 0.37–0.39; HW = 0.31–0.34; PRW = 0.19–0.21; PTW = 0.32–0.35; AW = 0.47–0.51.

Female

Scape as in Fig. 4. Thoracic and abdominal chaetotaxy as in Fig. 2; segments II–VIII with 3 *ps* on each side. Sternal plates with variable lateral extensions. Subgenital plate broad, with broad connection to cross-piece (Fig. 8); pigmentation variable, typically with antero-lateral corners pale brown as in Fig. 8, but pigmented areas may be medianly continuous; in some specimens extent of pigmentation more similar to that of *P. magnini* (Fig. 40). Vulval margin bulging medianly (Fig. 8), with 3–4 short, slender *vms* and 4–5 short, thorn-like *vss* on each side; 4–5 short, slender *vos* on each side of subgenital plate; distal 1 *vos* median to *vss*.

MEASUREMENTS (n = 25 except TL where n = 22 and AW where n = 23). TL = 1.78–2.15 (1.95); HL = 0.40–0.46 (0.42); HW = 0.35–0.40 (0.37); PRW = 0.20–0.24 (0.22); PTW = 0.30–0.41 (0.36); AW = 0.53–0.64 (0.58).

Remarks

See remarks under *Br.* (*P.*) *pengya* Ansari, 1947, for a discussion on Mey's (2017) claims regarding *Br.* (*P.*) *chilchil*. We have decided to simplify matters by designating a neotype for *Brueelia chilchil* Ansari, 1955. The selection of this specimen is based on the following arguments:

1) Ansari (1955) did not specify any collection locality of his specimens, nor did he give any indication of how many specimens were examined. Later, Ansari (1956a) gave more information, including 35 specimens from Lyallpur erroneously referred to as "paratypes", which is invalid as paratypes must be designated in the original publication. Ansari (1956a) also mentioned the examination of 3 specimens from Bharatpur (Rajputana), which were from the Meinertzhagen collection.

2) No identification numbers of any of these specimens were given, but Ansari (1956a: 133) stated that all types are in the NHMUK collection. As stated by Naz *et al.* (2020), only three specimens from Lyallpur remain at the NHMUK. This slide is labeled with a red T on the front, and an additional label on the reverse saying "(paratypes ?)". While this implies that someone, possibly Ansari, considered these specimens to be types, the significance of the red T has been lost; it is not found on other slides Ansari deposited at the NHMUK.

3) The specimens at NHMUK may be from the set of specimens considered "paratypes" by Ansari (1956a). However, this cannot be ascertained today; nor could any of them be designated the lectotype, as no paratypes were mentioned at the original description (Ansari 1955). To avoid any future confusion around the identity of this species, we designate the male on this slide the neotype, whereas the females on this slide have no special status.

Brueelia* (*Painjunirmus*) *brevipennis (Ansari, 1956a)

Figs 9–16

Brueelia brevipennis Ansari, 1956a: 159, figs 60–62.

Brueelia brevipennis – Price *et al.* 2003: 153. — Gustafsson & Bush 2017: 37–38. — Mey 2017: 157.

Type material

Holotype

PALESTINE • ♂; Jericho; 24 Nov. 1922; P.A. Buxton leg.; ex *Argya squamiceps squamiceps* (Cretzschmar, 1826) [as *Argya squamiceps* (Cretzschmar, 1827)]; NHMUK010670537; NHMUK.

Paratypes

PALESTINE • 2 ♂♂; same data as for holotype; NHMUK010708240–1; NHMUK.

Other material examined

ISRAEL • 1 ♂, 1 ♀; Masada [as Metzada]; 2 May 1958; ex *Argya squamiceps squamiceps* [as *Argya squamiceps*]; 326, Brit. Mus. 1958-520; NHMUK010708242; NHMUK.

Type host

Argya squamiceps squamiceps (Cretzschmar, 1826) – Arabian babbler.

Type locality

Jericho, Palestine.

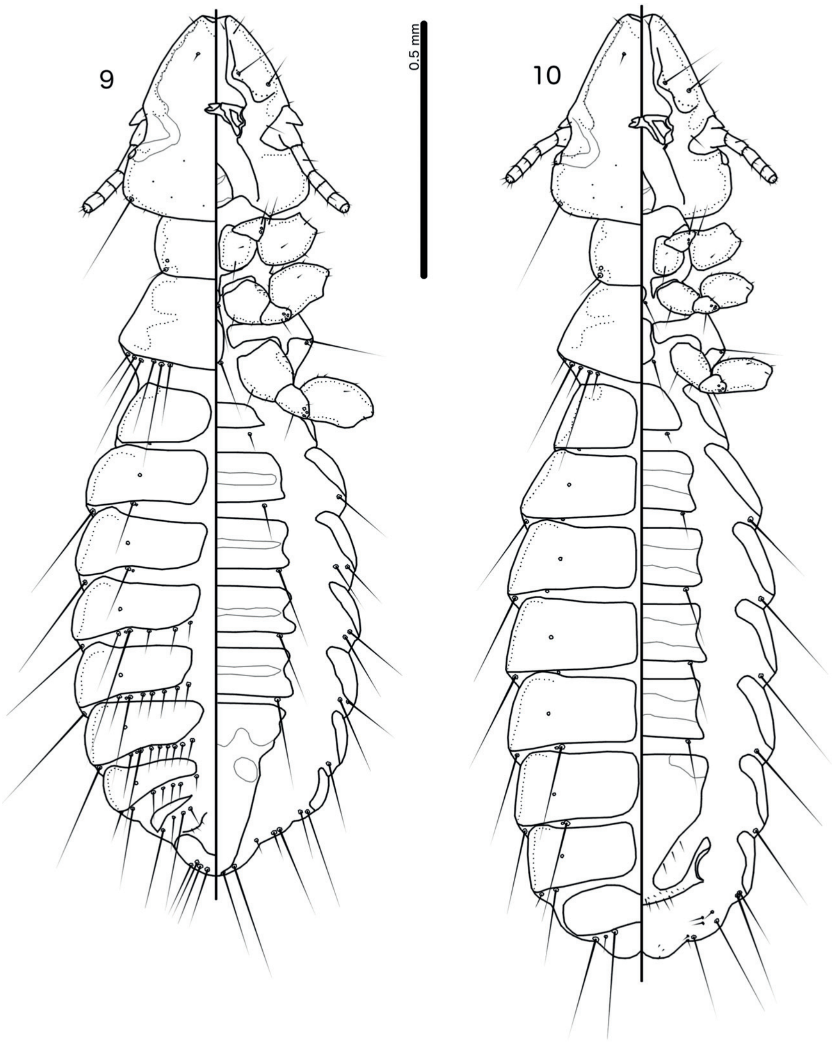
Description

Both sexes

Head convex dome-shaped (Fig. 11), lateral margins of preantennal area convex, frons shallowly concave. Marginal carina shallowly displaced and much widened at osculum; lateral sections slender, with slightly irregular median margin. Ventral anterior plate not visible. Head chaetotaxy as in Fig. 11. Pigmentation limited to near marginal carina and antennal socket. Thoracic and abdominal chaetotaxy as in Figs 9–10; proepimera and metepisterna with dark brown pigmentation; lateral margins of tergopleurites, anterior and posterior sections of sternal plates, and anterior ends of subgenital plates of both sexes with medium brown pigmentation.

Male

Scape as in Fig. 11. Thoracic and abdominal chaetotaxy as in Fig. 9; *aps* present on tergopleurite III; *tsp* present on tergopleurites V–VIII; 2 *ps* on each side of segments III and VII, 3 *ps* on each side of segments IV–VI. Sternal plates without lateral extensions. Subgenital plate with pigmentation along



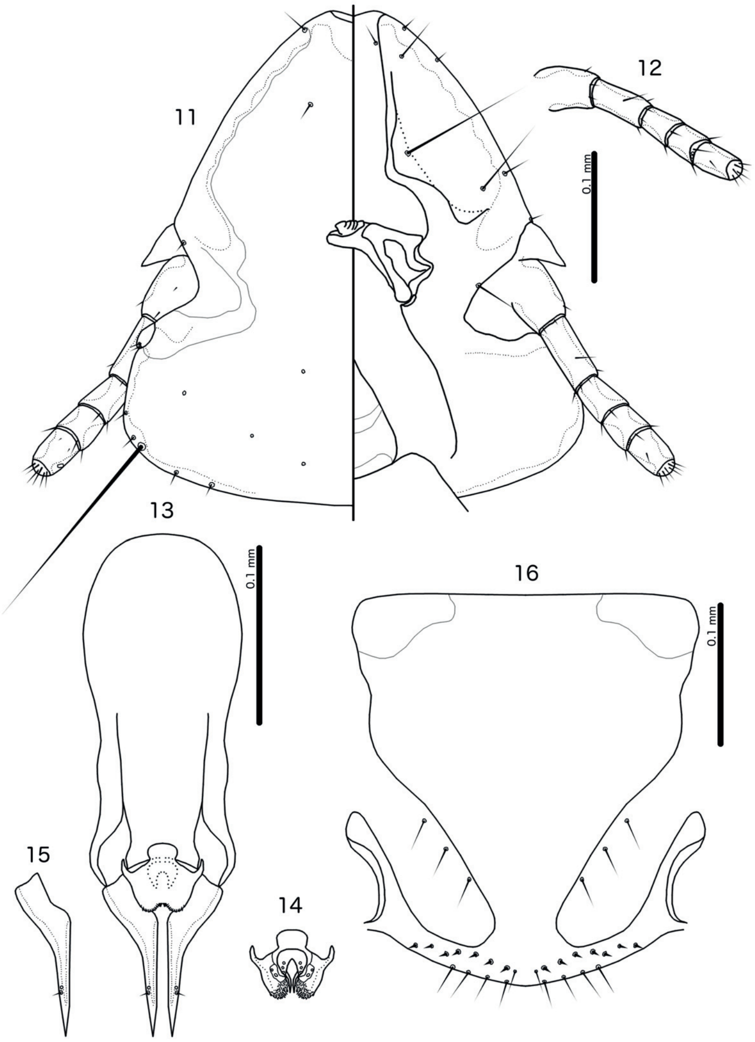
Figs 9–10. *Brueelia* (*Painjunirmus*) *brevipennis* Ansari, 1956. **9**. Paratype, ♂ (NHMUK010708241), habitus, dorsal and ventral views. **10**. ♀ (NHMUK010708242), habitus, dorsal and ventral views.

anterior margin, in some specimens also with lighter pigmentation submarginally farther posterior. Basal apodeme slender, slightly constricted at mid-length (Fig. 13). Proximal mesosome short and broad, somewhat rounded (Fig. 14). Mesosomal lobes convergent distally, antero-lateral horns short, slender, much curved. Rugose area of distal mesosome extensive; *pmes* as in Fig. 14. Gonopore broad, distal margin deeply concave; *ames* as in Fig. 14; penile arms do not reach distal margin of mesosomal lobes. Parameres much elongated, *pst1–2* as in Fig. 15.

Measurements (n = 3). TL = 1.66–1.72; HL = 0.39–0.41; HW = 0.35–0.37; PRW = 0.22–0.24; PTW = 0.36–0.37; AW = 0.49–0.57.

Female

Thoracic and abdominal chaetotaxy as in Fig. 10; segments III–VII with 2 *ps* on each side. Sternal plates without lateral extensions. Subgenital plate broad, with broad connection to cross-piece (Fig. 16); dark



Figs 11–16. *Brueelia* (*Painjunirmus*) *brevipennis* Ansari, 1956. **11, 13–15**. Paratype, ♂ (NHMUK010708241). **12, 16**. ♀ (NHMUK010708242). **11**. Head, dorsal and ventral views. **12**. Antenna, ventral side. **13**. Genitalia, dorsal view. **14**. ♂, mesosome, ventral view. **15**. Paramere, dorsal view. **16**. Subgenital plate and vulval margin, ventral view.

pigmentation limited to antero-lateral corners. Vulval margin gently rounded (Fig. 16), with 3–4 short, slender *vms* and 6–7 short, thorn-like *vss* on each side; 4 short, slender *vos* on each side of subgenital plate; distal 1 *vos* median to *vss*.

MEASUREMENTS (n = 1). TL = 1.89; HL = 0.43; HW = 0.38; PRW = 0.22; PTW = 0.35; AW = 0.56.

Remarks

Single examined female has a slightly tilted head, and the true head length and shape may be slightly different from that illustrated.

Brueelia* (*Painjunirmus*) *pengya (Ansari, 1947)

Figs 17–24

Painjunirmus pengya Ansari, 1947: 285–287, fig. 10.

Brueelia pengya – Hopkins & Clay 1952: 60. — Ansari 1956a: 157–158, figs 48–54. — Price *et al*. 2003: 157.— Gustafsson & Bush 2017: 40.— Mey 2017: 156–158, fig. 80.

Type material

Holotype

PAKISTAN • 1 ♀; Faisalabad [as Lyallpur, Punjab, India]; 16 Mar. 1932; ex *Argya striata sindiana* (Ticehurst, 1920) [as *Turdoides terricolor terricolor*]; Brit. Mus. 1953-2; NHMUK010670844; NHMUK.

Allotype

PAKISTAN • ♂; same data as for holotype; Brit. Mus. 1953-2; NHMUK010670844; NHMUK.

Paratypes

PAKISTAN • 2 ♂♂, 1 ♀; same data as for holotype; Brit. Mus. 1953-2; NHMUK010670844; NHMUK.

Other material examined

INDIA • 2 ♀♀; Lucknow [Uttar Pradesh]; ex *A. striata somervillei* (Sykes, 1832) [as *Turdoides somervillei*]; Brit. Mus. 1951-444; NHMUK010709548; NHMUK.

LOCALITY UNKNOWN • 1 ♂, 1 ♀; ex *A. striata somervillei* [as *Turdoides somervillei*]; NHMUK010709060–1; NHMUK.

Type host

Argya striata sindiana (Ticehurst, 1920) – jungle babbler.

Type locality

Faisalabad, Pakistan.

Other hosts

Argya striata somervillei (Sykes, 1832). *Argya striata* (Dumont, 1823).

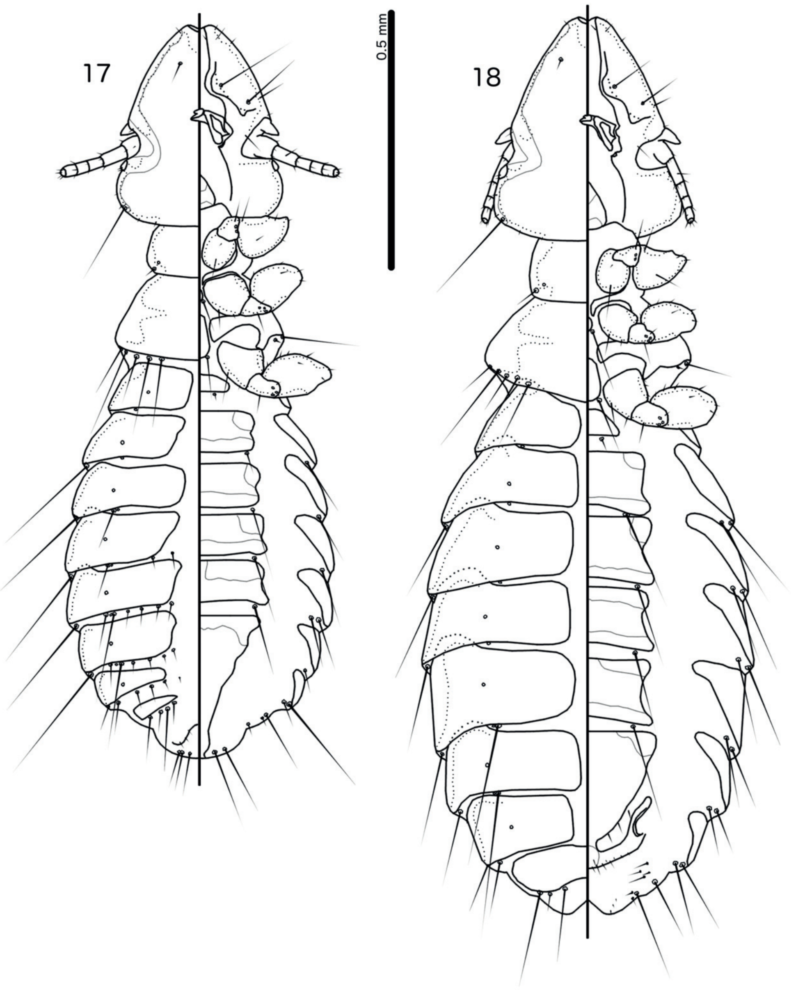
Description

Both sexes

Head convex dome-shaped (Fig. 19), lateral margins of preantennal area convex, frons shallowly concave. Marginal carina moderately displaced and much widened at osculum; lateral sections slender, with slightly irregular median margins. Ventral anterior plate not visible. Head chaetotaxy as in Fig. 19; dorsal post-antennal setae and sensilla not visible, but presumably same as in other species of *Painjunirmus*. Extent of head pigmentation as in Fig. 19, limited to lateral margins of head. Thoracic and abdominal segments as in Figs 17–18; proepimera, metepisterna, lateral margins of tergopleurites, and sternal plates with medium brown pigmentation; pigmentation of sternal plates paler medianly than laterally.

Male

Scape as in Fig. 19. Thoracic and abdominal chaetotaxy as in Fig. 17; *aps* absent from tergopleurite III; *tps* present on tergopleurites V–VIII; 2 *ps* on each side of segments III–V and VII, 3 *ps* one ach side of segment VI. Sternal plates without lateral extensions. Subgenital plate with dark pigmentation only on anterior margin, darker laterally than medianly. Basal apodeme broad, short, constricted at mid-length (Fig. 21). Proximal mesosome elongated, pointed (Fig. 22). Mesosomal lobes with near-parallel lateral margins distally, antero-lateral horns slender, more or less straight. Rugose area of mesosomal lobes limited to distal margin; *pmes* as in Fig. 22. Gonopore broad, crescent-shaped, distal margin deeply concave; *ames* as in Fig. 22; penile arms short, not reaching distal margin of mesosomal lobes. Parameres slender, much elongated; *pst1–2* as in Fig. 23.



Figs 17–18. *Brueelia* (*Painjunirmus*) *pengya* (Ansari, 1947). **17**. ♂, habitus, dorsal and ventral views. **18**. ♀, habitus, dorsal and ventral views.

Measurements (n = 1). TL = 1.39; HL = 0.38; HW = 0.32; PRW = 0.21; PTW = 0.34; AW = 0.49.

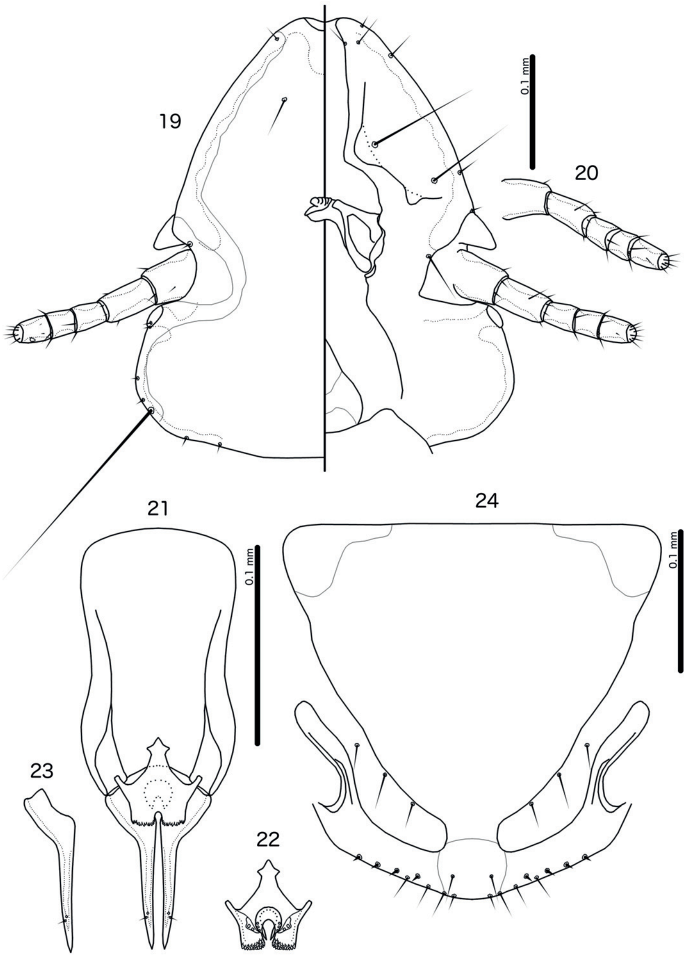
Female

Scape as in Fig. 20. Thoracic and abdominal chaetotaxy as in Fig. 18; segments III–VIII with 3 *ps* on each side. Sternal plates without lateral extensions. Subgenital plate broad, with broad connection to cross-piece (Fig. 24). Vulval margin gently rounded (Fig. 24), with 4 short, slender *vms* and 4–5 short, thorn-like *vss* on each side; 4–5 short, slender *vos* one each side of subgenital plate; distal 1 *vos* median to *vss*.

Measurements (n = 3). TL = 1.73–1.79; HL = 0.39–0.44; HW = 0.35–0.37; PRW = 0.21–0.23; PTW = 0.35–0.38; AW = 0.49–0.58.

Remarks

Mey (2017) discussed the complicated publication history of *Painjunirmus pengya*, inherited from Ansari's habit of redescribing the same species as new, often several times, in separate publications, and sometimes referring to clearly different species belonging to different genera (see Naz *et al.* 2020



Figs 19–24. *Brueelia* (*Painjunirmus*) *pengya* (Ansari, 1947). **19**. ♂, head, dorsal and ventral views. **20**. ♀, antenna, ventral side. **21**. ♂, genitalia, dorsal view. **22**. ♂, mesosome, ventral view. **23**. ♂, paramere, dorsal view. **24**. ♀, subgenital plate and vulval margin, ventral view.

for an example). As a large number of Ansari's types are missing (Naz *et al.* 2020), and his published illustrations are often partial or include setae transposed from ventral to dorsal sides, identification of species described by Ansari necessarily include a degree of imagination.

Mey (2017) argued both that the host associations of *P. pengya* are doubtful, and that this species may be a synonym of either *Brueelia mahrastan* Ansari, 1956, or *Brueelia chilchil* Ansari, 1955. As *Brueelia mahrastan* is today placed in the genus *Priceiella* Gustafsson & Bush, 2017, and *P. pengya* sensu Ansari, 1947, is clearly not a member of this genus, they cannot be synonyms. As the holotype is also different from the potential type specimens of *B. chilchil* we have examined, including the neotype (see above), we also reject the suggestion that *P. pengya* is a synonym of *B. chilchil*.

We agree with Mey (2017) that there are definitely differences in the illustrations of *P. pengya* between Ansari (1947) and Ansari (1956a); for instance, the abdominal chaetotaxy of the male does not include any *tps* or *ss* in the illustrations of Ansari 1947, but include them in the illustrations of Ansari 1956a; notably, in both illustrations the *sts* appear to have been transposed to the dorsal side. Neither of these illustrations have the same chaetotaxy as that illustrated here, which corresponds to the chaetotaxy of the allotype (but is based on the non-type male; Fig. 17). There are also differences in the shape of the male genitalia, but not necessarily in the structure, although detail is too scant to be sure. As these drawings are made by different people (see signatures on plates), and possibly based on different specimens, the differences are here not considered significant; however, we hope that the illustrations and description of this species provided here will be able to replace these older illustrations.

Concerning the doubtful host association, Mey (2017) based this primarily on the idea that "it is hard to believe that these two host species [*Turdoides striata* and *Turdoides caudata*, the originally given host species of *P. pengya*] are parasitized by the same louse species in nature" (Mey 2017: 156; our translation). This is common throughout the *Brueelia*-complex (Gustafsson & Bush 2017), but does not appear to be the case here: specimens from other *T. striata* are conspecific with the types of *P. pengya*, whereas specimens from *T. caudata* represent a different species (*B. chilchil*). Different louse species thus parasitize on different host species in this case, but there seem to be no reason to doubt that Ansari's host associations are erroneous. The neotype designation of *B. chilchil* above should put this matter to rest.

Note that specimens we have seen from *T. striata* from Nepal do not represent *P. pengya* and are here described as a new species.

Brueelia* (*Painjunirmus*) *alba sp. nov.

urn:lsid:zoobank.org:act:EBA67F37-C773-48C5-A8AB-E1AEA64A4B7A
Figs 25–32

Diagnosis

Brueelia (*Painjunirmus*) *alba* sp. nov. is most similar to *Br.* (*P.*) *chilchil*, and *Br.* (*P.*) *magnini*, with which it shares the following characters: *aps* absent from male tergopleurite III (Figs 1, 25, 33) and proximal mesosome slender and more or less rectangular (Figs 6, 30, 38).

Brueelia (*Painjunirmus*) *alba* sp. nov. is separated from *Br.* (*P.*) *chilchil* on the following characters: sternal plates not modified laterally in *Br.* (*P.*) *alba* (Figs 25–26), but modified in *Br.* (*P.*) *chilchil* (Figs 1–2); lateral margins of mesosome distally convergent in *Br.* (*P.*) *alba* (Fig. 30), but near-parallel in *Br.* (*P.*) *chilchil* (Fig. 6); parameres much more slender in *Br.* (*P.*) *alba* (Fig. 31) than in *Br.* (*P.*) *chilchil* (Fig. 7); basal apodeme slender in *Br.* (*P.*) *alba* (Fig. 29), but broader in *Br.* (*P.*) *chilchil* (Fig. 5); vulval margin gently rounded in *Br.* (*P.*) *alba* (Fig. 32), but with median bulge in *Br.* (*P.*) *chilchil* (Fig. 8).

Brueelia (*Painjunirmus*) *alba* sp. nov. is separated from *Br.* (*P.*) *magnini* on the following characters: male abdominal segments III–V with 3 *ps* on each side in *Br.* (*P.*) *alba* (Fig. 25), but 2 *ps* on each side in *Br.* (*P.*) *magnini* (Fig. 33); proximal mesosome smaller in *Br.* (*P.*) *alba* (Fig. 30) than in *Br.* (*P.*) *magnini* (Fig. 38); female subgenital plate roughly quadratic in *Br.* (*P.*) *alba* (Fig. 32), but more trapezoidal in *Br.* (*P.*) *magnini* (Fig. 40).

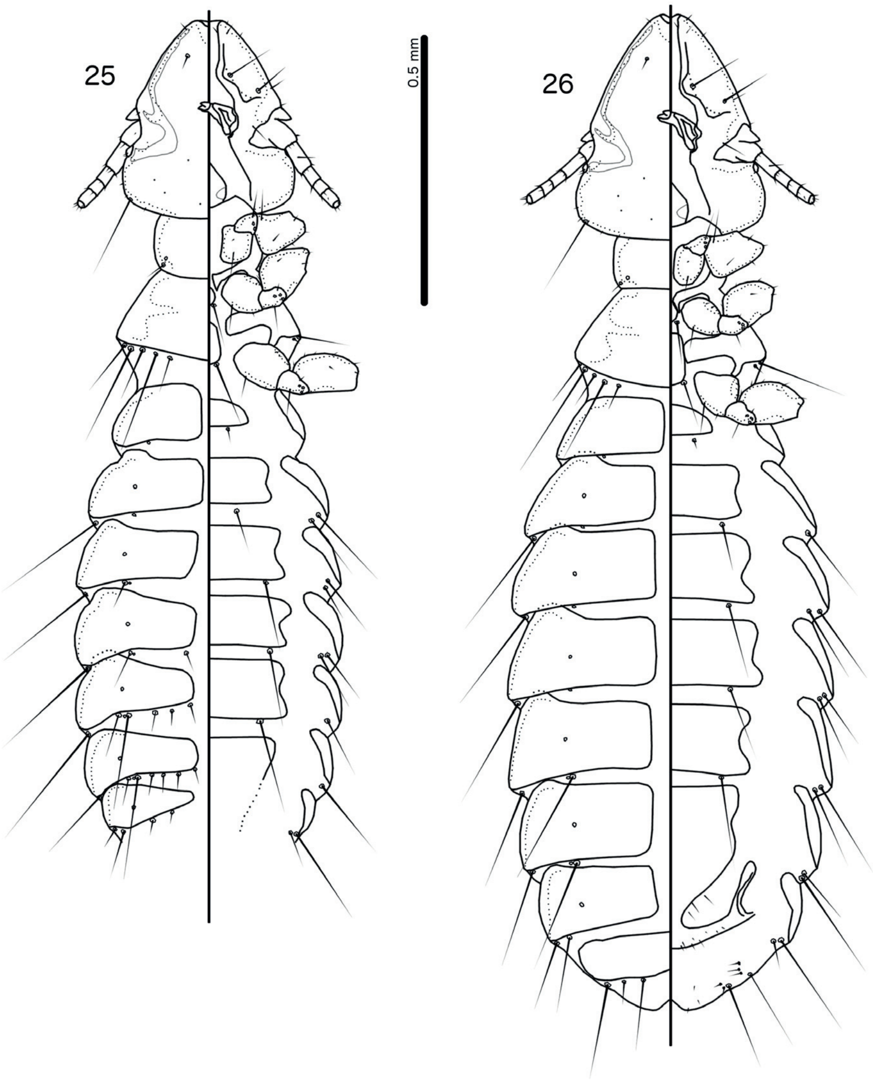
Etymology

The species epithet is derived from the Latin '*alba*' for 'white', referring to the near-complete lack of pigmentation in this species.

Type material

Holotype

NEPAL • ♂; Mar. 1937; R, Meinertzhagen leg.; ex *Argya striata striata* (Dumont, 1823) [as *Turdoides terricolor terricolor*]; 9339; NHMUK010709544; NHMUK.



Figs 25–26. *Brueelia* (*Painjunirmus*) *alba* sp. nov. **25**. Holotype, ♂ (NHMUK010709544), habitus, dorsal and ventral views. **26.** Paratype, ♀ (NHMUK010709545), habitus, dorsal and ventral views.

Paratypes

NEPAL • 3 ♀♀; same data as for holotype; 9339–40; NHMUK010709545; NHMUK.

Type host

Argya striata striata (Dumont, 1823) – jungle babbler.

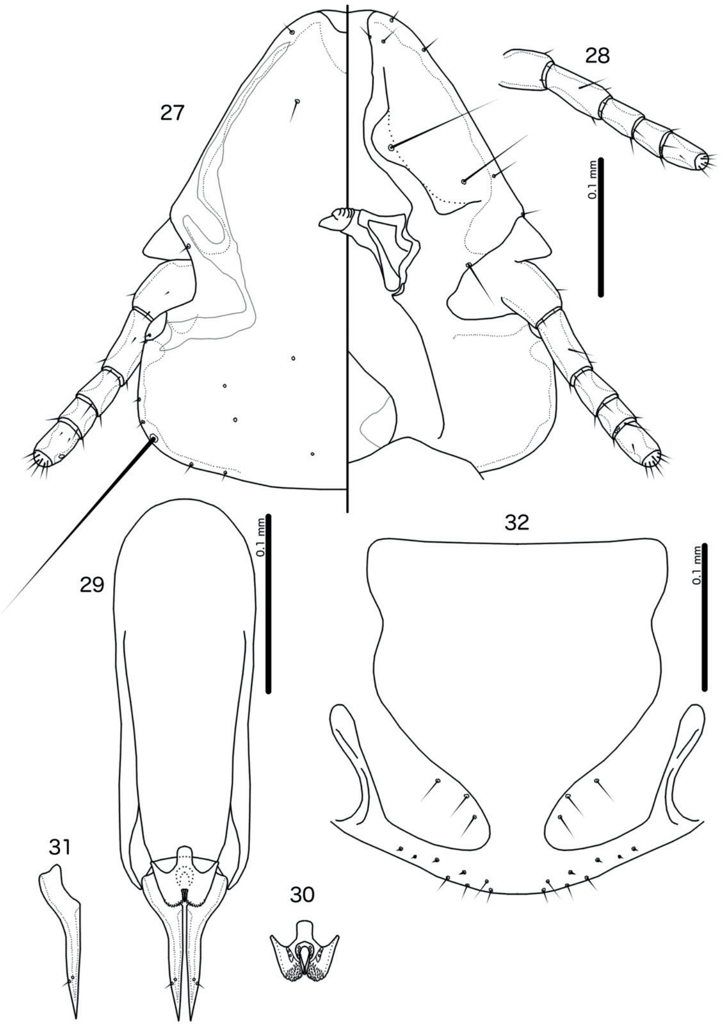
Type locality

Nepal.

Description

Both sexes

Head convex dome-shaped (Fig. 27), lateral margins of preantennal area slightly convex, frons shallowly concave. Marginal carina deeply displaced and much widened at osculum, lateral sections



Figs 27–32. *Brueelia* (*Painjunirmus*) *alba* sp. nov. **27, 29–31**. Holotype, ♂ (NHMUK010709544). **28, 32**. Paratype, ♀ (NHMUK010709545). **27**. Head, dorsal and ventral views. **28**. Antenna, ventral side. **29**. Genitalia, dorsal view. **30**. Mesosome, ventral view. **31**. Paramere, dorsal view. **32**. Subgenital plate and vulval margin, ventral view.

slender with slightly irregular median margins. Ventral anterior plate not visible. Head chaetotaxy as in Fig. 27. Extent of head pigmentation as delimited by thin dotted line in Fig. 27, interior of preantennal nodi unpigmented. Thoracic and abdominal segments as in Figs 25–26; proepimera with light brown pigmentation; metepisterna, metasternum, and anterior and posterior sections of sternal plates with very faint brown pigmentation.

Male

Scape as in Fig. 27. Distal abdomen destroyed during mounting of single examined male, and not illustrated. Thoracic and abdominal chaetotaxy as in Fig. 25; *aps* absent from tergopleurite III; *tps* present on tergopleurites VI–VII; 3 *ps* on each side of segments III–V and VII, 2 *ps* on each side of segment VI. Sternal plates without lateral extensions. Subgenital plate with very pale brown pigmentation in anterior end, distal end missing in specimen. Basal apodeme long and slender (Fig. 29). Proximal mesosome short, roughly rectangular (Fig. 30). Lateral margins of mesosomal lobes convergent distally, antero-lateral horns short, more or less straight. Rugose area of distal mesosome extensive; *pmes* as in Fig. 30. Gonopore small, distal margin deeply concave; *ames* as in Fig. 30. Parameres slender, much elongated; *pst1–2* as in Fig. 31.

MEASUREMENTS (n = 1). HL = 0.36; HW = 0.31; PRW = 0.20; PTW = 0.33; AW = 0.49.

Female

Scape as in Fig. 28. Thoracic and abdominal chaetotaxy as in Fig. 26; segment II with 2 *ps* on each side, segments III–VIII with 3 *ps* on each side. Sternal plates without lateral extensions. Subgenital plate with very faint brown pigmentation in anterior end, but posterior limit of pigmentation diffuse and not illustrated; plate moderately broad, with broad connection to cross-piece (Fig. 32). Vulval margin gently rounded to slightly flattened medianly (Fig. 32), with 3 short, slender *vms* and 3–5 short, thorn-like *vss* on each side; 4 short, slender *vos* on each side of subgenital plate; distal 1 *vos* median to *vss*.

MEASUREMENTS (n = 3). TL = 1.80–2.01; HL = 0.41; HW = 0.34–0.36; PRW = 0.21–0.22; PTW = 0.34–0.36; AW = 0.56–0.60.

Remarks

The occurrence of two different species of *Brueelia* (*Painjunirmus*) on *Turdoides striata* in different parts of its range may indicate that these species are geographically limited. No detailed collection locality is given on the type slides, and more collections are needed to establish whether *Br.* (*P.*) *alba* sp. nov. is more widely distributed.

Brueelia* (*Painjunirmus*) *magnini (Ansari, 1956)

Figs 33–40

Brueelia magnini Ansari, 1956a: 161, figs 67–70.

Brueelia magnini – Price *et al*. 2003: 156. — Gustafsson & Bush 2017: 40. — Mey 2017: 158.

Type material

Holotype

SUDAN • ♂; Dec. 1947; R. Meinertzhagen leg., ex *Argya fulva acaciae* (Lichtenstein, 1823) [as *Turdoides fulvus acaciae*]; 17066–17068; NHMUK010670707; NHMUK.

Allotype

SUDAN • ♀; same data as for holotype; 17066–17068; NHMUK010670707; NHMUK.

Paratypes (ex *Argya fulva acaciae* [as *Turdoides fulvus acaciae*])
SUDAN • 6 ♂♂, 5 ♀♀; same data as for holotype; 17066–17068; NHMUK010670707, NHMUK010708922; NHMUK.

Other material eamined

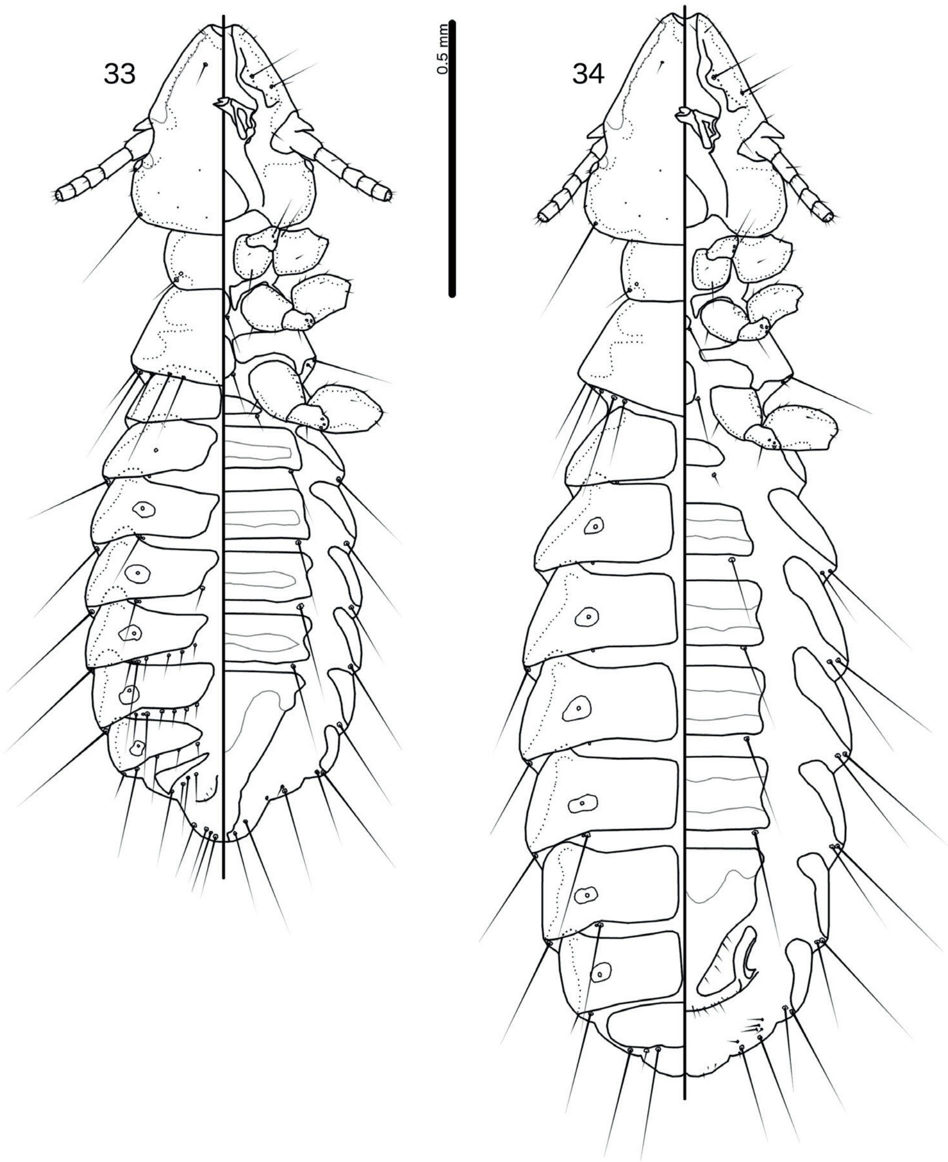
SUDAN • 4 ♂♂, 8 ♀♀; same data as for holotype; 17066–17068; NHMUK010709541; NHMUK.

Type host

Argya fulva acaciae (Lichtenstein, 1823) – fulvous chatterer.

Type locality

Sudan.

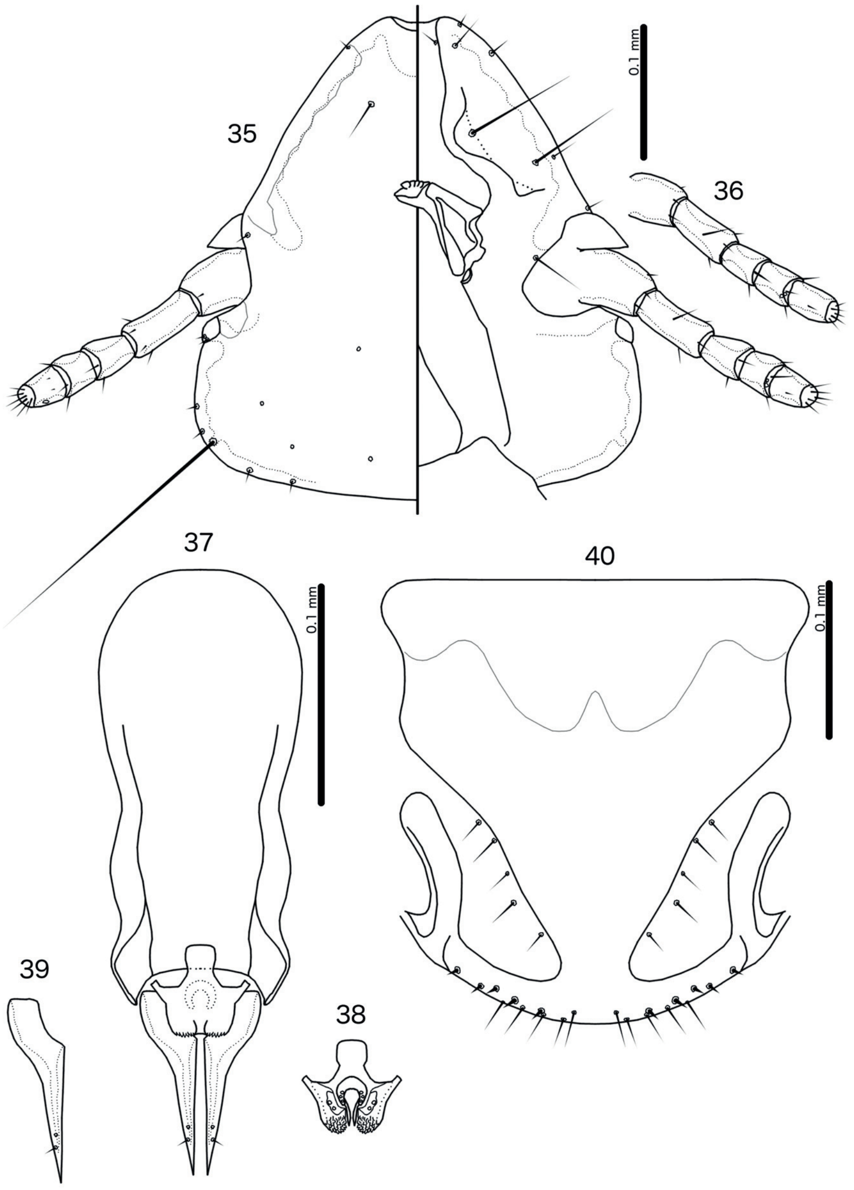


Figs 33–34. *Brueelia* (*Painjunirmus*) *magnini* Ansari, 1956. **33**. ♂, habitus, dorsal and ventral views. **34**. ♀, habitus, dorsal and ventral views.

Description

Both sexes

Head convex dome-shaped (Fig. 35), lateral margins of preantennal head convex, frons shallowly concave. Marginal carina shallowly displaced and much widened at osculum, lateral sections moderate with irregular median margin. Ventral anterior plate not visible. Head chaetotaxy as in Fig. 35. Head pigmentation pale, with dark pigmentation only at preantennal and preocular nodi, and light pigmentation along marginal carina; most examined specimens are dyed red, and pigmentation patterns cannot be determined. Thoracic and abdominal segments as in Figs 33–34; proepimera, anterior and posterior sections of sternal plates, and lateral margins of tergopleurites with brown pigmentation.



Figs 35–40. *Brueelia* (*Painjunirmus*) *magnini* Ansari, 1956a. **35**. ♂, head, dorsal and ventral views. **36**. ♀, antenna, ventral side. **37**. ♂, genitalia, dorsal view. **38**. ♂, mesosome, ventral view. **39**. ♂, paramere, dorsal view. **40**. ♀, subgenital plate and vulval margin, ventral view.

Male

Scape as in Fig. 35. Thoracic and abdominal chaetotaxy as in Fig. 33; *aps* absent from tergopleurite III; *tps* present on tergopleurites VI–VIII; segments III–VII with 2 *ps* on each side. Sternal plates without lateral extensions. Subgenital plate with pigmentation on anterior margin and central part. Basal apodeme broad, constricted at mid-length and again near distal end (Fig. 37). Proximal mesosome more or less quadratic, narrowing slightly distally (Fig. 38). Mesosomal lobes with near-parallel to slightly convergent lateral margins distally, antero-lateral horns broad, more or less straight, widely divergent. Rugose area of distal mesosome extensive; *pmes* as in Fig. 38. Gonopore slender, distal margin deeply concave; *ames* as in Fig. 38. Parameres slender, much elongated; *pst1–2* as in Fig. 39.

MEASUREMENTS (n = 5 except TL where n = 4). TL = 1.42–1.56; HL = 0.36–0.38; HW = 0.32–0.33; PRW = 0.20–0.23; PTW = 0.33–0.36; AW = 0.47–0.51.

Female

Scape as in Fig. 36. Thoracic and abdominal chaetotaxy as in Fig. 34; segment III with 2 *ps* on each side, segments IV–VIII with 3 *ps* on each side. Sternal plates without lateral extensions. Subgenital plate broad (Fig. 40), narrowing only gradually distally, with broad connection to cross-piece. Vulval margin gently rounded (Fig. 40), with 4 short, slender *vms* and 4–6 short, thorn-like *vss* on each side; 4–6 short, slender *vos* on each side of subgenital plate; distal 1 *vos* median to *vss*.

MEASUREMENTS (n = 8). TL = 1.80–1.91; HL =0.39–0.41; HW = 0.35–0.38; PRW = 0.23–0.24; PTW = 0.36–0.38; AW = 0.56–0.59.

Brueelia* (*Painjunirmus*) *parva (Mey, 2017)

Garrulaxeus parvus Mey, 2017: 164–165, fig. 88, pl. XVI fig. 1.

Brueelia parva – Gustafsson *et al.* 2019d: 273.

Type host

Argya gularis (Blyth, 1855) – white-throated babbler.

Type locality

Thityapante, 50 km S of Magwe, Myanmar.

Remarks

The placement of *Garrulaxeus parvus* Mey, 2017, in *Br.* (*Painjunirmus*) is based on the photo provided with the original description, which is compatible with *Br.* (*Painjunirmus*). The photo provided by Mey (2017) lacks detail on important characters such as the preantennal structure, head, leg and abdominal chaetotaxy, and the structure of the male genitalia. In the photo this species appears to have *aps* on tergopleurites III–IV, similar to *Br. brevipennis,* but unlike this species, *Br. parva* also appear to have *psps* on tergopleurite IV; other chaetotaxy cannot be assessed accurately, as it is not clear which are dorsal and which are ventral setae in the photo. If the minute setae seen centrally on segments II–VI are *ss*, this would indicate that this species may belong to some subgenus of *Priceiella*. It is thus possible that *Garrulaxeus parvus* does not belong in *Br.* (*Painjunirmus*), but a complete redescription is necessary before this species can be accurately placed and compared to other species in the *Brueelia*-complex.

It should be noted that the male genitalia of this species, as illustrated by Mey (2017), are difficult to homologize to any genus of the *Brueelia*-complex, as they are illustrated in the everted position, and the mesosome appears severely distorted. The parameral heads do not appear to be folded medianly in this species, and the distal mesosome appears to be dominated by paired, roughly rectangular, nodi, which may represent the mesosomal lobes. However, the rest of the mesosome is difficult to reconcile with the morphology of any *Brueelia*-complex genus known from babblers, and it is possible that the illustrated genitalia are too distorted to be adequately compared. No other illustrations were provided by Mey (2017), and the description includes no characters that are useful for placing this species in any genus. The female of this species is unknown.

Attempts to communicate with Mey about the species described in his 2017 paper, have been unanswered, and we have thus not been able to examine the holotype of *Garrulaxeus parvus*. Based on what can be seen in Mey's photo of the whole body of the male, *Garrulaxeus parvus* may be separated from all other species of *Br.* (*Painjunirmus*) by the relatively broad and short preantennal area.

Key to the species of Brueelia (Painjunirmus) Ansari, 1947

Note that the species *Br.* (*Painjunirmus*) *parva* (Mey, 2017) is not included in this key, as the original description, illustration and photos are inadequate to compare it with other species in this subgenus, and its relationship to *Br.* (*Painjunirmus*) is unclear.

1. Male tergopleurite III with *aps* (Fig. 9); proximal mesosome wider than long (Fig. 14); female vulval margin with more than 5 *vss* (Fig. 16) .... ***Brueelia* (*Painjunirmus*) *brevipennis*** (Ansari, 1956)
– Male tergopleurite III without *aps*; proximal mesosome longer than wide; female vulval margin with 5 *vss* or fewer 2

2. Male tergopleurite V with at least 1 *tps* (Fig. 17); proximal mesosome elongated, pointed (Fig. 22) ....***Brueelia* (*Painjunirmus*) *pengya*** (Ansari, 1947).
– Male tergopleurite V without *tps*; proximal mesosome more or less rectangular 3

3. Sternal plates with lateral extensions, more prominent in male (Fig. 1) than in female (Fig. 2); vulval margin with median bulge (Fig. 8) ....***Brueelia* (*Painjunirmus*) *chilchil*** (Ansari, 1955)
– Sternal plates without lateral extensions (but may have concave lateral margins); vulval margin gently rounded 4

4. Male abdominal segments III–V with 2 *ps* on each side (Fig. 33); shape of male mesosome as in Fig. 38; shape of female subgenital plate as in Fig. 40 ....***Brueelia* (*Painjunirmus*) *magnini*** (Ansari, 1956)
– Male abdominal segments III–V with 3 *ps* on each side (Fig. 25); shape of male mesosome as in Fig. 30; shape of female subgenital plate as in Fig. 32 .... ***Brueelia* (*Painjunirmus*) *alba*** sp. nov.

Discussion

The morphological differences between *Brueelia* (*Brueelia*) and *Brueelia* (*Painjunirmus*) underline the distinctness of the *Brueelia*-complex lice parasitizing babblers. However, the subgenus *Painjunirmus* stands out among the *Brueelia*-complex lice parasitizing babblers as the only group that is closely related to *Brueelia* s. str. In 2017, Gustafsson & Bush (2017) suggested that the host and geographical distribution of *Brueelia* roughly mirrors the biogeography of the Passerida. However, even if babblers are included in this radiation (e.g., Barker *et al.* 2004), they form an important exception to this general trend, as most babbler species are parasitized by species of *Guimaraesiella* Eichler, 1949, and the closely-related *Priceiella* (Bush *et al.* 2016). These two louse genera belong to a radiation that is more characteristic of the Corvides and the smaller oscine radiations (e.g., Meliphagoidea) (Gustafsson & Bush, 2017). This exception may be related to environmental conditions.

As a general rule, *Brueelia* and closely related genera are found primarily on birds living in drier or more open habitats (e.g., sparrows, finches, larks; Gustafsson & Bush 2017; Takano *et al.* 2019). By contrast, *Guimaraesiella* and closely related genera are typically found on birds that live in more humid or forested habitats (e.g., honeyeaters, birds-of-paradise, broadbills; Gustafsson & Bush 2017; Gustafsson *et al.* 2019e; Takano *et al.* 2019). This pattern is especially noticeable in those cases where *Brueelia* and *Guimaraesiella* occur on hosts outside the Passerida and Corvides radiations, respectively. For instance, species of *Brueelia* known from Corvidae are mainly found on birds that live in dry areas of North America or Africa (Gustafsson & Bush 2019a). Conversely, species of *Guimaraesiella* occur on humid forest habitat Passerida hosts such as members of the Chloropseidae, Irenidae and the various families of babblers (Mey & Barker 2014; Gustafsson & Bush 2017; unpublished data). The habitat preference of the host could thus play a part in determining which *Brueelia*-complex lice may occur on the host. Relative humidity has previously been suggested as a factor that may limit the geographical range of chewing lice (Malenke *et al.* 2011), and Bush *et al.* (2009) found *Brueelia* sp. only on the subspecies of *Aphelocoma californica* that occurs in the driest part of the host's range, further suggesting that *Brueelia* and its relatives may be tolerant to low humidity.

However, there are numerous exceptions to this pattern, including the occurrence of both *Guimaraesiella* and *Brueelia* on the same species of thrushes and bulbuls (Gustafsson & Bush 2017; unpublished data). The presence of both *Brueelia* (*Painjunirmus*) and *Priceiella* (*Torosinirmus*) on *Argya* and *Turdoides* babblers also forms an interesting exception to this pattern. Large-scale analyses of the interaction between ambient humidity, host phylogeny, and the louse-host associations within the *Brueelia*-complex are sorely needed to understand the evolutionary history of this group.

The host genera *Argya* and *Turdoides* are nested deep inside the Leiothrichidae, closely related to groups of birds that are generally found in more humid habitats, and other babblers in more dry environments are phylogenetically scattered among humid habitat babblers (Cibois *et al.* 2018; Cai *et al.* 2019). It is thus possible that *Br.* (*Painjunirmus*) originated on some other group of birds living in dry habitats, and subsequently switched to *Argya* and *Turdoides* babblers.

In summary, the species of *Br.* (*Painjunirmus*) parasitizing *Argya* babblers add another layer of complexity to the evolutionary and co-evolutionary history of the *Brueelia*-complex lice. Lice parasitizing babblers appear to have experienced periods of coevolution with their hosts punctuated by host-switching between distally related hosts. Intriguing patterns of louse-associations with ambient humidity suggest that future studies in this system may provide a deeper understanding of how lice have evolved in response to non-host elements of their environment.

Acknowledgements

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