Snow flies of the genus *Chionea* (Diptera: Limoniidae) in Austria

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ABSTRACT Contib. Nat. Hist. 12: 361–380.

About 130 mostly unpublished records of the four *Chionea* species occurring in Austria are compiled. Despite regional sampling deficits, preliminary statements on the distribution, altitudinal range, adult phenology and cave inhabitation of Austrian snow flies can be given. A key with photographs of diagnostic characters facilitates the identification of *Ch. araneoides*, *Ch. alpina*, *Ch. austriaca* and *Ch. lutescens*, along with a geographically neighboring species, *Ch. belgica*.

Keywords: Craneflies, winter-active, snow insects, determination, distribution, phenology, cave, Austria

Introduction

The virtually wingless, spiderlike craneflies of the genus *Chionea* are among the most conspicuous winter-active insects that regularly appear on the snow cover. Despite their striking appearance (Fig. 1) and the wide ecological ranges, snow flies are poorly represented in public collections, giving the impression of being rare species. Pitfall catches, however, indicate that Central European snow flies are locally abundant, especially in montane and alpine environments and in caves.

In the present paper I present all available *Chionea* records from Austria, most of them unpublished, based on specimens that passed through my hands over the course of the past three decades. Though sampling was regionally uneven and biased towards subterranean habitats, the rich material allows an outline of the geographic distribution, the altitudinal range, and the adult phenology of Austrian *Chionea* species.

Fig. 1. Habitus of a snow fly. Well visible are the halteres, but not the vestigial wings. *Chionea austriaca*, male on snow cover. Lunz, Lower Austria; 29 Jan., 1995. © Theo Kust.

I dedicate this article to the memory of the eminent Austrian biodiversity researcher, Konrad Thaler.

Material and Methods

Except for a few unexamined but trustworthy data quoted from the literature, I determined or re-determined all specimens reported here. Overly vague and uncheckable records (e.g., "Austria", "*Chionea* sp.") were disregarded. Public and private collections contributed only a small part to the data; most snow flies were directly lent from the collectors who kindly permitted deposition of vouchers in the Naturhistorisches Museum Wien and in my comparative collection. These specimens are stored in toto or dissected in 70% ethanol, or dismembered as permanent slides in the water-soluble mounting medium, Marc André II. Apart from the original descriptions, a number of papers provided helpful diagnostic information, especially Burghele-Bălăcesco 1969, Krzeminski 1982, Grootaert 1984, Reusch 1988, and, for the exemplary treat-

Fig. 2. Antenna of *Chionea araneoides* (left) and *Chionea austriaca* (right).

ment of North American species, Byers 1983. Nomenclature conforms to the online databases "Fauna Europaea" and "Catalogue of the craneflies of the world" (Oosterbroek 2004, 2006), and to the recently published review of the European *Chionea* craneflies (Oosterbroek & Reusch 2008) which contains an illustrated key to all recognized species of Europe.

Results

Identification of Austrian *Chionea* spp.

Four species of the genus *Chionea* have been recorded in Austria. *Ch. belgica* is included in the following key because records from southern Germany and Switzerland (Reusch 1997) suggest a possible occurrence in Austria. Presently, females of *Ch. lutescens*, *belgica* and *austriaca* cannot be distinguished with accuracy.

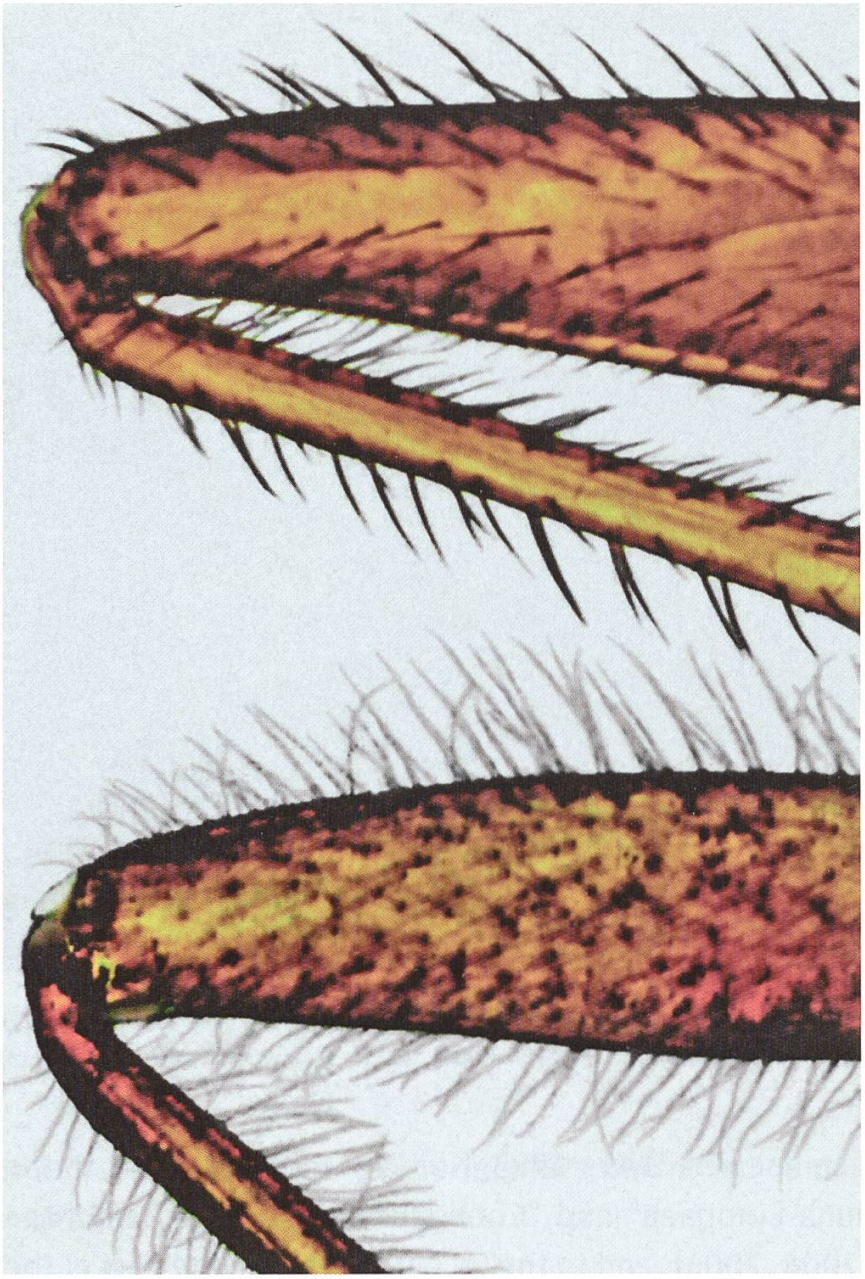

Fig. 3. Knee region of the third leg. *Chionea alpina* (top), *Chionea austriaca* (bottom).

1 The tip of the third, conical antennomere (i.e. the first flagellar joint) lies in the proximal half or in the middle of the antenna, followed by more than four thin tubular flagellomeres (Fig. 2). Penis short and compact .....
..... ***Chionea (Chionea) araneoides*** DALMAN, 1816

– The tip of the conical antennomere lies in the distal half of the antenna, followed by three or four thin tubular flagellomeres (Fig. 2). Penis long and slender (Fig. 4) **2**

2 Most leg setae spinelike (Fig. 3, top). Penis filaments curled, much longer than the penis tube (Fig. 4, top right)
..... ***Chionea (Sphaeconophilus) alpina*** BEZZI, 1908

– All leg setae hairlike (Fig. 3, bottom). Penis filaments much shorter than the penis tube or lacking **3**

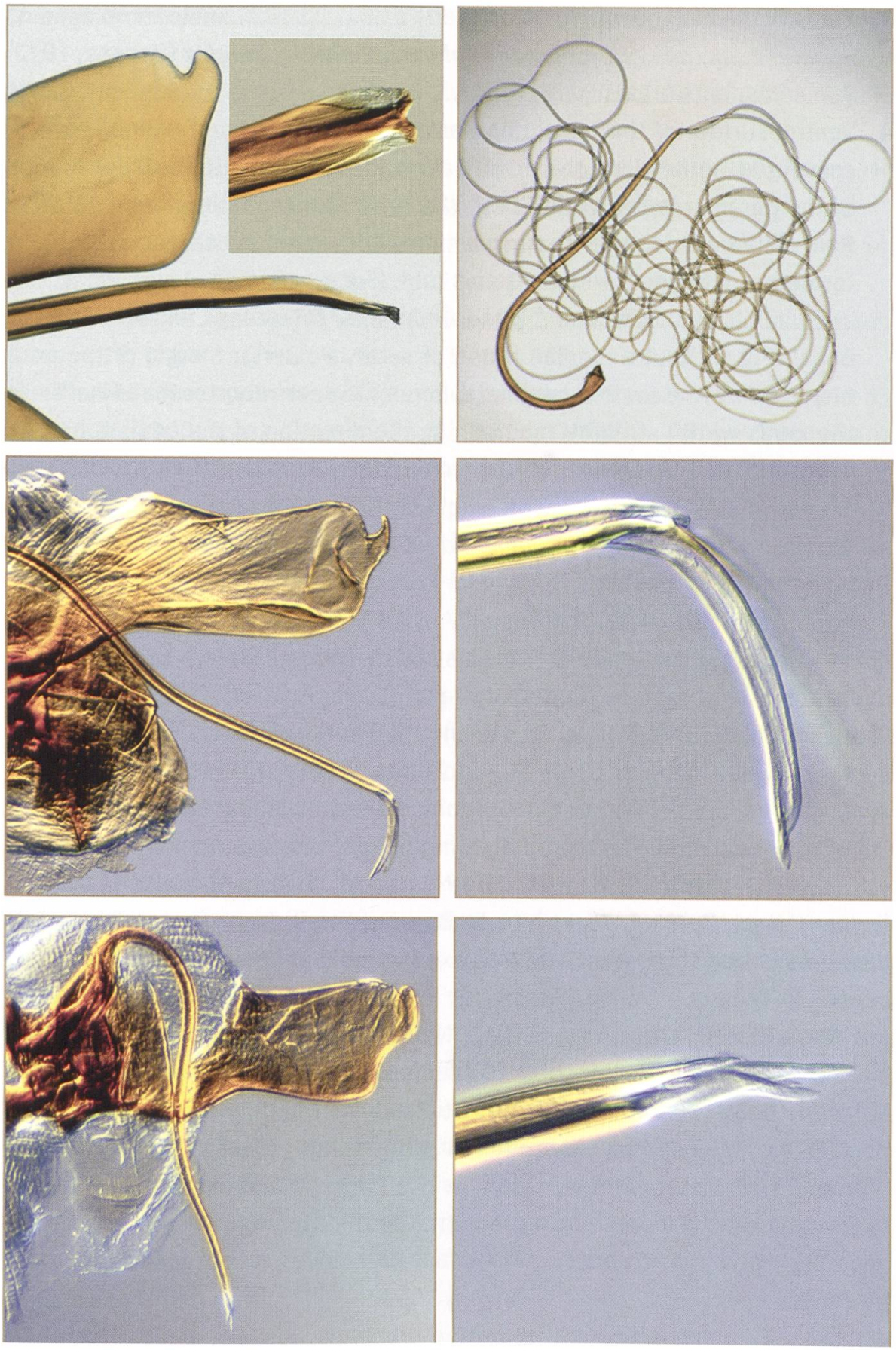

Fig. 4. Male genital structures of snow flies. Top left: *Chionea belgica*, paramere and penis, tip of penis in dorsal view (inset), specimen from Ulm, Germany, leg. W. Funke, Nov. 1983; top right: *Chionea alpina*, penis and penis filaments; middle: *Chionea lutescens*, paramere and penis (left), tip of penis with penis filaments (right); bottom: *Chionea austriaca*, paramere and penis (left), tip of penis with penis filaments (right).

3 Penis filaments absent (Fig. 4, top left) .....
..... ***Chionea (Sphaeconophilus) belgica*** (BECKER, 1912)

– Penis filaments present **4**

4 Ventral surface of the basal ring (last abdominal sternum) with a brush of converging setae along the distal half of the median line. Posterior margin of the parameres below the tooth smoothly curved, without emargination. Penis filaments longer than five times the penis width, sickle-shaped, forming a right angle with the penis tube (Fig. 4, middle) .....
..... ***Chionea (Sphaeconophilus) lutescens*** LUNDSTRÖM, 1907

– Basal ring without a median brush of setae. Posterior margin of the parameres below the tooth emarginate. Penis filaments shorter than four times the penis width, straight, maintaining the direction of the penis tube (Fig. 4, bottom) ..... ***Chionea (Sphaeconophilus) austriaca*** (CHRISTIAN, 1980)

Documentation of records

Entries are organized uniformly in this order: *Federal State* – B: Burgenland, K: Kärnten (Carinthia), N: Niederösterreich (Lower Austria), O: Oberösterreich (Upper Austria), S: Salzburg, St: Steiermark (Styria), T: Tirol (Tyrol), V: Vorarlberg, W: Wien (Vienna). *Locality* – Localities, arranged from east to west for each species, are set within a geographic frame, usually the mountain range. Cave sites are denoted by the number in the Austrian cave register in brackets, e.g. (1836/5). *Position* – E longitude / N latitude, altitude above sea level. *Collector* – "leg.". *Date of collection* – B: Barber (pitfall) trap; "before" a certain date means that the duration of trap exposition is unknown. *Number of specimens* – ♀: female, ♂: male. *Deposition* – Collections: Naturhistorisches Museum Wien, Dipterensammlung (NMW); Niederösterreichisches Landesmuseum (NÖLM); Oberösterreichisches Landesmuseum (OÖLM); Landesmuseum Kärnten (KLM); Sammlung Strobl, Stift Admont (Admont); Herbert Franz, Wien (Franz); Hans Mendl, Kempten/Allgäu (Mendl); Josef Vornatscher, Wien (Vornatscher). *Determinator* – "det."; since I determined or re-determined all specimens except those labelled n.v. (not verified), "det. E. Christian" is not separately given. *Syntopic species* – "+". *References* – occasionally followed by annotations.

N Wechselgebiet: Steyersberger Schwaig; 15 54 / 47 34, 1300 m; leg. H. Schönmann sen., 1. 2. 81: 1 ♂; Franz 1989.

N Wechselgebiet: St. Corona am Wechsel; 15 53 / 47 35, 850 m; leg. H. Schönmann sen., 14. 3. 80: 1 ♀ (NMW), + *Ch. austriaca*.

N Türnitzer Alpen: Puchenstuben: "Silver mine" Brandeben; 15 15 / 47 54, 1140 m; leg. E. Christian, 19. 8. 96–28. 8. 97 B: 2 ♀, 2 ♂, + *Ch. austriaca*.

St Schladminger Tauern: Untertal; 13 56 / 47 19, 1100 m; leg. H. Schönmann sen., 19. 1. 81: 1 ♂, + *Ch. austriaca*; Franz 1989.

K Villacher Alpe: south-east of refuge Ottohütte: Karlschacht (3741/2); 13 43 / 46 36, 1560 m; leg. G. Kuha, 26. 9. 75: 1 ♀ (NMW), + *Ch. austriaca*; Franz 1989.

K Hohe Tauern: Grossglockner High Alpine Road: Guttal; 12 49 / 47 04, 1750–1950 m; leg. K. Thaler, repeatedly between 1978 and 1980, B: altogether 127 ♀, 220 ♂, + *Ch. alpina*, *Ch. austriaca*; Franz 1989.

K Hohe Tauern: Grossglockner High Alpine Road: above the Glocknerhaus; 12 46 / 47 04, 2250 m; leg. K. Thaler, 1. 11. 78–5. 6. 79 B: 3 ♀, 1 ♂, + *Ch. austriaca*.

T Tuxer Alpen: Innsbruck: Patscherkofel; 11 27 / 47 12, 1990–2080 m; leg. G. Ebenbichler, 24. 10. 97–2. 6. 98 B: 20 ♀, 14 ♂ (1 ♀ NMW), + *Ch. alpina*, *Ch. austriaca*; Thaler 2002.

T Stubaier Alpen: Matrei am Brenner: Maria Waldrast; 11 24 / 47 07, 1400–1700 m; leg. K. Thaler, 16. 11. 76–4. 5. 77 B: 1 ♀, + *Ch. lutescens*.

T Ötztaler Alpen: Obergurgl: Festkogel; 11 03 / 46 51, 3035 m; leg. K. Thaler & B. Knoflach, 1. 11. 99–2. 6. 00 B: 1 ♂ (NMW), + *Ch. alpina*; Thaler & Knoflach 2001.

T Ötztaler Alpen: Obergurgl: Rosskar; 11 01–02 / 46 51, 2070–2230 m; leg. E. Meyer, 14. 10. 75–8. 10. 76 B: 5 ♀, 1 ♂, + *Ch. alpina*, *Ch. austriaca*.

T Stubaier Alpen: Kühtai: Finstertal reservoir; 11 01 / 47 11, 2200 m; leg. K. Schmölzer, 21. 10. 51: no. of ind. unknown, + *Ch. lutescens*; det. P. Nielsen (n.v.); Schmölzer 1962.

T Ötztaler Alpen: Obergurgl: Rotmoos: glacier foreland; 11 01 / 46 50, 2300 m; leg. R. Kaufmann, 12. 10. 96–1. 11. 97 B: 7 ♀, 9 ♂, + *Ch. alpina*, *Ch. austriaca*.

V Rätikon: Lünersee: station at the bottom of the cableway; 09 45 / 47 04, 1570 m; leg. W. Breuss, 6. 10. 95–1. 5. 96 B: 34 ♀, 16 ♂, + *Ch. alpina*, *Ch. lutescens*.

N "N/Na" = Lower Austria, Northern Alps (no further indications), sub *Niphadobates* [sic!] *alpina*; det. n. v. ("Christian" erroneously stated as informant); Franz 1990.

N Schneeberg: Almgatterl; 15 47 / 47 47, 1520 m; leg. H. Wiesbauer, 14. 3. 09: 1 ♂.

St Tonionalpe: Nixgrotte (1762/21); 15 23 / 47 42, 1545 m; leg. H. Lammer, 25. 5. 87–9. 8. 87 B: 2 ♀, 1 ♂ – The two females contained fully developed eggs.

St Lassingalpen: Weinbergerloch (1813/5); 15 16 / 47 44, 1230 m; leg. A. Mayer, 8. 8. 76: 1 ♂ carcass (NMW); det. H. Reusch; Franz 1989.

St Hochschwab: Langsteinhöhle (1742/1); 14 58 / 47 34, ca. 1450 m; leg. A. Pscherer, 11. 12. 94: 1 ♂.

St Hochschwab: Langsteineishöhle (1744/1); 14 58 / 47 34, 1600 m; coll., date and no. of ind. unknown; det. n.v.; Strouhal & Vornatscher 1975.

St Ennstaler Alpen: Lugauer: Haselkar; 14 42 / 47 32, 1620 m; leg. H. Sattmann, 28. 1. 84: 1 ♀, 1 ♂.

K Saualpe: Nixlucke (2753/1); 14 40 / 46 56, 1525 m; leg. H. Mixanig, 8. 11. 84: 1 ♀.

K Karawanken: Hochobir: mining gallery; 14 29 / 46 30, 2000 m; leg. M. Fischhuber, before 5. 9. 87 B: 2 ♀, 3 ♂, + *Ch. austriaca*.

St Warscheneck: Steileckhöhle (1635/6); 14 05 / 47 35, 1160 m; leg. K. Gaisberger, repeatedly 1979 and 1980 B: 19 ♀, 18 ♂; Franz 1989 – One female (collected in Dec. 1979) contained 129 eggs, each 520–550 µm in length and 260–270 µm in width.

O Totes Gebirge: Westliche Leckkogelhöhle (1625/8); 14 03 / 47 40, 1800 m; leg. J. Wirth, before 15. 8. 83 B: 2 ♀, + *Ch. austriaca*.

St Totes Gebirge: Schafsteinhöhle (1625/100); 14 00 / 47 36, 1813 m; leg. J. Wirth, Aug. 1983 B: 1 ♀.

St Totes Gebirge: Krahstein-Bärenhöhle (1622 /13); 13 59 / 47 34, 1480 m; leg. K. Gaisberger, before 1. 6. 80 B: 4 ♀, 1 ♂, + *Ch. austriaca*; Gaisberger 1984.

St Totes Gebirge: Große Brettsteinhöhle (1625/36); 13 58 / 47 37, 1580 m; 1965; leg. G. Graf, 1965: no. of ind. unknown; det. J. Vornatscher (n.v.); Graf 1965, Gaisberger 1984.

St Totes Gebirge: Untere Brettsteinbärenhöhle (1625/33); 13 58 / 47 37, 1670 m; leg. K. Gaisberger, before 12. 7. 81 B: 1 ♀, 1 ♂; Gaisberger 1984, Franz 1989.

St Totes Gebirge: Kriemandlhöhle (1622/8); 13 58 / 47 35, 1740 m; leg. K. Gaisberger, before 30. 7. 80 B: 19 ♀, 6 ♂; Gaisberger 1984, Franz 1989.

St Totes Gebirge: Elmhöhlensystem (1624/38) s; 13 57 / 47 41, 1653 m; leg. K. Gaisberger, 31. 7. 86 B?: 4 ♀, 2 ♂.

St Totes Gebirge: Salzofenhöhle (1624/31); 13 56 / 47 40, 2005 m; leg. K. Gaisberger, 5. 8. 80–25. 7. 81 B: 3 ♀, 1 ♂; Gaisberger 1984, Franz 1989.

St Totes Gebirge: Roterd-Bärenhöhle (1627/30); 13 52 / 47 42, 1650 m; leg. K. Gaisberger, 8. 9. 82–9. 7. 83 B: 25 ♀, 31 ♂; Gaisberger 1984.

St Totes Gebirge: Bärenhöhle beim Wildensee (1627/7); 13 51 / 47 42, 1770 m; leg. K. Gaisberger, 9. 9. 82–31. 10. 82 B: 1 ♀.

St Totes Gebirge: Talerkogelhöhle (1621/24); 13 51 / 47 35, 1600 m; leg. K. Gaisberger, 7. 6. 81–30. 8. 81 B: 1 ♀, 4 ♂; 7. 6. 81–7. 11. 82 B: 5 ♀, 6 ♂; Gaisberger 1984.

St Dachstein: Mausbendlloch (1548/2); 13 51 / 47 30, 1605 m; leg. K. Gaisberger, 31. 7. 81–11. 7. 82 B: 1 ♀, 1 ♂, + *Ch. austriaca*.

St Totes Gebirge: Klammkogelhöhle (1627/29); 13 49 / 47 38, 1660 m; leg. K. Gaisberger, before 20. 7. 80 B: 10 ♀, 20 ♂; Gaisberger 1984, Franz 1989.

St Totes Gebirge: Schoberwiesloserbärenhöhle (1624/4); 13 49 / 47 38, 1715 m; leg. A. Auer, 1964: no. of ind. unknown; det. J. Vornatscher (n.v.); Auer 1962, Gaisberger 1984.

St Dachstein: Elchhöhle (1548/22); 13 49 / 47 30, 1640 m; leg. A. Auer, 1966: no. of ind. unknown; det. n.v.; Auer & Mais 1968.

St Totes Gebirge: Elchhöhle (1623/31); 13 48 / 47 40, 1630 m; leg. K. Gaisberger, 1972: no. of ind. unknown; det. J. Vornatscher (n.v.); Gaisberger 1976, 1984.

St Totes Gebirge: Schichtgrenzhöhle (1623/33); 13 47 / 47 39, 1570 m; leg. K. Gaisberger, 3. 12. 82–6. 7. 83 B: 14 ♀, 6 ♂, + *Ch. austriaca*; Gaisberger 1984.

St Totes Gebirge: Pseudoskorpionhöhle (1623/63); 13 47 / 47 39, 1625 m; leg. K. Gaisberger, before 19. 7. 79 B: 3 ♀, 2 ♂ (NMW); det. H. Reusch; Gaisberger 1984, Franz 1989.

St Totes Gebirge: Biwakhöhle (1623/67); 13 47 / 47 39, 1670 m; leg. K. Gaisberger, 1976: 1 ♀ (NMW); Gaisberger 1984, Franz 1989.

St Totes Gebirge: Wisenthöhle (1623/75); 1347 / 4739, 1680 m; leg. K. Gaisberger, 24. 11. 84–12. 7. 86 B: 1 ♀, 2 ♂, + *Ch. austriaca*.

St Totes Gebirge: Großes Loserloch (1623/8); 1346 / 4739, 1615 m; leg. K. Gaisberger, 1972: 1 ♀, 1 ♂, det. J. Vornatscher; before 19. 5. 79 B: 1 ♀, 2 ♂ (NMW), det. H. Reusch; Gaisberger 1976, 1984, Franz 1989.

O Dachstein: Dachstein-Rieseneishöhle (1547/17); 1343 / 4732, ca. 1430 m; leg. J. Vornatscher, 18. 8. 67 B?: 1 ♂ (NMW); leg. H. Schönmann, 9. 12. 84: 2 ♀, 2 ♂; Strouhal & Vornatscher 1975, Franz 1989.

O Dachstein: Kraulhöhle (1547/14); 13 43 / 47 32, 1430 m; leg. K. Gaisberger, before 16. 7. 79 B: 1 ♀, 1 ♂ (NMW); det. H. Reusch.

O Dachstein: Backofen (1547/11); 13 43 / 47 32, 1450 m; leg. K. Gaisberger, before 16. 7. 79 B: 5 ♀, 1 ♂ (NMW); det. J. Vornatscher.

St Östliche Trauntaler Alpen, Leisling-Excentriqueshöhle (1611/26); 13 42 / 47 37, 950 m; leg. K. Gaisberger, 27. 12. 80–14. 5. 81 B: 2 ♀; Franz 1989.

St Östliche Trauntaler Alpen: Gamsgruben-Eishöhle (1611/35); 13 42 / 47 36, 1720 m; leg. A. Achleitner, before 2. 7. 83 B: 1 ♀, 2 ♂, + *Ch. austriaca*.

O Dachstein: Dachstein-Mammuthöhle (1547/9); 13 42 / 47 32, ca. 1350 m; leg. J. Vornatscher, Sept.–Dec.1962 B: 1 ♀, 10 ♂ (NMW), det. H. Reusch; leg. A. Vorderbrunner, 29. 12. 86: 1 ♂; Vornatscher 1964, Strouhal & Vornatscher 1975, Bourne 1979, Franz 1989.

O Östliche Trauntaler Alpen: Höhle bei der Niederen Sarsteinalm (1611/21); 13 41 / 47 36, 1710 m; leg. A. Achleitner, before 2. 7. 83 B: 2 ♀.

St Schladminger Tauern: Durchgangshöhle auf der Steirischen Kalkspitze (2622/2); 13 37 / 47 16, 2385 m; leg. K. Gaisberger, 21. 9. 80– 20. 9. 81 B: 2 ♀, 7 ♂; Franz 1989.

O Östliche Trauntaler Alpen: Anzenau: Höllenloch (1612/1); 13 36 / 47 39, 540 m; leg. K. Gaisberger, before 19. 11. 77 B: 5 ♀, 2 ♂.

K Hohe Tauern: Grossglockner High Alpine Road, Guttal; 12 49 / 47 04, 1750–1950 m; repeatedly between 1978 and 1980, B; leg. K. Thaler; altogether 6 ♀, 4 ♂, + *Ch. araneoides*, *Ch. austriaca*; Franz 1989.

S Kitzbüheler Alpen: Zell am See: Schmittenhöhe; 12 44 / 47 19, 1900 m; leg. H. Hölzel, 9. 2. 63: 1 ♀ (KLM).

T Zillertaler Alpen: Hornkees: glacier margin; 11 49 / 47 00, 2000 m; leg. B. Gereben, Sept. 1987: 1 ♂.

T Tuxer Alpen: Innsbruck: Patscherkofel; 11 27 / 47 12, 1990–2200 m; leg. G. Ebenbichler, 25. 8. 97–15. 9. 97 B: 1 ♂; 6. 10. 97–2. 6. 98 B: 33 ♀, 25 ♂ (NMW), + *Ch. araneoides*, *Ch. austriaca*; Thaler 2002.

T Innsbrucker Nordkette: Gleirschkar east of the Hafelekarspitze; 11 23 / 47 18, 2200 m; leg. K. Thaler, 15. 8. 76–26. 10. 76 B: 1 ♀; 26. 10. 76–30. 6. 77 B: 1 ♀ (NMW); Thaler 1977, Franz 1989.

T Innsbrucker Nordkette: Seegrube/Hafelekar; 11 22–23 / 47 18, 2280–2325 m: leg. H. Geiler, 24. 9.–22. 10. 79 B: 6 ♀, 5 ♂, + *Ch. austriaca*; 1890–2300 m: leg. A. Rief, 16. 9. 97–3. 6. 98 B: 87 ♀, 104 ♂ (NMW), + *Ch. austriaca*, *Ch. lutescens*; Thaler 2002.

T Ötztaler Alpen: Obergurgl: Festkogel; 11 03 / 46 51, 3000–3035 m; leg. K. Thaler & B. Knoflach, 30. 8.–2. 10. 99 B: 1 ♀, 1 ♂; 1. 11. 99–2. 6. 00 B: 2 ♂; 27. 9. 00–24. 6. 01 B: 3 ♀, 3 ♂ (NMW), + *Ch. araneoides*; Thaler & Knoflach 2001.

T Ötztaler Alpen: Obergurgl: Rosskar; 11 01–02 / 46 51, 2070 m; leg. E. Meyer, 14. 10. 75–8. 10. 76 B: 4 ♂, + *Ch. araneoides*, *Ch. austriaca*.

T Ötztaler Alpen: Obergurgl: Rotmoos: glacier foreland; 11 01–02 / 46 49–50, 2250–2400 m; leg. R. Kaufmann, 12. 10. 96–10. 6. 97 B: 8 ♀, 7 ♂; 10. 6. 97–1. 11. 97 B: 27 ♀, 21 ♂, + *Ch. araneoides*, *Ch. austriaca*.

T Ötztal: Ötztal Bahnhof: Forchet, Aubichl; 10 50 / 47 13, 800 m; leg. K. Thaler, 23. 11. 91–8. 3. 92 B: 1 ♀ (NMW); Thaler 2002.

T Lechtaler Alpen: Tarrenz: Antelsberg; 10 47 / 47 16, 900 m; leg. A. Rief & K. Thaler, 24. 10. 99– 24. 3. 00 B: 6 ♀, 5 m; Thaler 2002.

V Illtal: Bürser Schlucht; 09 47 / 47 08, 580 m; leg. W. Breuss, 27. 11. 95–2. 6. 96 B: 1 ♀, 5 ♂, + *Ch. lutescens*.

V Bregenzerwald: Große Freschenhöhle (1111/7); 09 46 / 47 17, 1860 m; leg. W. Breuss, 9. 10. 05: 1 ♂.

V Brandner Tal: Daleuwald near Galaverda; 09 45 / 47 07, 1060 m; leg. W. Breuss, 27. 11. 95–1. 5. 96 B: 2 ♀, 1 ♂, + *Ch. lutescens*.

V Rätikon: Lünersee: station at the bottom of the cableway; 09 45 / 47 04, 1570 m; leg. W. Breuss, 6. 10. 95–1. 5. 96 B: 24 ♀, 46 ♂, + *Ch. araneoides*, *Ch. lutescens*.

V Rätikon: near refuge Totalphütte; 09 43 / 47 03, 2340 m; leg. W. Breuss, 6. 10. 95–2. 6. 96 B: 4 ♀, 6 ♂.

V Bregenzerwald: Große Baschghöhle (1112/1) and surroundings; 09 39 / 47 14, 780 m; leg. W. Breuss, 1990–91 B: 2 ♀, 3 ♂, + *Ch. lutescens*; Breuss 1995, Breuss 2004.

V Walgau: Spiegelsteinhöhle (1112/4) and surroundings; 09 38 / 47 14, 675 m; leg. W. Breuss, 1990–91 B : 9 ♀, 11 ♂; Breuss 1995.

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? "Wildgrube" (no further indications); leg. G. Strobl?, 1887: 2 ♀, 5 ♂ (Admont).

N Bisamberg; 16 22 / 48 12, 330 m; leg. H. Schweiger, 8. 12. 72: 1 ♂; Franz 1989.

W Wien (no further indications); leg. J. Mik: 1 ♂ (NÖLM).

W Wien: Sievering: Neuberg; 16 18 / 48 15, 320 m; leg. J. Gruber, 20. 12. 80: 2 ♂ (NMW); Franz 1989.

W Wien: Halterbachtal; 16 14 / 48 14, 360 m; leg. E. Christian, 1. 3. 06: 2 ♀.

W Wien: Gütenbachtal; 16 14 / 48 08, 290 m; leg. W. Bittermann, 24. 11. 82–15. 1. 83 B: 3 ♀, 2 ♂.

B Bernsteiner Gebirge: Bad Tatzmannsdorf: Spa gardens; 16 13 / 47 20, 350 m; leg. E. Christian, 6. 2. 83: 2 ♀.

N Südlicher Wienerwald: Bad Vöslau; 16 12 / 47 58, ca. 300 m; leg. W. Kühnelt, date unknown: 2 ♂; Franz 1989.

N Südlicher Wienerwald: Merkensteinhöhle (1911/32); 16 08 / 47 58, 440 m; leg. E. Christian, 27. 11. 77–1. 4. 78 B: 2 ♀ (NMW), 1 ♂; Franz 1989.

N Nördlicher Wienerwald: Rekawinkel; 16 02 / 48 10, 370 m; leg. J. Gruber, 26. 10. 78–19. 11. 78 B: 1 ♀, 19. 11. 78–18. 3. 79 B: 5 ♀, 8 ♂; leg. M. Mally, 10. 3. 81: 1 ♀.

N Wechselgebiet: Kirchberg am Wechsel: Eulenberg; 15 58 / 47 37, 620 m; leg. E. Christian, 21. 12. 86: 1 ♂.

N Wechselgebiet: St. Corona am Wechsel; 15 53 / 47 35, 850 m; leg. H. Schönmann sen., 14. 3. 80: 1 ♀, 6 ♂ (NMW; det. H. Reusch: *Ch. belgica*), + *Ch. araneoides*; Franz 1989.

N Gutensteiner Alpen: Kleinzell: Wendellucke = Wendelgupfhöhle (1866/16); 15 40 / 47 59, 1050 m; leg. J. Vornatscher, 1962/63 B?: 1 ♀, 1 ♂ (NMW); Strouhal & Vornatscher 1975 (sub *Ch. lutescens*), Franz 1989.

St Grazer Bergland: Schöckl; 15 27 / 47 11, altitude unknown; leg. H. Hölzel, Jan. 1971: 2 ♀.

N Türnitzer Alpen: Goldlochschwinde (1837/25); 1527 / 4756, 630 m; leg. H. Raschko, 16. 7. 80–28. 2. 81 B: 1 ♂; Franz 1989.

N Türnitzer Alpen: Schoberberghöhle (1836/51); 15 24 / 47 55, 1025 m; leg. E. Christian & H. Schönmann, 4. 11. 78–23. 6. 79 B: 1 ♀, 2 ♂ (NMW; det. H. Reusch: *Ch. belgica*), Franz 1989.

N Türnitzer Alpen: Schwarzenbach an der Pielach: Eisgrube (1836/50); 15 23 / 47 55, 930 m; leg. E. Christian & H. Schönmann, 4. 11. 78–23. 6. 79 B: 8 ♀, 7 ♂ (NMW; det. H. Reusch: *Ch. belgica*); Franz 1989.

N Türnitzer Alpen: Schwarzenbach an der Pielach: Schagerlhöhle (1836/5), locus typicus; 15 20 / 47 54, 940 m; leg. E. Christian & H. Schönmann, 5. 11. 78–23. 6. 79 B: 4 ♀, 2 ♂; Christian 1980, Ressl 1983, Franz 1989, Oosterbroek & Reusch 2008.

N Türnitzer Alpen: St. Anton an der Jessnitz: Kreuztanne; 15 15 / 47 56, ca. 700 m; leg. E. Hüttinger, Jan./Feb. 1972: 2 ♀, 2 ♂ (Mendl); det. H. Mendl (n. v.).

N Türnitzer Alpen: Puchenstuben: "Silver mine" Brandeben; 15 15 / 47 54, 1140 m; leg. E. Christian, 19. 8. 96–28. 8. 97 B: 2 ♀, 3 ♂, + *Ch. araneoides*.

St Grazer Bergland: Stiwoll: Oberweizberg; 15 12 / 47 06, 650 m; leg. E. Christian, 6. 1. 80: 1 ♂ (NMW); Franz 1989.

N Erlauftal: Zehnbach near Purgstall: Steinfeldberg; 15 08 / 48 02, 320 m; leg. H. Malicky, 2. 2. 70–11. 2. 70 B: 3 ♀ (Mendl), det. H. Mendl (n.v.); leg. H. Rausch, 28. 11. 70: 1 ♂ (Mendl), det. H. Mendl (n.v.).

N Erlauftal: Feichsen near Purgstall; 15 06 / 48 03, ca. 350 m; leg. E. Hüttinger, 11. 2. 70–19. 2. 70 B: 1 ♀, 1 ♂ (Mendl); det. H. Mendl (n.v.).

N Ybbstaler Voralpen: Surroundings of Lunz am See; 15 04 / 47 50, ca. 620 m; leg. H. Malicky, 15. 1. 71: 1 ♂; 4. 1. 73: 1 ♀; 12. 2. 73: 1 ♀ (Mendl); det. H. Mendl (n.v.).

N Ybbstaler Voralpen: Lunz am See: Bodingbach; 15 00 / 47 52, 600 m; leg. T. Kust, 21. 12. 92: 1 ♀.

N Ybbstaler Voralpen: Lunz am See: Übelgraben; 14 59 / 47 50, 740 m; leg. T. Kust, 15. 1. 94: 1 ♂.

N Ybbstaler Voralpen: Lunz am See: Jägergraben; 14 58 / 47 52, 670 m; leg. T. Kust, 2. 1. 94: 1 ♂.

N Ybbstaler Voralpen: Lunz am See: Preselreith; 14 58 / 47 52, 680 m; leg. T. Kust, 29. 1. 95: 2 ♂.

N Ybbstaler Voralpen: Lunz am See: Wilhelminenhöhle (1823/7); 14 58 / 47 50, 695 m; leg. M. Fischhuber, before 26. 5. 84 B: 3 ♀.

N Ybbstaler Voralpen: Lunz /See: Brunngrabenhöhle (1823/15); 14 58 / 47 50, 860 m; leg. M. Fischhuber, before 29. 9. 84 B: 1 ♀.

N Ybbstaler Voralpen: Lunz am See: Hirschfallhöhle (1823/5); 14 58 / 47 50, 930 m; leg. M. Fischhuber, before 29. 9. 84 B: 2 ♀, 2 ♂.

N Ybbstaler Voralpen:Lunz am See: Schwabenreithhöhle (1823/32); 14 58 / 47 50, 950 m; leg. H. Malicky, Oct.78–10. 9. 79 B: 17 ♀, 6 ♂ (Ressl); leg. M. Fischhuber, before 30. 4. 83: 4 ♀; before 30. 6. 84: 3 ♀; Ressl 1983, Franz 1989 – Two females (leg. H. Malicky) were dissected; they contained 69 eggs (545–570 µm in length, 245–260 µm in width) and 85 eggs (530–580 µm in length, 260–280 µm in width).

N Ybbstaler Voralpen: Lunz am See: Apostelfeichtnhöhle (1823/1); 14 57 / 47 49, 900 m; leg. M. Fischhuber, before 21. 9. 85 B: 1 ♀, 1 ♂.

St Ennstaler Alpen: Johnsbach; 14 36 / 47 31, 860 m; collector unknown, 19. 2. 43: 1 ♀ (NMW).

St Ennstaler Alpen: Lahngangkogel, near refuge Oberst-Klinke-Hütte; 14 30 / 47 32, 1600 m; leg. H. Sattmann, 15. 1. 84: 1 ♂; Franz 1989.

K Karawanken: Obir: gallery below the refuge Eisenkapplerhütte; 14 30 / 46 30, 1530 m; leg. M.E. Schmid, before 19. 8. 80 B: 1 ♀.

K Karawanken: Hochobir: mining gallery; 14 29 / 46 30, 2000 m; leg. M. Fischhuber, before 5. 9. 87 B: 2 ♀, 3 ♂, + *Ch. alpina*.

St Ennstaler Alpen: Admont: Kaiserau; 14 28 / 47 31, 1120 m; leg. H. Franz, date unknown: 1 ♂ (NMW; det. H. Reusch: *Ch. ?belgica*).

St Ennstaler Alpen: Admont: Röthelstein; 14 27 / 47 34, 830 m; leg. H. Franz, date unknown: 1 ♀ (Franz); Franz 1989.

St Grebenzen: Zeutschach; 14 21 / 47 03, 1100 m; leg. H. Gross, 21. 2. 91: 1 ♂.

K Klagenfurt: Viktring; 14 16 / 46 35, 460 m; leg. E. Hölzel, 24. 12. 67: 1 ♀ (KLM).

O Totes Gebirge: Westliche Leckkogelhöhle (1625/8); 14 03 / 47 40, 1800 m; leg. J. Wirth, before 15. 8. 83 B: 1 ♀, + *Ch. alpina*.

St Totes Gebirge: Krahstein-Bärenhöhle (1622 /13); 13 59 / 47 34, 1480 m; leg. K. Gaisberger, before 1. 6. 80 B: 1 ♀, + *Ch. alpina*; Gaisberger 1984 (sub *Ch. lutescens*).

St Sölktal: between Stein an der Enns and St. Nikolai (no further indications); leg. H. Franz: 1 ♂ (Franz); Franz 1989.

St Schladminger Tauern: Untertal ; 13 56 / 47 19, 1100 m; leg. H. Schönmann sen., 19. 1. 81: 1 ♀, + *Ch. araneoides*; Franz 1989.

St Totes Gebirge: Höhle am Schödlkogel (1621/13); 13 54 / 47 34, 940 m; leg. K. Gaisberger, before 30. 3. 78 B: 1 ♂ (NMW; det. H. Reusch: *Ch. belgica*), before 18. 10. 80 B: 1 ♀, 1 ♂; Gaisberger 1984, Franz 1989.

St Dachstein: Mausbendlloch (1548/2); 13 51 / 47 30, 1605 m; leg. K. Gaisberger, 31. 7. 81–11. 7. 82 B: 2 ♂, + *Ch. alpina*.

K Villacher Alpe: Graschelitzen; 13 49 / 46 34, 540 m; leg. E. Christian, 16. 2. 96: 1 ♂.

St Dachstein: Hochstubeneishöhle (1548/14); 13 48 / 47 30, 1740 m; collector and date unknown: 1 ♀ (NMW); Strouhal & Vornatscher 1975 (sub *Ch. alpina*).

St Totes Gebirge: Schichtgrenzhöhle (1623/33); 13 47 / 47 39, 1570 m; leg. K. Gaisberger, 3. 12. 82–6. 7. 83 B: 1 ♀, + *Ch. alpina*; Gaisberger 1984.

St Totes Gebirge: Wisenthöhle (1623/75); 13 47 / 47 39, 1680 m; leg. K. Gaisberger, 24. 11. 84–12. 7. 86 B: 1 ♀, + *Ch. alpina*.

K Gurktaler Alpen: Innerkrems; 13 43 / 46 57, 1500 m; leg. E. Hölzel, 15. 3. 52: 1 ♂ (KLM).

K Villacher Alpe: south-east of refuge Ottohütte: Karlschacht (3741/2); 13 43 / 46 36, 1560 m; leg. G. Kuha, 26. 9. 75: 3 ♀ (NMW), + *Ch. araneoides*.

St Östliche Trauntaler Alpen: Gamsgruben-Eishöhle (1611/35); 13 42 / 47 36, 1720 m; leg. A. Achleitner, before 2. 7. 83 B: 1 ♀, + *Ch. alpina*.

St Ennstal: Schladming; 13 41 / 47 23, 750 m; leg. H. Schönmann sen., 24. 1. 80: 2 ♀, 2 ♂ (NMW; det. H. Reusch: *Ch. belgica*).

St Ennstal: Schladming: Talbachklamm; 13 41 / 47 23, ca. 800 m; leg. H. Schönmann sen., 18. 1. 81: 1 ♀; Franz 1989.

O Westliche Trauntaler Alpen: Nixhöhle am Jainzen (1566/18); 13 37 / 47 43, 750 m; leg. K. Gaisberger, 8. 1. 83–17. 4. 83 B: 1 ♀.

S Hohe Tauern: Bad Gastein: Stubnerkogel; 13 06 / 47 06, 1850 m; leg. H. Troger, 3. 10. 79 (Baermann extraction): 7 ♀, 23 ♂; Franz 1989.

K Hohe Tauern, Grossglockner High Alpine Road: Hochtor; 12 50 / 47 05, 2500 m; leg. K. Thaler, 11. 9.–1. 11. 78 B: 1 ♀.

K Hohe Tauern, Grossglockner High Alpine Road: Guttal; 12 49 / 47 04, 1750–1950 m; leg. K. Thaler, repeatedly between 1978 and 1980, B: altogether 13 ♀, 21 ♂, + *Ch. araneoides*, *Ch. alpina*; Franz 1989.

K Hohe Tauern, Grossglockner High Alpine Road: above the Glocknerhaus; 12 46 / 47 04, 2250 m; leg. K. Thaler, 1. 11. 78–5. 6. 79 B: 19 ♀, 24 ♂, + *Ch. araneoides*.

T Tuxer Alpen, Innsbruck: Patscherkofel; 11 27 / 47 12, 1990–2140 m; leg. G. Ebenbichler, 15. 9.–6. 10. 97 B: 1 ♂ (NMW), + *Ch. araneoides*, *Ch. alpina*; Thaler 2002 (sub *Ch. lutescens/austriaca*).

T Innsbrucker Nordkette: Hafelekar; 11 22–23 / 47 18, 2280–2320 m; leg. H. Geiler, 24. 9.–22. 10. 79 B: 9 ♀, 14 ♂, + *Ch. alpina*; leg. G. Ebenbichler & A. Rief, 16. 9. 97–7. 10. 97 B: 1 ♂ (NMW), + *Ch. alpina*.

T Ötztaler Alpen: Obergurgl: Rosskar; 11 01–02 / 46 51, 1960–2230 m; leg. E. Meyer, 14. 10. 75–8. 10. 76 B: 9 ♀, 28 ♂, + *Ch. araneoides*, *Ch. alpina*.

T Ötztaler Alpen: Obergurgl: Rotmoos: glacier foreland; 11 01–02/46 50, 2250–2300 m; leg. R. Kaufmann, 12. 10. 96–1. 11. 97 B: 10 ♀, 16 ♂, + *Ch. araneoides*, *Ch. alpina*.

Chionea (Sphaeconophilus) lutescens

O Hausruck: Pilgersham near Haag; 13 35 / 48 10, 550 m; leg. G. Bergthaler, 2. 11. 97–22. 2. 98 B: 149 ♀, 175 ♂.

T Tuxer Alpen: Rinn near Innsbruck; 11 30 / 47 15, 900 m; leg. S. Flatz, repeatedly in winter 1978/79: altogether 10 ♀, 3 ♂.

T Tuxer Alpen: Innsbruck: Patscherkofel; 11 27 / 47 12, 1990–2140 m; leg. G. Ebenbichler, 15. 9. 97–2. 6. 98 B: 31 ♀, 36 ♂, + *Ch. araneoides*, *Ch. alpina*; Thaler 2002 (sub *Ch. lutescens/austriaca*).

T Stubaier Alpen: Matrei am Brenner: Maria Waldrast; 11 24 / 47 07, 1400–1700 m; leg. K. Thaler, 16. 11. 76–4. 5. 77 B: 16 ♀, 12 ♂, + *Ch. araneoides*.

T Innsbrucker Nordkette: Seegrube; 11 22–23 / 47 18, 1890–1980 m; leg. A. Rief, 16. 9. 97–3. 6. 98 B: 10 ♀, 11 ♂, + *Ch. alpina*; Thaler 2002 (sub *Ch. lutescens/austriaca*).

T Surroundings of Innsbruck; above 600 m; leg. K. Thaler, 29. 8. 76–17. 11. 76 B: 26 ♀, 26 ♂; det. H. Mendl, J. Bourne (n.v.); Bourne 1979.

T Stubaier Alpen: Kühtai: Finstertal reservoir; 11 01 / 47 11, 2200 m; leg. K. Schmölzer, 21. 10. 51; no. of ind. unknown, + *Ch. araneoides*; det. P. Nielsen (n.v.); Schmölzer 1962.

V? Bodensee (no further indications); leg. L. Czerny; 2 ♀, 1 ♂ (OÖLM); Mendl 1978.

V Illtal: Bürser Schlucht; 09 47 / 47 08, 580 m; leg. W. Breuss, 27. 11. 95–2. 6. 96 B: 1 ♂, + *Ch. alpina*.

V Allgäuer Voralpen: Ruggburg near Hörbranz; 09 46 / 47 32, 675 m; no further indications: 4 ♂ (NMW).

V Brandner Tal: Daleuwald near Galaverda; 09 45 / 47 07, 1060 m; leg. W. Breuss, 27. 11. 95–1. 5. 96 B: 1 ♀, 3 ♂, + *Ch. alpina*.

V Rätikon: Lünersee: station at the bottom of the cableway; 09 45 / 47 04, 1570 m; leg. W. Breuss, 6. 10. 95–1. 5. 96 B: 16 ♀, 17 ♂, + *Ch. araneoides*, *Ch. alpina*.

V Bregenzerwald: Surroundings of the Große Baschghöhle (1112/1); 09 39 / 47 14, 780 m; leg. W. Breuss, before 22. 12. 90 B: 1 ♂, + *Ch. alpina*; Breuss 1995, Breuss 2004.

Discussion

It is premature to compare the distribution patterns of *Chionea* craneflies in Austria because vast regions in the northern provinces have been poorly, if ever, sampled. Sampling effort and density of sampling sites have varied greatly over the federal territory. In parts of the country, especially in the east, most snow flies were hand sampled, whereas there was extensive (although not *Chionea*-aimed) pitfall trapping in long-term study areas of the western federal states and in certain cave districts. Nevertheless, tentative borderlines can be drawn across the Austrian map.

According to Oosterbroek & Reusch (2008), *Chionea araneoides* has a European distribution and occurs in the north of the continent and in the mountains of Central Europe and Romania. This widely scattered species, recorded in Austria between 850 and more than 3000 m a.s.l., clearly avoids the eastern hilly landscape and the adjacent plains. At the highest sites, *Ch. araneoides* co-occurs with *Ch. alpina*.

Ch. alpina, distributed in the mountains of Central and South Europe (see Oosterbroek & Reusch 2008), likewise prefers upper montane and alpine zones, but exhibits a wide altitudinal range down to 540 m. Turquin (1973) reported on cave records in the French Jura Mountains at 300–600 m, at sites with exceptionally cold microclimate. While the sparsity of records in the mountain regions of southern Lower Austria may be due to incomplete sampling, an occurrence in the east Austrian lowland is highly improbable for climatic reasons.

Only *Ch. austriaca* descends down to the colline zone and touches the Vienna Basin at 290 m. Syntopic occurrences with *Ch. araneoides* and *Ch. alpi-*

na at altitudes of 2000–2500 m, however, indicate high ecological tolerance. Originally described from a cave in Lower Austria (Christian 1980), *Ch. austriaca* reaches the western limits of distribution in the Innsbruck region, where a narrow overlap with the *Ch. lutescens* area was observed. The northern limits and thus a possible approach to the *Ch. belgica* area are not documented. Eastwards, records of *Ch. austriaca* cover the entire area of Austria except the unsampled regions north of the Danube River. The known range of distribution ends in southern Slovenia (Novak & al. 2007), northern Italy (Oosterbroek & Reusch 2008), and in the Bakony forest in Hungary (Alba Regia Cave near Isztimér, leg. I. Eszterhás, 2 ♀ Nov. 1978, 1 ♂ Feb. 1981, Christian unpubl.).

The West Palearctic *Ch. lutescens* has been recorded in the western part of Austria at altitudes between 550 and 2300 m. North of the overlap zone with *Ch. austriaca* in the Tyrolean Inn valley, which marks a distinct boundary, the borderline is blurred. Though an Upper Austrian record suggests that *Ch. lutescens* may spread further to the east in northern parts of the country, the presence of this species in the region of Vienna, as supposed by Lundström (1907) and Lackschewitz (1940), remains unreliable. The voucher specimens of the latter publication, formerly kept in the NMW collection, are lost; they probably belonged to *Ch. austriaca*.

Ch. lutescens exhibits a wide geographic and ecological range, provided that the morphological variants traditionally assigned to this taxon belong to a coherent entity. This caveat also applies to *Ch. belgica* and *Ch. austriaca*, which are probably elements of a species group around *Ch. lutescens*, the former occupying a north-western, the latter a south-eastern area in Central Europe. At the transition of the *lutescens* to the *austriaca* range in North Tyrol, I found a small number of males with a genital morphology intermediate between *Ch. lutescens* and *Ch. austriaca*, among typical individuals of one or the other species. Morphological transitions between *Ch. austriaca* and *Ch. belgica* were not observed. The application of molecular methods could help disentangle species borders and phylogeny of the *Ch. lutescens* group.

Chionea craneflies are winter insects inasmuch as they mature and mate during the cold season. The present data largely support this general view, but provide new information on phenological peculiarities associated with cave inhabitation. Each of the four Austrian *Chionea* species has also been recorded in subterranean habitats, with the percentage of underground records being especially high in *Ch. alpina* (75%) and *Ch. austriaca* (40%). These values are biased by disproportionate sampling in caves, but they highlight the known tendency of Chioneas to sojourn in caves and artificial galleries. Snow flies probably usually invade caves in an opportunistic manner. Novak

& al. (2007) concluded that *Ch. austriaca* inhabits macrocaverns in Slovenia facultatively and only temporarily in the cold season. *Ch. alpina*, on the other hand, might maintain genuinely troglophilic populations as indicated by its "dealpine" occurrence in caves at low altitudes (e.g. Höllenloch, 540 m) and by a shift in its seasonal periodicity. The earliest above-ground record was a male from a pitfall trap exposed between Aug 25 and Sep 15 (Innsbruck: Patscherkofel), whereas pitfall traps in caves repeatedly yielded mature specimens during summer (1 ♂ and 2 ♀ ready for oviposition, May 25 – Aug 9, Nixgrotte; 4 ♂ and 1 ♀, June 7 – Aug 30, Talerkogelhöhle). So far there is no proof of successful reproduction in the subterranean habitat, however.

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