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Redescription of *Syringophiloidus glandarii* (Fritsch, 1958) with new records of hosts and localities

(Acariformes, Syringophilidae)

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Syringophiloidus glandarii was originally described as *Syringophilus minor glandarii* Fritsch, 1958 and collected in part from the Eurasian Jay *Garrulus glandarius* (L.) from Germany. Because the type material has been lost and the original description is insufficient, *S. glandarii* is redescribed and illustrated herein, and a neotype designation is proposed. Additionally, we give records of this mite collected from five subspecies of *G. glandarius*, i.e., *krynickyi*, *rufitergum*, *cervicalis*, *lusitanicus*, and *sinensis*, and at previously unrecorded localities for *S. glandarii*, i.e., England, Spain, France, North Macedonia, Tunisia, and China. Although the frequency of occurrence of *S. glandarii* on the Eurasian Jay was 8% (N = 125; CI^{95%} = 4.3–14.3), it ranged from 7.1% to 50% for particular subspecies of *G. glandarius*.

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Introduction

The Syringophilidae (Acariformes, Prostigmata, Cheyletoidea) represent the most diverse prostigmatan family associated with birds. Currently, about 400 species are described, and the range of their hosts comprises 24 orders and 95 families from all zoogeographical regions, except Antarctica (Kethley 1970, Skoracki 2011, Zmudzinski et al. 2021). All species of this family are permanent and obligatory avian ectoparasites, and most of them display a high degree of host specificity, being mono- or oligoxenous parasites (Skoracki 2011, Skoracki et al. 2016).

Syringophiloidus glandarii (Fritsch, 1958) (Acariformes, Syringophilidae) is one of the few mite species of the family Syringophilidae with complicated taxonomical history. In 1958, Fritsch described and figured a new subspecies *glandarii* of the *Syringophilus*

minor Berlese, 1887, based on mite material collected from two passerine host species, i.e., the Eurasian Jay *Garrulus glandarius* (Linnaeus) (Passeriformes, Corvidae) and the Hawfinch *Coccothraustes coccothraustes* (Linnaeus) (Fringillidae) (Fritsch 1958: 235). Later, Kethley listed *Syringophilus glandarii* as an independent species but as ‘incertae sedis’ concerning genus placement, and (without discussion) limited the host data to “Corvidae” only (Kethley 1970: 65). Additionally, on page 5 of the same paper, he reported that “all of Fritsch’s material” (i.e., including the types) had been “destroyed (in litt., H. J. Stammer)”. Herein, we also confirm that currently, there is no microscope slide with mite material at Friedrich-Alexander-Universität Erlangen-Nürnberg, where Fritsch worked when he described these taxa (personal comm. Schmidl 2022).

In 1998, Bochkov & Mironov moved *Syringophilus glandarii* to the genus *Syringophiloidus* based on material collected from the House Martin *Delichon urbicum* (Linnaeus) (Passeriformes, Hirundinidae) from the European part of Russia (Kaliningrad Prov.) (Bochkov & Mironov 1998: 14). However, three years later, Bochkov (2001) noticed that the host mentioned above is parasitized not by *S. glandarii* but by another species, i.e., *Syringophiloidus delichonum* Bochkov, 2001. Fortunately, in the same paper, he briefly diagnosed and figured *Syringophiloidus glandarii* based on mite material collected from the type host species *Garrulus glandarius* from the European part of Russia (Smolensk Prov.) (Bochkov 2001: 149).

In 2011, Skoracki excluded the Hawfinch from the host spectrum for *Syringophiloidus glandarii* and described *Syringophiloidus coccothraustes* Skoracki, 2011 from that host species (Skoracki 2011: 59). In the same paper, Skoracki recorded the presence of *S. glandarii* on three additional corvid hosts, i.e., Eurasian Magpie *Pica pica* (Linnaeus) from Japan, the Eurasian Jackdaw *Corvus monedula* Linnaeus, and the Rook *Corvus frugilegus* Linnaeus, both from Kazakhstan (Skoracki 2011: 57).

In the present paper, we redescribe *S. glandarii* based on a newly established neotype and additional material (21 females and 4 males) collected from *Garrulus glandarius glandarius* from Germany. Additionally, we give new records of this mite from five subspecies of *G. glandarius* recorded from several new localities for *S. glandarii*, i.e., England, Spain, France, North Macedonia, Tunisia, and China.

The designation of a neotype for *S. glandarii* is necessary due to the following reasons: The original type material is considered lost, some diagnostic features were not clarified in the original description, the species is rather variable, and there is the possibility of the existence of two or more species within *S. glandarii* sensu Fritsch, especially for those specimens recorded from host species other than *Garrulus glandarius*. Consequently, we are herein proposing a neotype in compliance with the International Code of Zoological Nomenclature (ICZN 1999: Article 75.3).

The redescription and figures clarify the taxonomic status of *S. glandarii* (Art. 75.3.1); the diagnostic and differential features are included in the redescription and figures (Art. 75.3.2); the neotype specimen is identified below (Art. 75.3.3); as stated above, the type material of *S. glandarii* has not been found in two separate searches (Art. 75.3.4); as described below, the neotype fits the original description (Art. 75.3.5); it was collected from one of the two original host species; a specific type locality was not stated in the original publication (Art. 75.3.6); the neotype is deposited in the Zoologische Staatssammlung München (Section Arthropoda Varia), Munich, Germany (Art. 75.3.7).

Material and methods

The mite material used in the present study was collected from dry bird skins housed in the ornithological collection of the Bavarian State Collection of Zoology, Munich, Germany. (SNSB-ZSM). Mites were removed from contour feathers and under-tail coverts using sharp tweezers. Before mounting, specimens 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).

Identification of mite specimens and drawing preparations were carried out with a ZEISS Axioscope2™ light microscope with DIC optics and a camera lucida. All measurements are given in micrometers. The nomenclature for the idiosomal setation follows Grandjean (1939), as adapted for Prostigmata by Kethley (1990), leg setation is that of Grandjean (1944), and general morphological terms follow Skoracki (2011).

The prevalence and exact confidence limits for the prevalence (Sterne's method; Confidence level = 95 %) were computed using Quantitative Parasitology on the Web (Reiczigel 2003, Reiczigel et al. 2019).

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

Table 1. Infestation of the *Garrulus glandarius* subspecies by *Syringophiloidus glandarii* (Fritsch, 1958).

Host	No. examined	No. infested	Prevalence (CI 95 % (Sterne))
<i>Garrulus g. garrulus</i> (Linnaeus)	42	3	7.1 % (2.0–19.9)
<i>Garrulus g. krynicki</i> Kaleniczenko	12	1	8.3 % (0.4–37.0)
<i>Garrulus g. rufitergum</i> Hartert	4	2	50.0 % (9.8–90.2)
<i>Garrulus g. cervicalis</i> Bonaparte	5	1	20.0 % (1.0–65.7)
<i>Garrulus g. lusitanicus</i> Voous	16	2	12.5 % (2.3–37.2)
<i>Garrulus g. sinensis</i> Swinhoe	6	1	16.7 % (0.9–58.9)



Fig. 1. *Syringophiloides glandarii* (Fritsch, 1958), female. A. Dorsal view; B. ventral view.

Results

We have investigated 125 host individuals belonging to 12 subspecies of the *Garrulus glandarius*. Among them, ten individuals belonging to six subspecies, i.e., *garrulus* (N=42), *krynickyi* (N=12), *rufitergum* (N=4), *cervicalis* (N=5), *lusitanicus* (N=16), and *sinensis* (N=6), were infested by quill mite species *Syringophiloides glandarii*.

Although the prevalence of *S. glandarii* in *Garrulus glandarius* was 8% (N=125; 10 infested; $CI^{95\%}=4.3-14.3$), it varied from 7.1% to 50% for particular subspecies (Table 1).

The following six subspecies, i.e., *japonicus* (N=14), *taivanus* (N=3), *atricapillus* (N=4), *hibernicus* (N=1), *bispeularis* (N=7), and *brandthii* (N=11) were not infested by syringophilid mites (and were excluded from the table). Additionally, we also

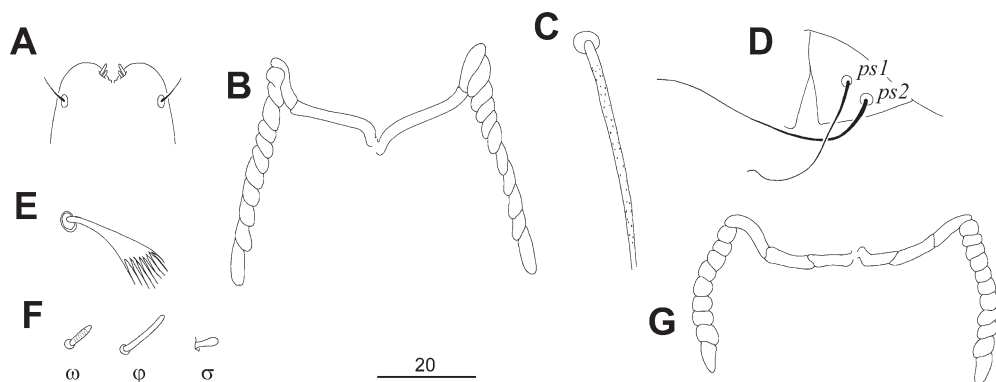


Fig. 2. *Syringophiloidus glandarii* (Fritsch, 1958), female. **A.** Hypostomal apex in dorsal view; **B.** peritremes; **C.** propodonal setae *vi* and *si*; **D.** genito-anal region with pseudanal setae; **E.** fan-like seta *p'III*; **F.** solenidia of leg I.

checked the other two species of the genus *Garrulus*: the Lidth's Jay *G. lidthi* Bonaparte (N=1) and the Black-headed Jay *G. lanceolatus* Vigors (N=1), and both of them were not infested.

Systematics

Family Syringophilidae Lavoipierre, 1953
Subfamily Picobiinae Johnston & Kethley, 1973
Genus *Syringophiloidus* Kethley, 1970

Syringophiloidus glandarii (Fritsch, 1958)

Figs 1–3

Syringophilus minor glandarii Fritsch, 1958: 235, fig. 6
Syringophilus glandarii Fritsch – as incertae sedis (Kethley 1970: 65)

Syringophiloidus glandarii (Fritsch) – (Bochkov & Mironov 1998: 14; Bochkov 2001: 149, fig. 1; Skoracki 2011: 57, figs 37 and 38)

Neotype host: *Garrulus glandarius* (Passeriformes: Corvidae) from Germany

Female

Neotype: Total body length 790 (780–850 in additional 15 specimens from same host individual).

Gnathosoma. Infracapitulum densely punctate. Each medial branch of peritremes with 2 chambers, each lateral branch with 9–10 chambers. Stylophore 200 (200–210) long; exposed portion of stylophore apunctate, 160 (160–165) long. Movable cheliceral digit 150 (150–155) long.

Idiosoma. Propodonal shield well sclerotized, with convex anterior margin, punctate at lateral margins. Propodonal setae *vi*, *ve*, and *si* lightly ornamented in basal part. Length ratio of setae

vi:ve:si 1:2.4–2.7:4.5–5. Setae *c1* and *se* situated at same transverse level. Hysteronotal shield apunctate not fused to pygidial shield, anterior margin reach above level of setal bases *d2*. Pygidial shield sparsely punctate or apunctate, anterior margin indiscernible. Hysteronotal setae *d1*, *d2*, and *e2* subequal in length. Opisthonotal setae *f1* and *h1* subequal in length. Pseudanal setae *ps2* 1.2–1.6 times longer than *ps1*. Genital setae *g1* and *g2* subequal in length or *g2* slightly (1.1–1.3) longer than *g1*. Genital plate present, weakly sclerotized, setae *ag2* and *ag3* situated near lateral margins of this plate. Coxal fields I–IV densely punctate. Setae *3c* 2.7–3 times longer than *3b*. Cuticular striations as in Figure 1A–B.

Legs. Fan-like setae *p'* and *p''* of legs III and IV with 8–10 tines. Setae *l'RIII* 1.5 times longer than *l'RIV*. Setae *tc'''III-IV* slightly (1.2–1.3 times) longer than *tc'''III-IV*. Podomeres of legs, especially III and IV punctate on ventral side.

Lengths of setae: *vi* 40 (40–45), *ve* 90 (90–110), *si* 185 (180–200), *se* (240–280), *c1* (240–270), *c2* 250 (230–260), *d1* 200 (190–230), *d2* 235 (210–250), *e2* 190 (190–230), *f1* 30 (30–45), *f2* 330 (280–325), *h1* 30 (30–45), *h2* (410–455), *ps1* 20 (20–30), *ps2* 30 (30–50), *g1* 30 (30–40), *g2* 35 (35–50), *ag1* 200 (180–200), *ag2* (140–175), *ag3* 230 (215–260), *3b* 40 (35–45), *3c* 115 (120–135), *4b* 40 (35–45), *4c* 120 (115–125), *l'RIII* 60 (50–65), *l'RIV* 40 (35–45), *tc'''III-IV* 60 (60–70), *tc'''III-IV* 75 (70–85).

Male

Total body length 520–530 in 4 specimens.

Gnathosoma. Infracapitulum apunctate. Each medial branch of peritremes with 3 chambers, each lateral branch with from 9–11 chambers. Stylophore apunctate, 165–170 long; exposed portion of stylo-

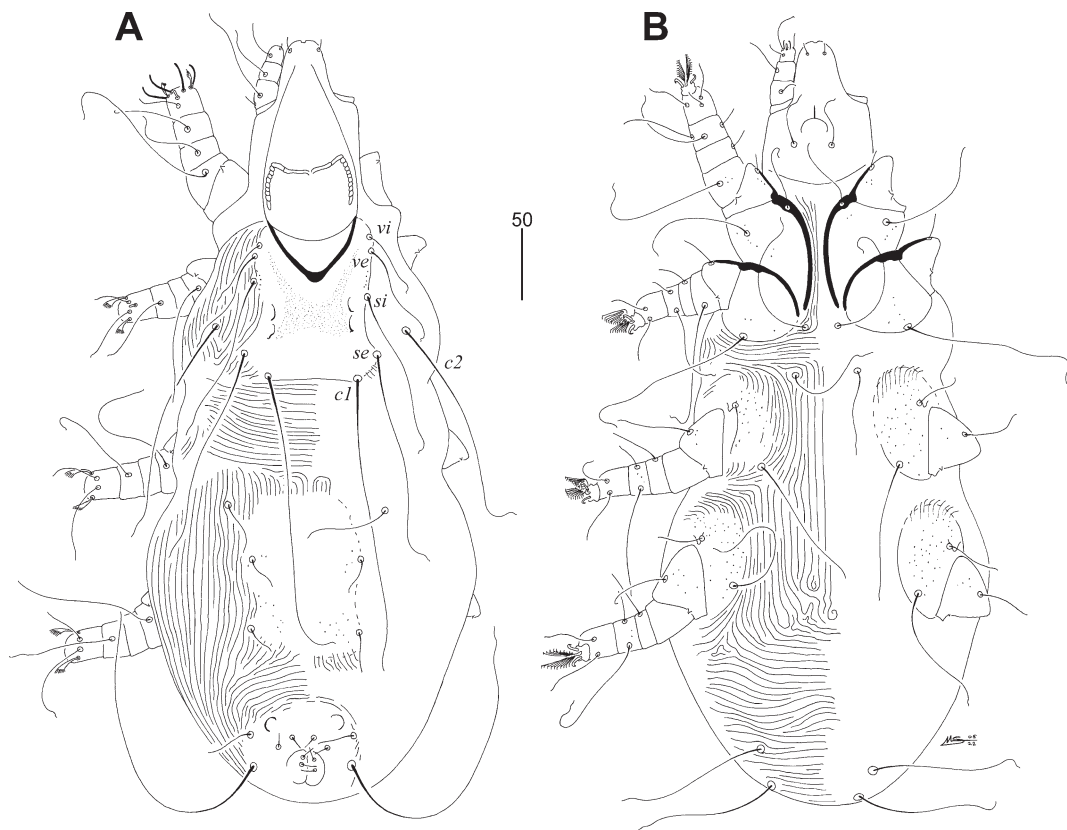


Fig. 3. *Syringophiloidus glandarii* (Fritsch, 1958), male. A. Dorsal view; B. ventral view; C. peritremes.

phore apunctate, 130–140 long. Movable cheliceral digit 140–150 long.

Idiosoma. Propodonal shield well sclerotized, covered by minute punctations in the central part, bearing bases of setae *vi*, *ve*, *si*, *se*, and *c1*; anterior and lateral margins slightly concave. Length ratio of setae *vi:ve:si* 1:1.2–1.4:2.2. Hysteronotal shield not fused to pygidial shield, sparsely punctate or apunctate, weakly sclerotized, margins indiscernible. Setae *d2* variable in length, 2.2–4.4 times longer than *d1* and *e2*. Pygidial shield apunctate with rounded anterior margin. Bases of genital setae *g1* situated anterior to level of setal bases *g2*. Setae *h2* 7–8 times longer than *f2*. Setae *ag1* slightly 1.2–1.4 times longer than *ag2*. Coxal fields I–II sparsely punctate or apunctate, III–IV densely punctate.

Legs. Fan-like setae *p'* and *p''* of legs III and IV with 7 tines. Setae *tc'''III–IV* 1.4–1.6 times longer than *tc'''III–IV*.

Lengths of setae: *vi* 50–60, *ve* 70–75, *si* 120–130, *se* 155–180, *c1* 190–205, *c2* 150–160, *d1* 25–30, *d2* 55–110, *e2* 20–25, *f2* 30–35, *h2* 220–295, *ag1*

110–115, *ag2* 80–90, *l'RI* 10, *l'RII* 20, *l'RIII* 35–45, *l'RIV* 25–35, *tc'''III–IV* 35–45, *tc'''III–IV* 55–65.

Material examined. Female neotype and additional specimens: 21 females and 4 males from Eurasian Jay (subsp. *glandarius*) *Garrulus glandarius glandarius* (Linnaeus) (host reg. no. SNSB-ZSM-11.637); GERMANY: Rhineland-Palatinate, Südwestpfalz Prov., Fischbach bei Dahn, 2 December 1913, coll. F. Waltzinger.

Material deposition. The neotype (reg. no. A20112084/1), 13 additional females and 2 males are deposited in the SNSB-ZSM (reg. no. A20112084/2-16), 8 females and 2 males in the AMU (reg. no. MS-22-0318-001).

Additional material examined. Ex same host species and subspecies as above (host reg. no. SNSB-ZSM 18.759); NORTH MACEDONIA: Caska municipality, Izvor, 12 March 1917, coll. L. Mueller – 4 females and 2 males deposited in the SNSB-ZSM (reg. no. A20112086), 5 females and 2 males in the AMU (reg. no. MS-22-0318-002). Ex same host species and subspecies (host reg. no. ZSM-28.487); FRANCE: Grand Est, Ecouvies, 13 March 1915, coll. J. Gengler – 3 females deposited in the SNSB-

ZSM (reg. no. A20112085), 4 females and 1 male in the AMU (reg. no. MS-22-0202-053).

Ex *Garrulus glandarius krynicki* Kaleniczenko (host reg. no. SNSB-ZSM 17.531); RUSSIA: Republic of North Ossetia-Alania, Vladikavkaz, March 1899, coll. Laubmann – 5 females deposited in the SNSB-ZSM (reg. no. A20112087), 3 females and 1 male in the AMU (reg. no. MS-22-0202-043).

Ex *Garrulus glandarius rufitergum* Hartert (host reg. no. SNSB-ZSM 20.768); ENGLAND: Sussex, 27 January 1920, coll. F. Witherby – 2 females deposited in the SNSB-ZSM (reg. no. A20112088), 3 females in the AMU (reg. no. MS-22-0202-046). Ex same host species and subspecies (host reg. no. SNSB-ZSM 20.770); ENGLAND: Yorkshire, Yarm-on-Tees, 22 May 1920, coll. F. Witherby – 4 females and 2 males deposited in the SNSB-ZSM (reg. no. A20112089), 4 females and 3 males in the AMU (reg. no. MS-22-0202-047).

Ex *Garrulus glandarius cervicalis* Bonaparte (host reg. no. SNSB-ZSM 03.1359); TUNISIA: Ain Draham, April 1903, coll. Blanc – 7 females deposited in the SNSB-ZSM (reg. no. A20112090), 7 females and 1 male in the AMU (reg. no. MS-22-0202-048).

Ex *Garrulus glandarius lusitanicus* Voous (host reg. no. SNSB-ZSM 53.62); SPAIN: Salamanca, Linares de Riofrio, 17 May 1953, coll. H. Gruen – 5 females deposited in the SNSB-ZSM (reg. no. A20112091), 2 females and 1 male in the AMU (reg. no. MS-22-0202-049). Ex same host species (host reg. no. SNSB-ZSM 53.61) and locality; 16 May 1953, coll. H. Gruen – 6 females deposited in the SNSB-ZSM (reg. no. A20112092), 3 females in the AMU (reg. no. MS-22-0202-050). Ex same host species (host reg. no. SNSB-ZSM 54.18) and locality; 14 May 1953, coll. H. Gruen – 1 female deposited in the SNSB-ZSM (reg. no. A20112093).

Ex *Garrulus glandarius sinensis* Swinhoe (host reg. no. SNSB-ZSM 28.512); CHINA: Fujian, 9 March 1912, coll. J. Gengler – 5 females and 1 male deposited in the SNSB-ZSM (reg. no. A20112094), 3 females and 2 males in the AMU (reg. no. MS-22-0202-052).

Remarks. The type host species, *Garrulus glandarius*, is a widespread and common species with 27 subspecies in 6 groups from Northwest Africa, Western Europe to Japan/Southern half of Palaearctic, Eastern Sino-Japanese to North-East Oriental region (del Hoyo 2020). Infestation of the Eurasian Jay originates from Europe (Spain, France, Germany, England, North Macedonia, European part of Russia), North Africa (Tunisia), and Asia (China), indirectly indicating that probably the whole population of this host species is parasitized by *Syringophiloides glandarii*.

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