

A new *Rafapicobia* species associated with the Grey-breasted Crake *Laterallus exilis* in Brazil

(Acariformes, Syringophilidae and Aves, Gruiformes)

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Only one quill mite species representing the subfamily Picobiinae Johnston & Kethley, 1973 (Acariformes, Syringophilidae) has been known from gruiform birds (Gruiformes, Rallidae) up to now, i.e., *Rafapicobia melzeri* Skoracki et al., 2014 recorded from hosts belonging to four genera of rails, *Rallus*, *Pardirallus*, *Porzana*, and *Zapornia*. Herein we describe the second species, *Rafapicobia exilis* sp. nov., collected from the Grey-breasted Crake *Laterallus exilis* (Temminck, 1831) from Brazil. Additionally, the key to the species of *Rafapicobia* is presented.

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Introduction

The Syringophilidae Lavoipierre, 1953 is the most species-rich family among all prostigmatan mite families permanently associated with birds (Skoracki et al. 2012). Currently, this family includes more than 400 species grouped into 62 genera and reported so far from 26 avian orders (Kethley 1970, Skoracki 2011, Skoracki et al. 2016, Zmudzinski et al. 2021).

The cosmopolitan order Gruiformes comprises six families with 175 species in 51 genera, in the size of the tiny Junin Rail *Laterallus tuerosi* (12 cm) to the human-sized Sarus Crane *Antigone antigone* (176 cm), and with a widespread geographical distribution (Billerman et al. 2020, del Hoyo 2020, Clements et al. 2021). The syringophilid fauna associated with this host group is still poorly explored, and currently, only 11 out of 175 gruiform species have been

recorded as hosts for quill mites (Table 1). Among them, ten belong to the widely distributed and most speciose (141 species) family rails Rallidae and one to the monotypic Neotropical family Aramididae. The other gruiform families, i.e., cranes Gruidae, trumpeters Psophiidae, finfoots Heliornithidae, and flufftails Sarothuridae, have yet not been examined for the presence of syringophilid mites.

The currently described fauna of Syringophilidae of gruiform birds includes five species – two mesostenoxenous parasites (associated with host belonging to different genera of the same family), i.e., *Charadriophilus ralli* Skoracki & Bochkov, 2010 and *Rafapicobia melzeri* Skoracki et al., 2014, and three monoxenous species, i.e., *Niglarobia trouessarti* (Oudemans, 1904), *Ascetomylla gallinula* Kethley, 1970 and *A. porzanae* (Bochkov & Galloway 2004) (Table 1).

In this paper, we describe a new species of the genus *Rafapicobia* collected from another representative of the rails, the Grey-breasted Crake *Laterallus exilis* (Temminck, 1831) (Gruiformes, Rallidae) from Brazil. The host, a terrestrial, sedentary, and locally common rail, dwelling among dense vegetation near water, is widespread in Central and South America from southern Mexico to southeast Brazil (Taylor 2020). The ancestral area of the genus *Laterallus* (10 species) is the Neotropical region (Winkler et al. 2020, Garcia-Ramirez & Matzke 2021).

Rafapicobia Skoracki, 2011 is one of the 12 genera belonging to the subfamily Picobiinae Johnston & Kethley, 1973, and currently includes 13 species. It is worth noting that this taxon has the broadest host spectrum among all genera of picobiine mites. The representatives of *Rafapicobia* are known to parasitize birds belonging mainly to Telluravian orders, i.e., Coraciiformes, Passeriformes, Piciformes, Psittaciformes (Skoracki 2011, Skoracki et al. 2016, 2020a, c). Only one species, *R. melzeri*, was reported from a few bird species of the phylogenetically distant neoavian order Gruiformes (Kuhl et al. 2021), and it was regarded as an example of a horizontal transfer of picobiine mites (Skoracki et al. 2020b). However, a more extensive examination of the birds of the order Gruiformes can change this view in the future.

Material and methods

We examined eight specimens of the Grey-breasted Crake individuals deposited in the Bavarian State Collection of Zoology, Munich, Germany (ZSM – SNSB). From each specimen, we examined about ten contour feathers (near the cloaca region). Among all investigated birds, only one specimen was infested with quill mites.

Before mounting, mites were softened and cleared in Nesbitt's solution at room temperature for three days, according to the protocol introduced by Walter & Krantz (2009) and Skoracki (2011). Then, mites were mounted on slides in Hoyer's medium and investigated using a light microscope (ZEISS Axioscope, Germany) with differential interference contrast (DIC) illumination.

Drawings were made using a camera lucida drawing attachment. All measurements are in micrometers. Dimension ranges of the paratypes are given in parentheses following the data from the holotype.

In the description, the idiosomal setation follows Grandjean (1939) as adapted for Prostigmata by Kethley (1990). The leg chaetotaxy follows that proposed by Grandjean (1944). Finally, the morphological terminology follows Skoracki (2011).

Specimen depositories are cited using the following abbreviations: AMU – A. Mickiewicz University, Department of Animal Morphology, Poznan, Poland; ZSM–SNSB – Zoologische Staatssammlung München, München, Germany.

Taxonomy

Family Syringophilidae Lavoipierre, 1953
Subfamily Picobiinae Johnston & Kethley, 1973
Genus *Rafapicobia* Skoracki, 2011

Rafapicobia exilis sp. nov.

Figs 1,2

Type material. Female holotype and six female paratypes from quills of contour feathers of the cloaca region of the Grey-breasted Crake *Laterallus exilis* (Temminck, 1831) (Gruiformes, Rallidae); BRAZIL, Para State, Peixe-boi, 13 April 1910, coll. Müller.

Type material deposition. All type specimens are deposited in the AMU, except for two female paratypes in the ZSM–SNSB.

Etymology. The specific name "*exilis*" is taken from the specific name of the host.

Description

Female, holotype. Total body length 620 (600–620 in six paratypes).

Gnathosoma. Stylophore apunctate, 165 (160) long. Each medial branch of peritremes with four chambers, each lateral branch with barely visible borders between chambers. Movable cheliceral digit edentate on proximal end. Infracapitulum apunctate.

Idiosoma. Propodonal shield entire, shirt-like, punctate. Bases of all propodonal setae, except *c2*, situated on propodonal shield. Length ratio of setae *vi:ve:si* 1:2.3–2.4:3.6–3.9. Setae *ve* situated postero-lateral to setae *vi*; setae *si* situated anterior to level of setae *c2*; setae *c1* situated posterior to level of setae *se*. Hysteronotal shield reduced to two small sclerites surrounded bases of setae *d1*. Setae *d2* and *e2* subequal in length, both slightly (1.2–1.3 times) longer than *d1*. Pygidial shield well developed, 110 long, punctate on whole surface, except three pairs of apunctate lacunae. Setae *f2* four times longer than *f1*. Two punctate weakly sclerotized agenital plates situated anterior to bases of setae *ag1*. Agenital setae *ag1* and *ag3* subequal in length, both distinctly (12–17 times) longer than *ag2*. Genital setae *g1* about twice as long as pseudanal setae *ps1* and *ps2*. Coxal fields of legs I and II apunctate, III and IV punctate and well sclerotized.

Lengths of setae: *vi* 35 (35), *ve* 80 (85), *si* 135 (125), *se* 210 (200), *c1* 240 (230), *c2* 215 (215), *d1* 160 (160), *d2* 210 (200), *e2* 195 (190), *f1* 20 (20), *f2* 80 (80), *h1* 10 (10), *ag1* 170 (150), *ag2* 15 (10), *ag3* 175 (170), *g1* 20 (20), *ps1* 10 (10), *ps2* 10 (10), *3b* 30 (35), *4b* 35 (35), *3c* 70 (75), *4c* 85 (75), *l'RIII-IV* 20 (20).

Male. Not found.

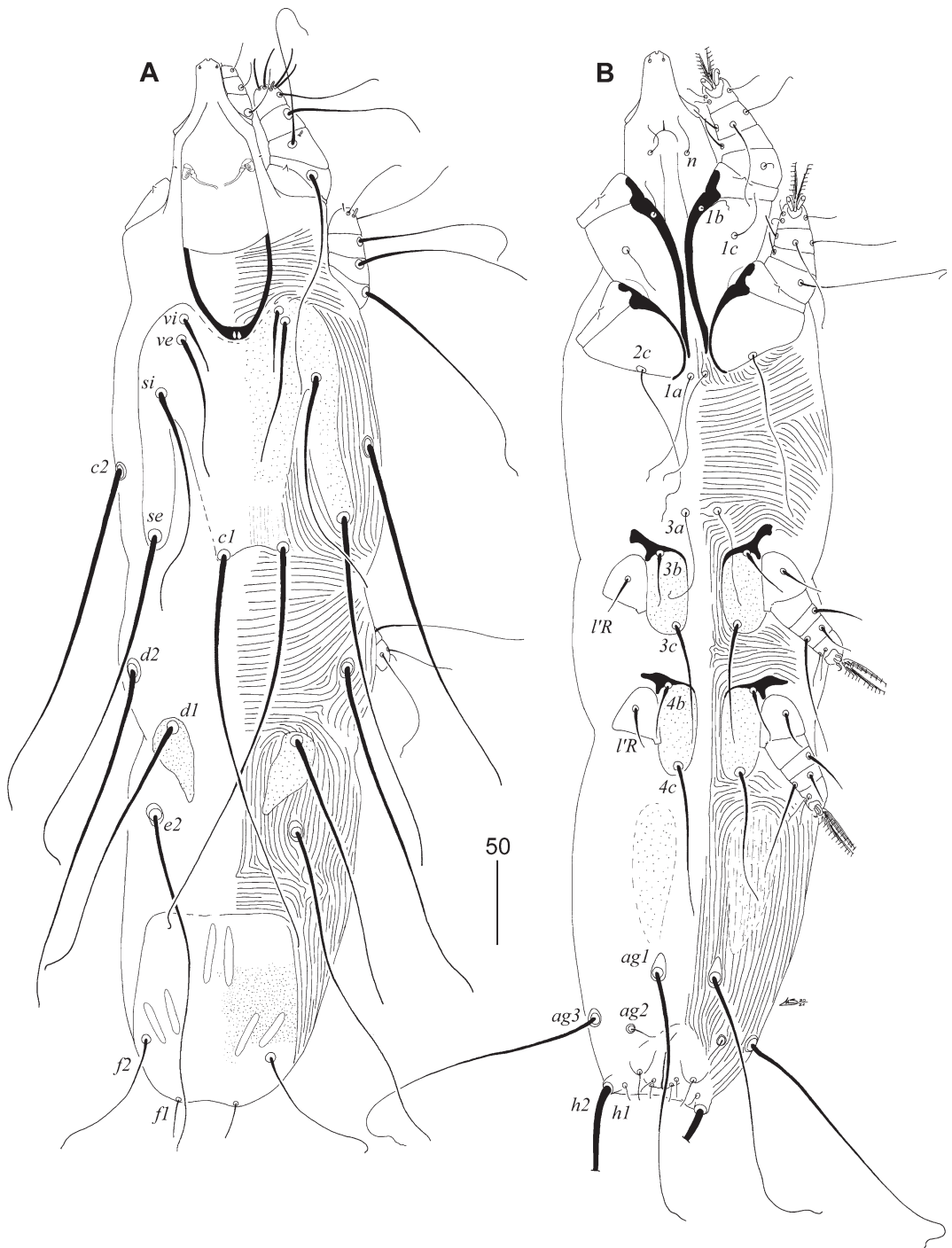


Fig. 1. *Rafapicobia exilis* sp. nov., female. A. Dorsal view; B. ventral view.

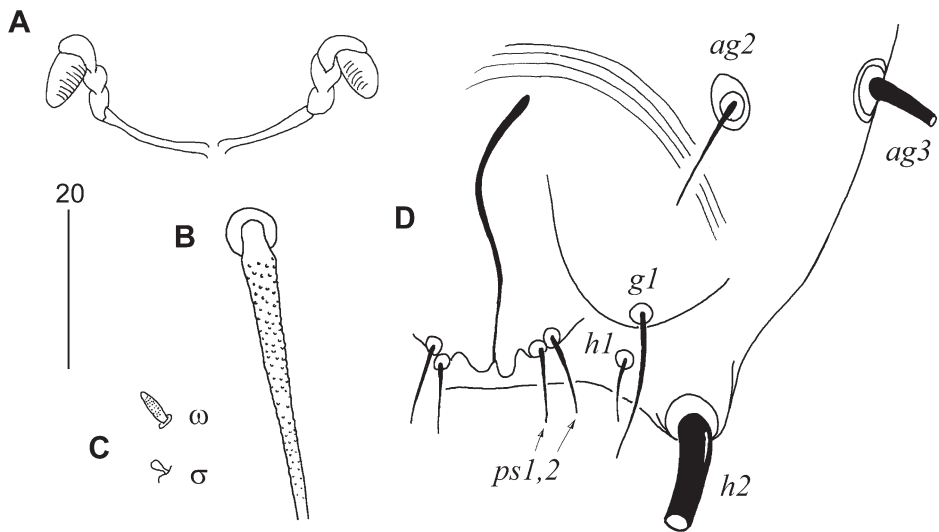


Fig. 2. *Rafapicobia exilis* sp. nov., female. A. Peritremes; B. propodonal seta *si*; C. solenidia of leg I; D. opisthosoma in ventral view.

Differential diagnosis. *Rafapicobia exilis* spec. nov. is morphologically similar to *R. olszanowskii* Skoracki, Zmudzinski & Sikora, 2020 described from Toucan Barbet *Semnormis ramphastinus* (Jardine, 1855) (Pici-formes: Semnornithidae) from Ecuador (Skoracki et al. 2020c). In females of both species, the setal bases *ve* are situated posterolateral to *vi*, and both setae are in close proximity; setae *ag2* and *h1* are short (about 10 µm); the agenital and hysteronotal plates are present, and coxal fields III and IV are punctate. This new species differs from *R. olszanowskii* by the following features: in females of *R. exilis*, the

hysteronotal setae *d2* and *e2* are slightly (1.2–1.3 times) shorter than setae *d1*; the agenital plates are elongated, and the posterior margin of these plates are situated close to bases of setae *ag1*. In females of *R. olszanowskii*, the hysteronotal setae *d2* and *e2* are about twice as long as setae *d1*; the agenital plates are small and oval, and the posterior margins of these plates are far from the level of setal bases *ag1*.

Females of this new species can also be easily distinguished from other *Rafapicobia* species recorded on rails, i. e., *R. melzeri*, by the presence of the agenital plates, which are absent in the *R. melzeri* females.

Table 1. Mites associated with birds of the order Gruiformes; * = type host species.

Mite species	Host species	Distribution	References
<i>Ascetomylla gallinula</i>	<i>Gallinula chloropus</i>	South Africa	Kethley 1970
<i>Ascetomylla porzanae</i>	<i>Porzana carolina</i>	Canada	Bochkov & Galloway 2004
<i>Charadriphilus ralli</i>	<i>Fulica americana</i>	USA	Skoracki et al. 2011
	<i>Porphyriops melanops</i>	Chile	Skoracki et al. 2014
	<i>Laterallus melanophaius</i>	Paraguay	Skoracki et al. 2014
	<i>Rallus aquaticus</i> *	Kazakhstan	Skoracki & Bochkov 2010
	<i>Zapornia parva</i>	Kyrgyzstan	Skoracki et al. 2014
<i>Niglarobia trouessarti</i>	<i>Aramus guarauna</i>	S. America	Oudemans 1904
<i>Rafapicobia melzeri</i>	<i>Pardirallus sanguinolentus</i>	Chile	Skoracki et al. 2014
	<i>Porzana porzana</i>	France	Skoracki et al. 2014
	<i>Rallus aquaticus</i> *	Germany	Skoracki et al. 2014
	<i>Zapornia fusca</i>	Japan	Skoracki et al. 2014
	<i>Zapornia parva</i>	Kyrgyzstan	Skoracki et al. 2014
<i>Rafapicobia laterallus</i> spec. nov.	<i>Laterallus exilis</i>	Brazil	Current study

**Key to *Rafapicobia* species
(based on Skoracki et al. 2016, modified)**

(females)

1. Setae *ve* situated distinctly posteromedial to setae *vi* *R. brotogeris*
(Fain, Bochkov & Mironov, 2000)
 - Setae *ve* situated posterior or posterolateral to setae *vi*, both setae in close proximity 2
2. Setae *ag2* 45–60 long 3
 - Setae *ag2* 10–20 long 4
3. Each lateral branch of peritremes with 4–5 well-visible chambers. Length ratios of setae *vi:si* and *fl:f2* 1:3 and 1:1.5 respectively. Genital plate absent *R. zirnitra*
Skoracki, 2011
 - Each lateral branch of peritremes with poorly visible chambers. Length ratios of setae *vi:si* and *fl:f2* 1:5–5.6 and 1:5 respectively. Genital plate present *R. toxostoma*
Sikora, Fajfer & Skoracki, 2011
4. Two agenital plates present 5
 - Agenital plates absent 9
5. Hysteronotal shields absent *R. lepidocolaptesi*
Skoracki & Solarczyk, 2012
 - Hysteronotal shields present 6
6. Length of setae *h1* 65–70 *R. thamnophili*
Głowska & Schmidt, 2014
 - Length of setae *h1* 7–10 7
7. Coxal fields III and IV apunctate
..... *R. brachypteraci*
Skoracki, Hromada & Sikora, 2020
 - Coxal fields III and IV punctate 8
8. Setae *d2* and *e2* about twice as long as setae *d1*. Agenital plates small, oval, posterior margin far from level of setae *ag1* *R. olszanowskii*
Skoracki, Zmudzinski & Sikora, 2020
 - Setae *d2* and *e2* 1.2–1.3 times shorter than setae *d1*. Agenital plates elongated, posterior margin and bases of setae *ag1* in close proximity
..... *R. exilis* sp. nov.
9. Hysteronotal shields present 10
 - Hysteronotal shields absent 11
10. Length ratios of setae *fl:f2* and *fl:h1* 1:4.8–5.5 and 2:1 *R. dendrocolaptesi*
Skoracki & Solarczyk, 2012
 - Length ratios of setae *fl:f2* and *fl:h1* 1:1 and 1:2–3.5 *R. milenskyi*
Głowska & Schmidt, 2014
11. Coxal fields III and IV punctate *R. melzeri*
Skoracki, Unsoeld, Skorupski & Kavetska, 2014
 - Coxal fields III and IV apunctate 12
12. Length ratio of setae *fl:f2* 1:2.2–2.3. Lengths of setae *d1* 105–120 *R. ramphastos*
(Fain, Bochkov & Mironov, 2000)
 - Length ratio of setae *fl:f2* 1:5.3. Lengths of setae *d1* 160–195 *R. momoti*
Skoracki, Hromada & Sikora, 2020

Detailed descriptions of the species included in the key are presented in the following papers (Fain et al. 2020, Sikora et al. 2011, Skoracki 2011, Skoracki & Solarczyk 2012, Głowska & Schmidt 2014, Skoracki et al. 2014, 2020a, c).

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