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Castosyringophilus meropis sp. n. (Acariformes: Syringophilidae) – a new quill mite species parasitising the world population of *Merops apiaster* Linnaeus (Coraciiformes: Meropidae)

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Abstract: A new species, *Castosyringophilus meropis* sp. n., found in quills of feathers of the European bee-eater *Merops apiaster* Linnaeus (Coraciiformes: Meropidae) is described. This new species is close to *C. claravis* Skoracki et Glowska, 2008 and differs, in females, by the presence apunctate coxal fields (*vs* sparsely punctate in *C. claravis*) and by the lengths of setae *d1* 145–180 µm, *f2* 170–185 µm and *ag3* 190–215 µm (*vs d1* 200–220 µm, *f2* 230–250 µm and *ag3* 150–170 µm). We present a vast mite material collected from bee-eaters originated from different localities in Europe, Asia and Africa, both breeding and wintering grounds of this bird. It indicates that the whole world population of the European bee-eater is parasitised by this quill mite species.

Keywords: acari, birds, ectoparasites, faunistics, parasitology, systematics

The family Syringophilidae (Acariformes: Cheyletoidea) includes permanent, obligatory and highly host specific (mono- or stenoxenous) ectoparasites inhabiting feather quills of birds. Syringophilid mites live and reproduce inside quills of different types of feathers, and feed on tissue fluids by piercing the quill wall with their long and flexible chelicerae (Kethley 1970, Skoracki et al. 2012). This family currently includes 377 species arranged in 62 genera known from 24 orders of birds (Zmudzinski and Skoracki 2017).

The genus *Castosyringophilus* was created by Bochkov and Perez (2002) and is one of the little-known genera in the family Syringophilidae. Currently, this genus includes only three described species: *Castosyringophilus claravis* Skoracki et Glowska, 2008, *C. forpi* Bochkov et Perez, 2002 and *C. mucuya* (Casto, 1980) (type species). Its species were recorded from columbiform and psittaciform birds from the Nearctic and Neotropical regions (Casto 1980, Bochkov and Perez 2002, Skoracki and Glowska 2008).

In the present paper, a new *Castosyringophilus* species parasitising *Merops apiaster* Linnaeus (Coraciiformes: Meropidae) in different localities in Europe, Asia and Africa is described. It is the first record of a species of this quill mite genus on coraciiform birds. The previous records of syringophilids from bee-eaters of the genus *Merops* Linnaeus are represented by two species of the genus *Syringophilopsis* Kethley, 1970; *Syringophilopsis albicollisi* Skoracki et Dabert, 2000 from *M. albicollis* Vieillot and *S. melitophagi* Skoracki et Dabert, 2001 from *M. bulocki* Vieillot (see Skoracki and Dabert 2000, 2001).

MATERIALS AND METHODS

The mite material used in this study was collected from dry bird skins housed in the ornithological collection of the Bavarian State Collection of Zoology (Munich, Germany) and National Museum of Kenya (Nairobi, Kenya), according to the technique proposed by Skoracki (2011). Slide-mounted mites were examined under a light microscope (ZEISS Axioscope2™) equipped with DIC optics and camera lucida. All measurements are given in micrometres. Measurements (ranges) for paratypes are given in parentheses following data for a holotype. In the descriptions, the idiosomal setation follows Grandjean (1939) as adapted for Prostigmata by Kethley (1990). The nomenclature of leg chaeto-

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taxy follows that proposed by Grandjean (1944). The morphological terminology follows Skoracki (2011). Descriptive statistics was performed using Quantitative Parasitology on the Web (Rózsa et al. 2000).

Specimen depositories are displayed using the following abbreviations: AMU – Adam Mickiewicz University, Department of Animal Morphology, Poznan, Poland; IPCAS – Institute of Parasitology, Biology Centre of the Czech Academy of Sciences, České Budějovice, Czech Republic; ZSM – Bavarian State Collection of Zoology, Munich, Germany; NMK – National Museum of Kenya, Nairobi, Kenya.

RESULTS

Family Syringophilidae Lavoipierre, 1953

Subfamily Syringophilinae Lavoipierre, 1953

Genus *Castosyringophilus* Bochkov et Perez, 2002

Castosyringophilus meropis sp. n. Figs. 1, 2

ZooBank number for species:
urn:lsid:zoobank.org:act:45C22156-6242-469F-A28C-0883EEC9D4E0

Female (holotype, Fig. 1A–E). Total body length 800 (780–840 in 10 paratypes). *Gnathosoma*. Stylophore apunctate, covered with longitudinally striate ornament, 140 (140–155) long. Each medial branch of peritremes with 1 elongated chamber, each lateral branch with 4 chambers. Infracapitulum apunctate. *Idiosoma*. Propodonotal shield weakly sclerotised, apunctate, divided into 2 lateral sclerites bearing bases of setae *ve*, *si*, and unpaired medial narrow sclerite. Setae *ve* and *si* subequal in length. Bases of setae *c1* situated posterior to level of setal bases *se*, setae *c2* situated anterior to level of setal bases *se*. Hysteronotal shield absent. Setae *d2* 1.5 times longer than *d1* and *e2*. Pygidial shield reduced to small region bearing bases of setae *f2* and *f1*, anterior margin indiscernible. Setae *h2* about twice as long as *f2*. Both pairs of pseudanal setae subequal in length. Genital plate present, apunctate, bases of setae *ag2* and *ag3* situated on margin of this plate. Length ratio of setae *ag1* : *ag2* : *ag3* 5.4 : 1 : 8.6. Setae *g1* and *g2* subequal in length. All coxal fields apunctate. Setae *3c* 3.6–3.8 times longer than *3b*. *Legs*. Fan-like setae of legs III–IV with 13 tines. Setae *tc"III–IV* twice as long as *tc'III–IV*. *Lengths of setae*: *ve* 20 (20–25), *si* 20 (20–30), *c1* 215 (200–220), *c2* 200 (190–210), *se* 225 (230–250), *d1* 145 (165–180), *d2* 225 (235–265), *e2* 155 (135–165), *f1* 15 (15), *f2* 175 (170–185), *h1* 20 (20), *h2* 365 (340–365), *ag1* 155 (135–160), *ag2* 25 (25), *ag3* 215 (190–200), *3b* and *4b* 25 (25), *3c* and *4c* 95 (90–95), *tc'III–IV* 25 (25–30), *tc"III–IV* (60–70), *ps1* and *ps2* 12 (12–14), *g1* and *g2* 17 (17–18), *l'RIII* 25 (25), *l'RIV* 20 (20).

Male (three paratypes, Fig. 2A–C). Total body length 500–520. *Gnathosoma*. Stylophore apunctate, covered with longitudinally striate ornament, 120–125 long. Each medial branch of peritremes with 2 elongated chamber, each lateral branch with 3 chambers. Infracapitulum apunctate. *Idiosoma*. Propodonotal shield weakly sclerotised, entire, apunctate, posterior margin indiscernible, bearing bases of setae *ve*, *si* and *c1*. Hysteronotal shield absent. Pygidial shield reduced to small region bearing bases of setae *f2*, *h2*, and genital setae, anterior and lateral margins indiscernible. Aggenital series with 2 pairs of setae. All coxal fields apunctate. Aedeagus 180 long. *Lengths of setae*: *ve* 30–45, *si* 50–60, *c1* 130–145, *c2* 140–150, *se* 140–150, *d1* 15–25, *d2* 30–55, *e2* 20, *f2* 20, *h2* 50–60, *ag1* 60, *ag2* 40–45, *3b* and *4b* 25, *3c* and *4c* 50–60, *tc'III–IV* 20, *tc"III–IV* 45, *g1* and *g2* 10, *l'RIII* 25, *l'RIV* 15–20.

Type host: European bee-eater *Merops apiaster* Linnaeus (Coraciiformes: Meropidae).

Type locality: Sevilla (37°22'58"N; 05°05'23"W), Spain, 6 June 1905, coll. Laubmann, host no. ZSM 17.3406/907.

Site of infection: Quills of under- and upper-tail covers, lesser wing coverts, back contour feathers and contour feathers of cloaca region.

Type material: Female holotype and paratypes: 5 females, 2 males, 13 tritonymphs, 6 protonymphs and 3 larvae in AMU (AMU-SYR.551), 5 female paratypes in IPCAS (N-2039), 3 female and 1 male paratypes in ZSM (ZSM 20112061), and 2 female paratypes in NMK (NMK/S/24).

Additional material: The mite material presented below was collected from the type host species. All mite material is deposited in the AMU:

Europe: 6 females and 2 larvae from France: Corsica, 31 May 1910, coll. F. Canesi [host no. ZSM 10.696; habitat: under-tail covert]; 7 females and 5 males from Gibraltar (British Overseas Territory), 14 April 1937, coll. Goetner [host no. ZSM 37.102; habitat: under-tail covert and back contour feather]; 4 females and 3 tritonymphs from Italy: Sardinia, Cagliari, June 1907, coll. P. Bonomi [host uncatalogued; habitat: under-tail covert]; 4 females, 3 males and 3 tritonymphs from Macedonia: Sar-Planina, 27 June 1917, coll. L. Mueller [host no. ZSM 17.3928; habitat: under-tail covert]; 4 females and 2 protonymphs from Macedonia: Stip District, Stip, 5 June 1918, coll. L. Mueller [host no. ZSM 18.1417; habitat: under-tail covert]; 3 females and 2 larvae from Romania: Konstanca District, Cernavoda, May 1910, coll. N. Enachescu [host no. ZSM 17.3412; habitat: under-tail covert]; 3 females, 1 male, 4 tritonymphs, 1 protonymph and 1 larva from Bosnia and Herzegovina: Dracevo, 5 May 1893, coll. R. Schlegl [host no. ZSM 17.3402; habitat: contour feathers of cloaca region]; 6 females, 2 tritonymphs, 2 protonymphs and 7 larvae from Greece: Thessalia Sterea, Ellada, May 1931, coll. Kattinger [host no. ZSM 33.298; habitat: under-tail covert, lesser wing covert, back contour feather].

Asia: 8 females from Turkey: Anatolia, Ankara, 27 April 1917, coll. P. Rockinger [host no. ZSM 18.437; habitat: under-tail covert]; 2 females from Turkey: Sanliurfa Province, Sanliurfa, 14 April 1911, coll. H. Weigold [host no. ZSM 17.3399; habitat: under-tail covert]; 13 females, 4 male, 8 tritonymphs, 2 protonymphs and 4 larvae from Russia: Volga District, 17 May 1912, coll. Laubmann. [host no. ZSM 17.3419; habitat: under- and upper-tail covers; lesser wing covert]; 9 females, 1 male, 7 tritonymphs, 2 protonymphs and 7 larvae from Russia: Kabardino-Balkar Republic, Nalchik, coll. Ryssel [host no. ZSM 17.3422; habitat: contour feathers of cloaca region]; 7 females, 4 males, 8 tritonymphs, 4 protonymphs and 2 larvae from Russia: Northern Caucasus, Krasnodar Region, 11 June 1914, coll. M. Prager [host no. ZSM 14.892; habitat:

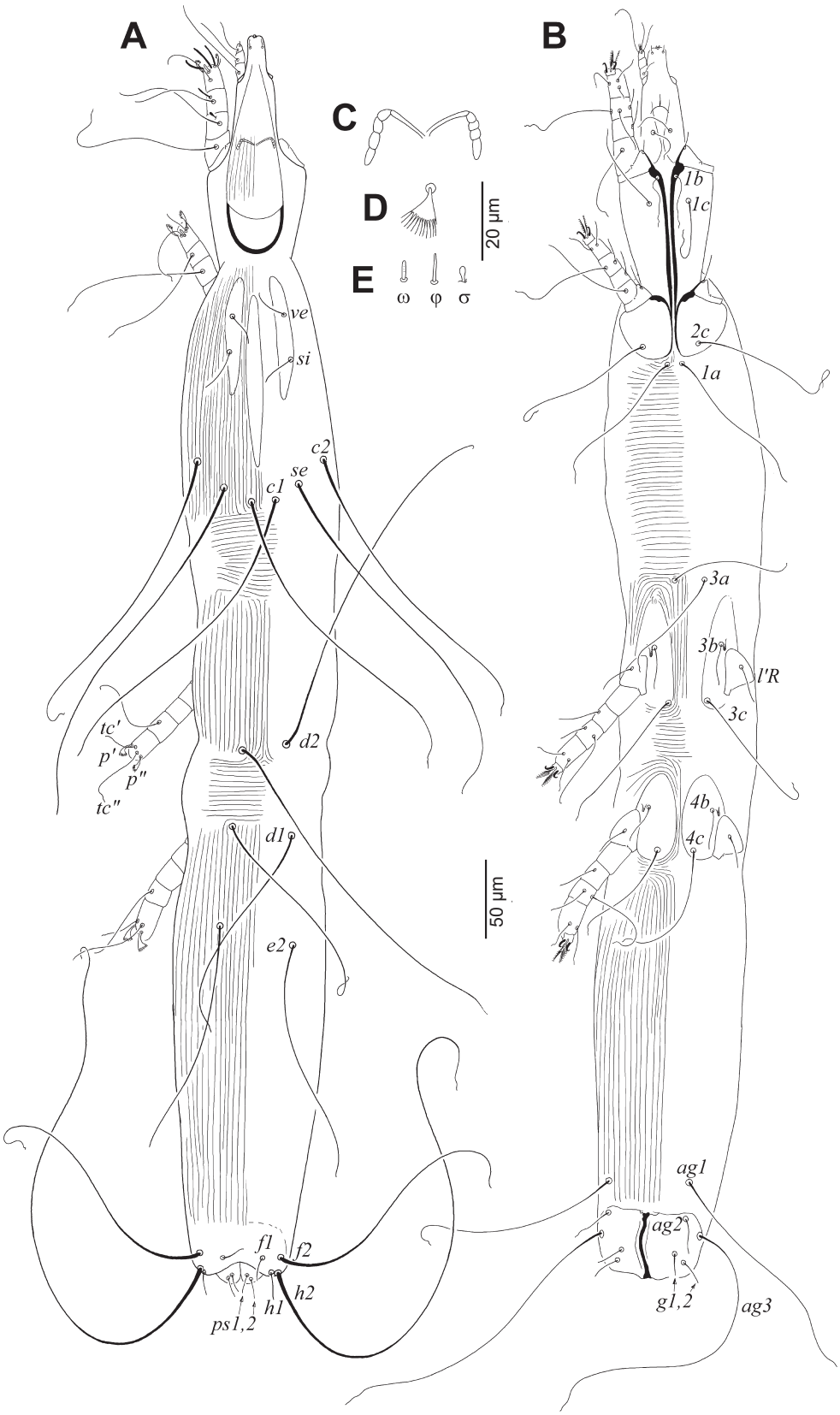

Fig. 1. *Castosyringophilus meropis* sp. n., female, from *Merops apiaster* Linnaeus. **A** – dorsal view; **B** – ventral view; **C** – peritremes; **D** – fan-like seta *p'III*; **E** – solenidia of leg I.

under- and upper-tail coverts]; 7 females from Azerbaijan: Nagorno-Karabakh Republic, Martakert Region, Talish, May 1909, coll. Laubmann [host no. ZSM 17.3400; habitat: under- and upper-tail coverts, lesser wing covert]; 2 females, 2 tritonymphs and 3 protonymphs from Pakistan: Belochistan Province, October 1911, coll. E. Zugmayer [host no. ZSM 12.991; habitat: under-tail covert].

Africa: 2 females from Morocco: Tanger-Tetuan-Al-Husajma

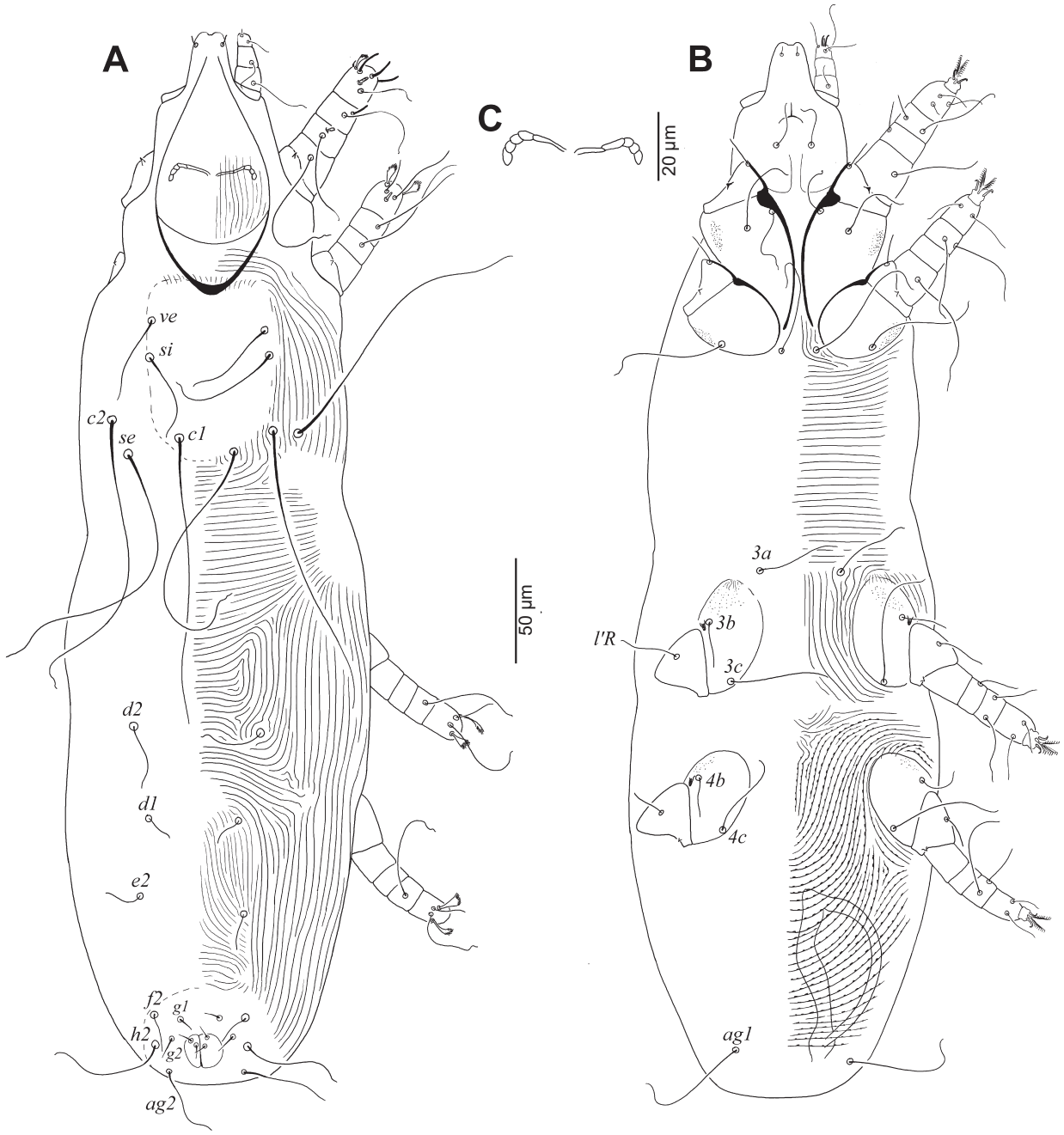

Fig. 2. *Castosyringophilus meropis* sp. n., male, from *Merops apiaster* Linnaeus. **A** – dorsal view; **B** – ventral view; **C** – peritremes.

Region, Tangier, coll. Laubmann [host no. ZSM 17.3424; habitat: under- and upper-tail coverts]; 3 females from Tanzania: Morogoro Region, Morogoro Urban District; 20 September 1952, coll. Th. Andersen [host no. ZSM AH.1000; habitat: under- and upper-tail coverts]; 5 females from Kenya, Nairobi, 3 April 1982, coll. unknown [host no. NMK 6758/467; habitat: under-tail covert]; 2 females from Kenya, Kitale, 21 April 1929, coll. Jeltery [host no. NMK 6776/467; habitat: under-tail covert]; 3 females from Kenya, Kamwega escarpment, North Nandi Forest, 26 November 1978, coll. unknown [host no. NMK 6759/467; habitat: under-tail covert]; 2 females from Kenya, Naivasha, 1 October 1968, coll. unknown [host no. NMK 6750/467; habitat: under-tail covert].

P r e v a l e n c e : Estimated overall prevalence in our samples of *Merops apiaster* was 29% (22 out of 75 birds infected, 95% confidence interval (Sterne) 20–40; SE ± 5%).

E t y m o l o g y : The specific name is taken from the generic name of the host and is a noun in the genitive case.

Remarks. *Castosyringophilus meropis* sp. n. is morphologically similar to *C. claravis* described from *Claravis pretiosa* (Ferrari-Pérez) (Columbiformes: Columbidae) from Bolivia (Skoracki and Glowska 2008). In females of both species (males of *C. claravis* are unknown), each medial branch of the peritremes has one elongated chamber, each lateral branch has four chambers, bases of setae *c1* are situated posterior to the level of setal bases *se*, setae *c2* are situated anterior to the level of setal bases *se*, and the pygidial shield is present. This new species differs from *C. claravis* by the following features: in females of *C. meropis*, all coxal fields are apunctate, and the lengths of following se-

tae are: *c1* 200–220 μm, *d1* 145–180 μm, *e2* 135–165 μm, *f2* 170–185 μm, *ag3* 190–215 μm. In females of *C. claravis*, all coxal fields are sparsely punctate, and the lengths of following setae are: *c1* 230–260 μm, *d1* 200–220 μm, *e2* 175–195 μm, *f2* 230–250, *ag3* 150–170 μm.

DISCUSSION

The European bee-eater is an insectivorous bird, relying largely on stinging hymenopterans. It breeds in Europe, North Africa and Asia. All populations are migratory, wintering in southern Africa (Snow 1978, Cramp 1985, Fry and Boesman 2016). In the present study, the mite material was removed from European bee-eater individuals collected in breeding grounds in Europe (Bosnia and Herzegovina, France, Greece, Italy, Macedonia, Romania, Spain), Asia (Azerbaijan, Pakistan, Russia, Turkey) and northern Africa (Morocco), as well as in wintering grounds in Africa (Kenya, Tanzania). It suggests that the whole world population of *M. apiaster* is parasitised by *C. meropis*.

The prevalence of 29% is quite high in comparison to other examined wild bird hosts of syringophilid mites (see Skoracki et al. 2010, 2012), probably because the host species is highly social; bee-eaters are sitting or roosting together often so close that they touch. They are highly gregarious in the breeding season and also when not nesting. European bee-eaters breed in nest burrows, similarly to other bee-eaters. Both sexes are incubating and one fifth to one third of breeding pairs have helpers, usually adult sons (Fry and Boesman 2016).

The genus *Castosyringophilus* is one of the little-known genera of the family with only three described species now: *C. mucuya* from *Columbina passerina* (Linnaeus) (Columbiformes: Columbidae), *C. claravis* from *Claravis pretiosa* (Columbidae) and *C. forpi* from *Forpus cyanopygius* Souancé (Psittaciformes: Psittacidae) in Mexico (Casto 1980, Bochkov and Perez 2002, Skoracki and Glowska 2008). The presence of the representatives of the genus *Castosyringophilus* on birds belonging to the Coraciimorphae clade is its first confirmation in the Afroaves (Jarvis et al. 2014). As it was before known from Psittaciformes (Australaves: Passerimorphae), this quill mite genus is now confirmed from both main lineages of core landbirds, Telluraves (Jarvis et al. 2014). The third host order where *Castosyringophilus* was recorded are Columbiformes from the Columbea clade, which is a sister taxon to the whole Passerea; thus, it is present in both main lineages of Neoaves.

Although the pattern of its presence in such phylogenetically distant, not closely related, host lineages (Yuri et al. 2013, Jarvis et al. 2014, Prum et al. 2015) can be explained by cases of horizontal transfers, more detailed studies are needed.

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