Cortestina thaleri – a new dwarf six-eyed spider from Austria and Italy (Araneae: Oonopidae: Oonopinae)

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ABSTRACT Contrib. Nat. Hist. 12: 743–771.

A new representative of the soft bodied "Oonopides molles" (Oonopinae), *Cortestina thaleri* KNOFLACH gen. nov., sp. nov., is described from Innsbruck (Austria) and Gais (Southern Tyrol, Italy). It shows an extremely flat carapace, a modified clypeus, small body size, stout legs and strongly reduced posterior spinnerets, and lacks scuta, leg spination as well as enlarged male palpal segments. The respiratory system consists of paired tracheae, book lungs being transformed to tracheae. The species appears to be specialised for subcorticolous life. It was found under bark of pine trees, where it builds delicate silk nests for resting and moulting. Egg sacs are deposited within or in the vicinity of nests of other spiders, mainly Salticidae. The egg sac contains a single huge egg. Postembryonic development apparently involves three stages, apart from an incomplete prelarval one within the egg sac. *C. thaleri* KNOFLACH gen. nov., sp. nov. is eurychronous, adult males and females, juveniles and cocoons are present throughout the year.

Keywords: taxonomy, Oonopinae, new genus, new species, respiratory system, spinnerets, postembryonic development, single egg, egg sac, eurychronous phenology

Introduction

Dedicated to Konrad Thaler (19. 12. 1940–11. 7. 2005), partner, friend, colleague and teacher, with sincere thanks for his stimulating and inspiring enthusiasm, for his loyalty and generosity in sharing his knowledge. B.K. owes him an unforgettable pleasant period of life and subtle introduction into arachnology, taxonomy and alpine zoology.

Small spiders have often been overlooked in earlier times. Nowadays it is surprising to discover new species in a well-studied mid-European region like Northern Tyrol (Austria) even in the small-sized spider families. In 2002 a single female of an enigmatic soft-bodied oonopid species was recorded by Thaler & Knoflach as doubtful *Orchestina* ? sp. Its identity and origin remained unclear. Further findings of both sexes now give reason for a more precise taxonomic placement of this dwarf six-eyed spider species. Indeed, neither comparison with material of several genera of "Oonopidae molles" nor with available descriptions from the literature allowed assignment, not even at generic level (Simon 1893a, b, 1907, 1914, Simon & Fage 1922, Dalmas 1916, Chamberlin & Ivie 1935, 1938, Denis 1937, Bryant 1940, 1942, Harvey 1987, Machado 1941, Bristowe 1948, Locket & Millidge 1951, Wiehle 1953, Marples 1955, Brignoli 1967a, b, 1972, 1979, Kraus 1967, Thaler 1981, Wunderlich 1981, 2004, Dumitrescu & Georgescu 1983, 1987, Forster & Platnick 1985, Platnick & Brescovit 1995, Höfer & Brescovit 1996, Platnick 2000, Ruffell & Kovoor 1994, Saaristo 2001, Saaristo & van Harten 2002, 2006, Saaristo & Marusik 2004; most literature on loricate Oonopidae not listed). Its special combination of characters deserves establishment of a new genus, *Cortestina thaleri* KNOFLACH gen. nov., sp. nov.

As this species had not been collected before 1995 despite intensive field work in this region (Thaler 1992, 1994, 1995, 1997a, b, 1998, 1999 a.o.), it was considered as a vagrant (Thaler & Knoflach 2002). However, the present data display a well established population in a peripheral park of Innsbruck at the university and institute of zoology and ecology. Another locality in a garden in Southern Tyrol even indicates a wider occurrence of a probably hitherto overlooked species. Generally, Oonopidae do not inhabit the northern and temperate region, apart from a few synanthropic exceptions (Miller & Zitnanska 1976, Koponen 1997, Pekar & Gajdos 2001, Saaristo 2001, Saaristo & Marusik 2004, Platnick 2009). Thus, the presence of a free-living population in an inner-alpine basin is even more remarkable. With the recent discovery of males and other specimens a full description of this species can now be presented, together with notes on natural history.

Material and Methods

Specimens were examined with a Wild M8 stereo microscope. For drawings of genitalia a Wild M20 compound microscope was used. Female genital organs were immersed in Hoyers compound fluid or in clove oil. For leg measurements, legs were separated from the body of the spider, prepared as perman-

Figs. 1–4. *Cortestina thaleri* Knoflach gen. nov., sp. nov. Male dorsal (1), ventral (2–3) and lateral (4) view. (3) Male in silk nest. Automontage digital photos. (1–2) males from Innsbruck, June 2005, (3) April 2006, (4) Sept. 2005. Note transverse eye field and stout and spineless legs.

ent mounts and measured through a compound optical microscope. For analysis of the respiratory system, freshly preserved specimens were immersed in glycerol (Fig. 45).

SEM micrographs were made with a Zeiss DSM 950 by K. Pfaller from air-dried and gold-coated specimens. For Figs. 1–4, 43, 52–57, 58, 60–61, 68–71 the Auto-Montage system was used. The habitus photograph (Fig. 59) was done with an analogue Nikon camera. Colour photos and figures were made by B.K.

In order to avoid producing a generic homonym, the online Nomenclator Zoologicus 1758 up to 2004 (Neave 1939–2004) was used as taxonomic tool as well as the printed version of Zoological Record (1864–2004; Biosis and Zoological Society, London). According to these sources the genus name is unoccupied.

Abbreviations and depository:

AMNH	American Museum of Natural History, New York
CAS	California Academy of Sciences, San Francisco
CTh	Thaler and Knoflach collection, Innsbruck
MHNG	Muséum d'histoire naturelle, Genève
MNHN	Muséum national d'Histoire naturelle, Paris
NMBE	Naturhistorisches Museum Bern
NMW	Naturhistorisches Museum Wien
SMF	Senckenberg Museum, Frankfurt am Main

Description

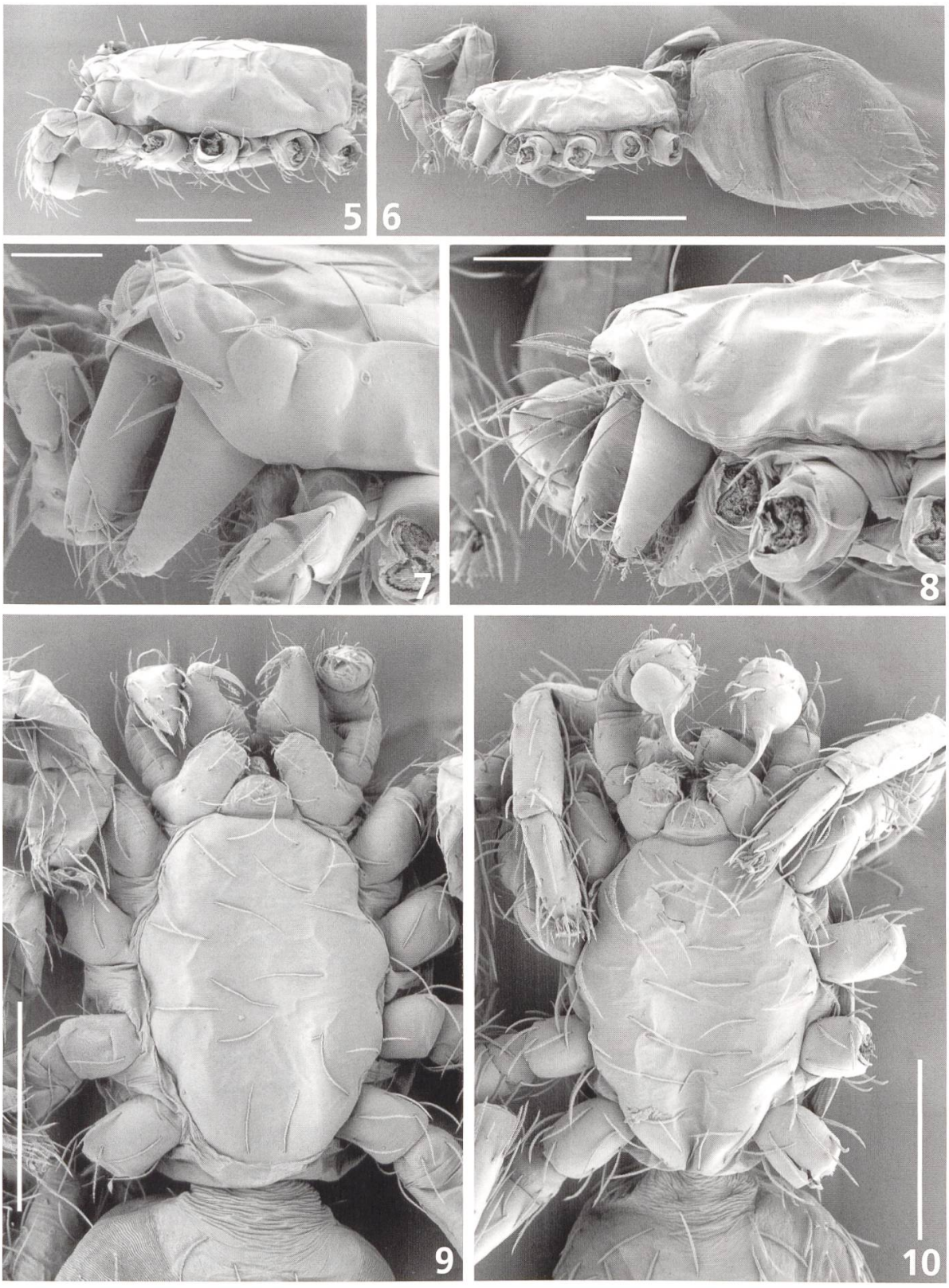
Cortestina Knoflach gen. nov.

Diagnosis: Integument weakly sclerotised. Abdomen without scuta (Figs. 1–2, 4, 59). Carapace extremely flattened, elongate and not markedly tapering in front, with slightly modified clypeus (Figs. 11, 13, 14, 38, 40). Arrangement of eyes transverse. Median eyes largest (Figs. 1, 11, 38). Legs comparatively short and stout. Femora of legs I–IV similar in size, femur IV not considerably enlarged (Figs. 25–26); without ability to jump. Legs I devoid of strong spines. Labium wider than long, without incision (Figs. 15, 17, 27). Posterior spinnerets largely reduced (Figs. 32, 33), their minute remnants are close together. No segment of male palp swollen (Figs. 19, 23, 24). Cymbium and bulbus separate. Embolus short and inornate. Tarsal claw of leg with biseriate dentition (Figs. 30, 34, 35).

Type species: *Cortestina thaleri* Knoflach sp. nov.

Etymology: *Cortestina* is a hybrid name, alluding to the corticolous lifestyle of this oonopid spider, from Latin *cortex* = bark, and *Orchestina*, a comprehensive oonopid genus with similar arrangement of eyes. Gender feminine.

Comparative remarks: Among the non-scutate oonopids, a transverse arrangement of eyes is also present in *Ferchestina* Saaristo & Marusik, 2004, *Orchestina* Simon, 1882, *Sulsula* Simon, 1882, *Unicorn* Platnick & Brescovit, 1995 and *Xiombarg* Brignoli, 1979. *Ferchestina* differs from *Cortestina* by the gibbose shape of carapace and chelicerae and by enlargement of the male palpal tibia (Saaristo & Marusik 2004). In *Orchestina* the fourth femora are elongated and enlarged, which enables them to jump (Simon 1893a, 1914, Dalmas 1916, Saaristo 2001). *Orchestina* presents further differences:



Figs. 5–10. ***Cortestina thaleri*** **KNOFLACH gen. nov., sp. nov. Male (5, 10), female (7) and juvenile (6, 8–9). Prosoma, lateral (5, 6), anterior-lateral (7, 8) and ventral view (9, 10). Specimens from Innsbruck, 10. Aug. 2006 (5, 7, 10), 9. Aug. 2006 (6, 8–9). Scale bars: 0.2 mm (5, 6, 9, 10), 0.1 (8) and 0.05 mm (7). Note small projection of clypeus. Carapace artificially shrivelled.**

Distal leg segments slender compared to the basal ones. Male palp with swollen tibia. Sperm duct narrow and convoluted. Labium longer than wide. Tarsal claws with uniseriate dentition (Dalmas 1916). *Sulsula* shows spines on the

hind legs and long, slender legs (Simon 1882, 1893a). The genus *Unicorn* has a more distinct clypeal horn, enlarged palpal tibia, spines on hind legs and uniseriated tarsal claws (Platnick & Brescovit 1995). *Xiombarg* has a cheliceral tooth and a complex bulbus genitalis (Brignoli 1979). Its carapace is about as wide as long. In all these genera the carapace appears to be more elevated than in *Cortestina*.

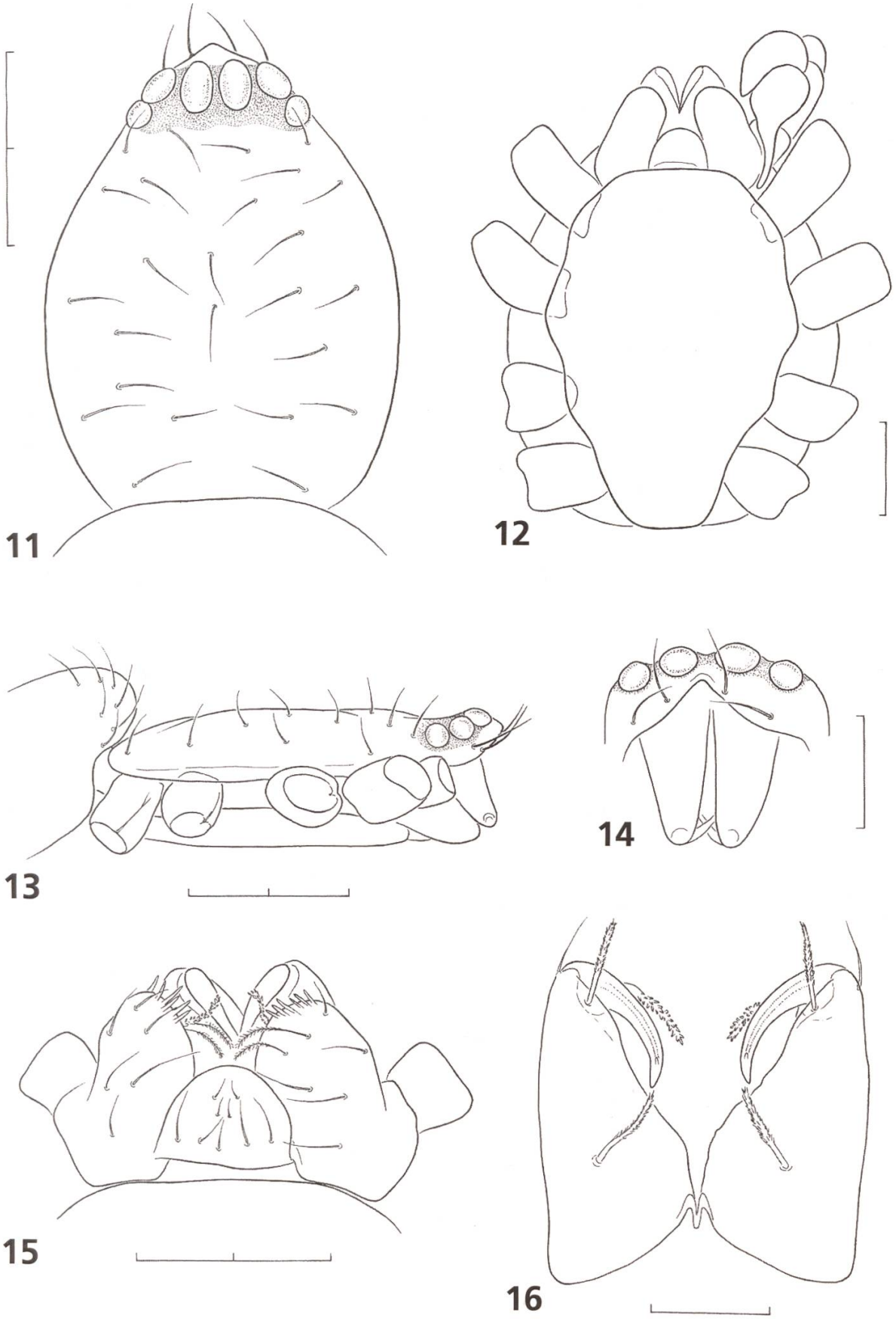
Another mysterious soft-bodied, sometimes eight-eyed Oonopid with uncertain generic placement has been recorded from England sub *Orchestina* sp. ? (Ruffell & Kovoor 1994, Merrett & Murphy 2000, Harvey & al. 2002). Eye field and shape of prosoma do not resemble that of *C. thaleri*.

***Cortestina thaleri* KNOFLACH sp. nov.** (Figs. 1–72)

Orchestina ? sp.: Thaler & Knoflach (2002): 429, figs. 13–15, ♀.

Type material: 1 ♂ holotype, deposited in NMBE, Austria, Northern Tyrol, Innsbruck, park of the University near Viktor-Franz-Hess-Haus in western part of the city, 580 m, 47° 15.835' N, 11° 20.536' E, 22. Sept. 2006. 1 ♂ paratype, NMW, same locality, May 2005 (matured on 23. June 2005). 1 ♂ paratype, MNHN, same locality, 15. Sept. 2005. 1 ♂ paratype, MHNG, same locality, 23. Sept. 2005. 1 ♂ paratype, CTh, same locality, 15. Dec. 2005. 1 ♂ paratype, AMNH, same locality, May 2006. 2 ♀ paratypes, NMBE, same locality, May 2005. 1 ♀ paratype, CTh, same locality, 5. June 2004. All specimens under bark of pine trees, leg. F. Stauder.

Other material examined: Austria: Northern Tyrol, Innsbruck, same locality as types, 1 ♂, SMF, 12. Sept. 2005. 1 ♂, NMBE, 15. Sept. 2005. 1 ♂ (fragments), MHNG, same locality, 5. July 2006. 1 ♀, NMW, 21. July 2006 (matured on 25. July 2006). 1 ♂ (palps aberrant), CTh, 27. July 2006. 2 ♂ 1 ♀ (SEM photos), 10. Aug. 2006. 1 ♀, MNHN, 15. Sept. 2005. 1 sad ♂, 27. Jan. 2006. 1 juv, 9. Sept. 2005. 1 juv, 12. Sept. 2005. 1 juv, NMBE, 23. Sept. 2005. 1 sad ♂, 11. Oct. 2005. 1 sad ♂, 14. Oct. 2005. 1 sad ♂, 19. Oct. 2005. 1 juv, 11. Nov. 2005. 1 juv, 2. Dec. 2005. 1 juv, MHNG, 22. March 2006. 2 juv, SMF, April 2006. 2 juv, AMNH, May 2006. 1 juv, MNHN, 20. July 2006. 1 juv, NMW, 28. July 2006. 2 juv (SEM photos), 8.–9. Aug. 2006. 1 ♀ 1 juv, NMBE, 6. Oct. 2006. All specimens under bark of pine trees, leg. F. Stauder. 1 ♀, CTh, same locality, in stem eclector, 3.–17. May 1995, leg. Meyer. Italy: Southern Tyrol, Pustertal, Gais near Bruneck, 840 m, 1 ♂, CTh, 13. Sept. 2006. 1 ♂ 2 juv, same locality, NMBE, 22. 10. 2006. All under bark of pine tree in garden, leg. F. Stauder.



Figs. 11–16. ***Cortestina thaleri*** **KNOFLACH gen. nov., sp. nov., male. Prosoma, dorsal (11), ventral (12), lateral (13) and anterior view (14). Mouthparts (15). Chelicerae, posterior view (16). Specimens from Innsbruck, 12. Sept. 2005 (11–15) and 5. July 2006 (16). Scale bars: 0.2 mm (11, 13, 15), 0.1 mm (12, 16) and 0.05 mm (16). Note flattened carapace and modified clypeus.**

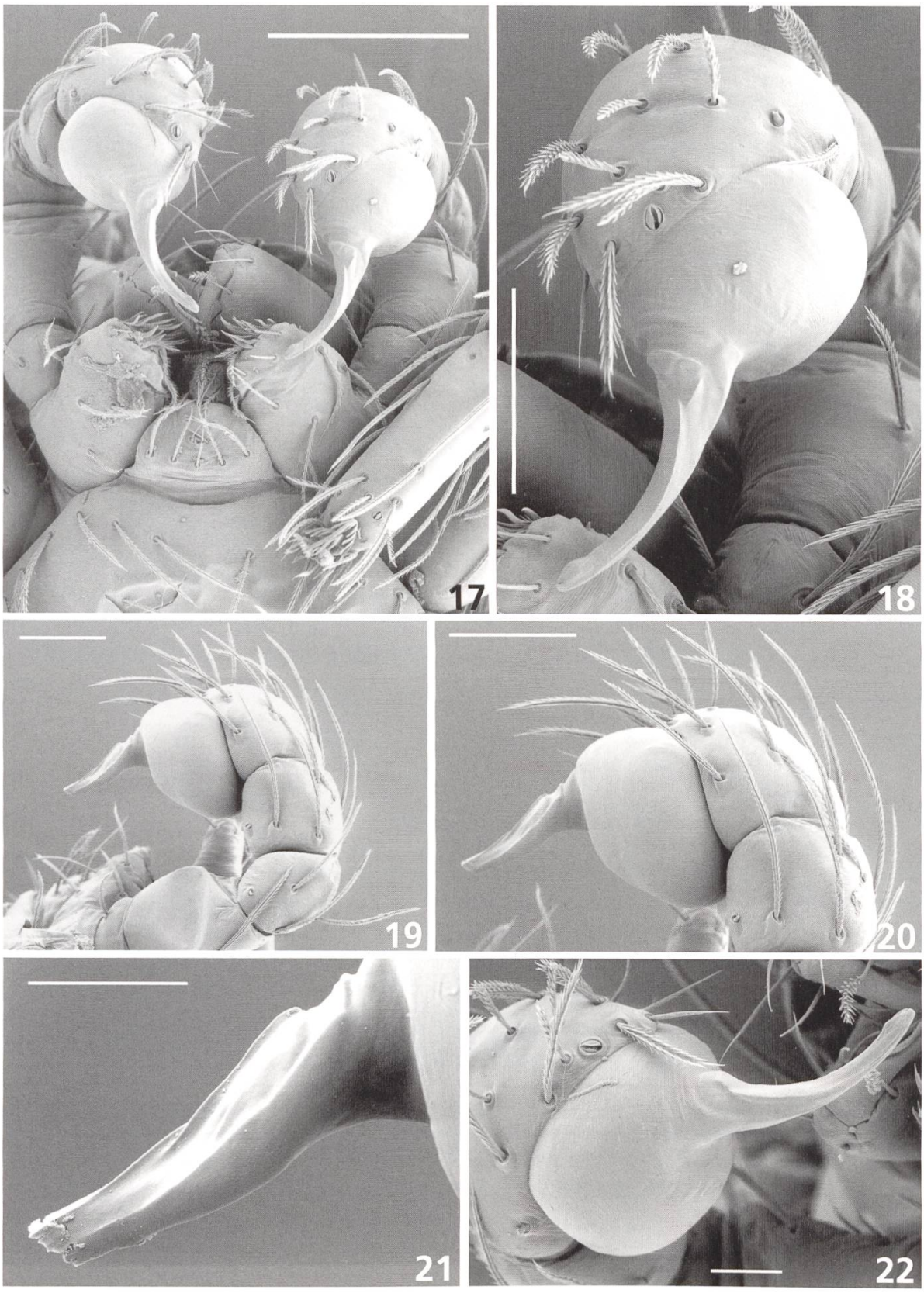
Etymology: The species is named in honour of Konrad Thaler, dedication see above.

Diagnosis: *C. thaleri* KNOFLACH sp. nov. is recognised by the following combination of characters (see also generic diagnosis): Soft body devoid of scuta (Figs. 1, 2, 4, 59). Small size with ca. 1 mm total length. Carapace and sternum extremely flat (Figs. 13, 40) and elongate. Arrangement of eyes transverse (Figs. 1, 11, 38). Median eyes largest (Figs. 1, 11, 38). Labium wider than long, without anterior incision (Figs. 15, 17, 27, 39). Legs stout. Legs I without strong spination (Fig. 26). Femur IV not considerably enlarged (Figs. 25 versus 26). Tarsal claw with biseriate dentition (Figs. 30, 34, 35). Posterior spinnerets minute. Male palpal tibia not enlarged (Figs. 5, 19, 23, 24). Cymbium and bulbus not fused (Figs. 17–24). Sperm duct rather wide, embolus short and inornate. Female genital organ scarcely sclerotised, with small, median, bipartite receptaculum (Figs. 41, 44).

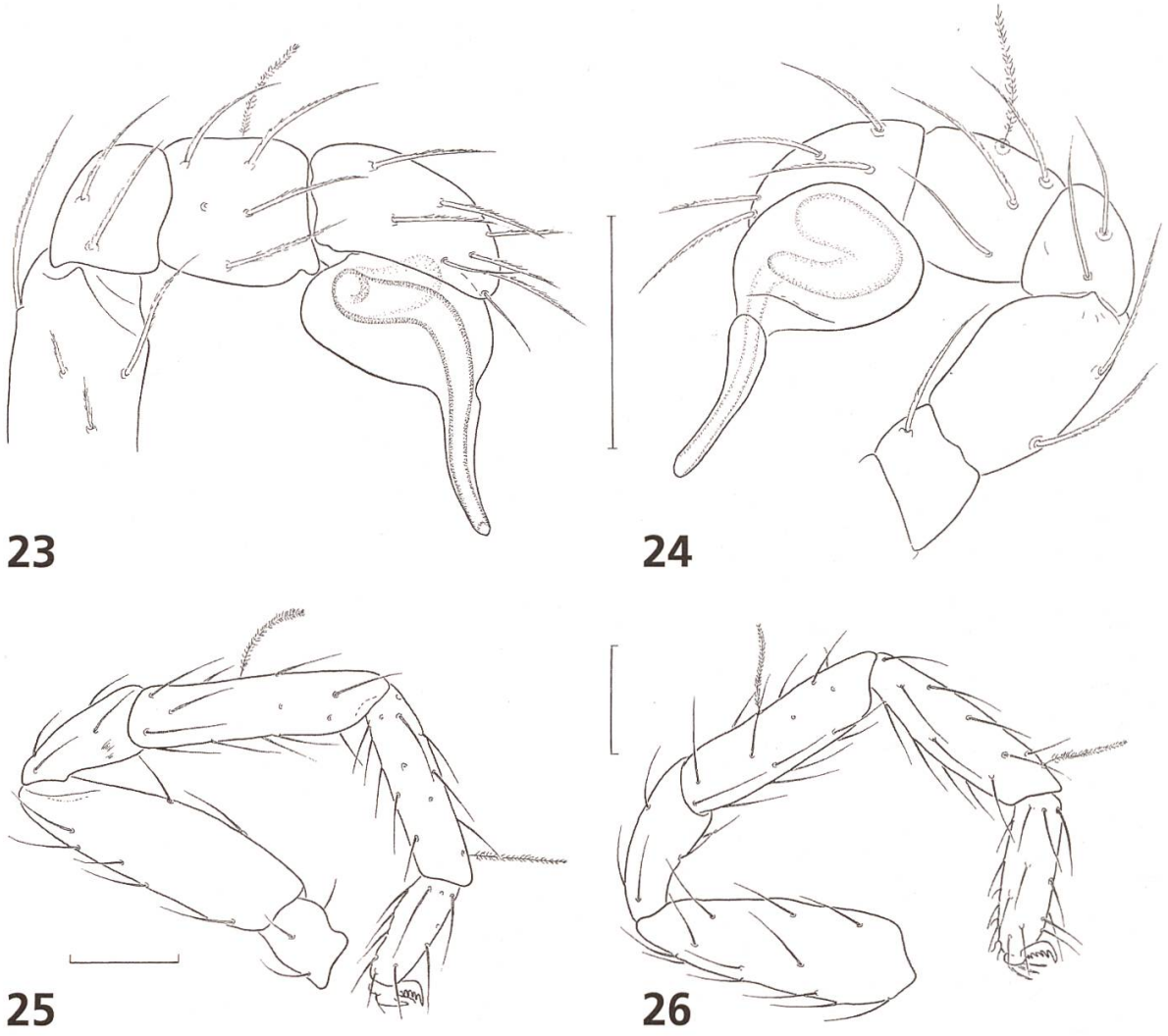
Measurements [♂/♀, n=8/6, min–max (mean), mm]: Total length 0.97–1.27 (1.11) / 1.11–1.32 (1.33), carapace length 0.50–0.54 (0.52) / 0.47–0.54 (0.51), width 0.34–0.38 (0.36) / 0.34–0.38 (0.36), length tibia I 0.20–0.21 (0.20) / 0.19–1.20 (0.20). Carapace height / length in male (females; n=2): 0.18 (0.18/0.24). Sternum 1.4 (1.5) times longer than wide (Figs. 9, 10, 12, 39, 43). Abdomen 1.4–1.6 times longer than wide, in two males (females) 0.57/0.69 (0.66/0.93) long, 0.41/0.47 (0.44/0.57) wide and 0.32/0.34 (0.34/0.45) high. Leg formula 4213 in male (n=2), 4123 in female (n=1), see leg measurements. Patellae as long as tarsi. Tibiae I–IV with one dorsal-median trichobothrium (Figs. 25, 26), position on I in males (n=2) (female, n=1) 0.42/0.44 (0.40), on II 0.44/0.47 (0.47), on III 0.36/0.40 (0.45), on IV 0.43/0.45 (0.44). Metatarsi I–IV with one subdistal trichobothrium (Figs. 25, 26, 46–48), position on I in males (female) 0.88/0.88 (0.88), on II 0.87/0.87 (0.88), on III 0.83/0.85 (0.83), on IV 0.83/0.84 (0.83). Tarsal claws of legs with a double array of six side teeth (Figs. 30, 34–37).

Leg measurements (mm) female (n=1):

	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
I	0.27	0.14	0.20	0.20	0.14	0.95
II	0.25	0.14	0.19	0.19	0.14	0.91
III	0.23	0.13	0.15	0.17	0.10	0.78
IV	0.28	0.14	0.24	0.22	0.13	1.01



Figs. 17–22. ***Cortestina thaleri*** **KNOFLACH gen. nov., sp. nov., male. Fore part of prosoma with palps (17). Palp in oblique anterior (18, 22) and retrolateral view (19–20). Detail of embolus (21). Both specimens from Innsbruck, 10. Aug. 2006. Scale bars: 0.1 mm (17), 0.05 mm (18–20) and 0.02 mm (21–22). Palpal tibia not enlarged.**

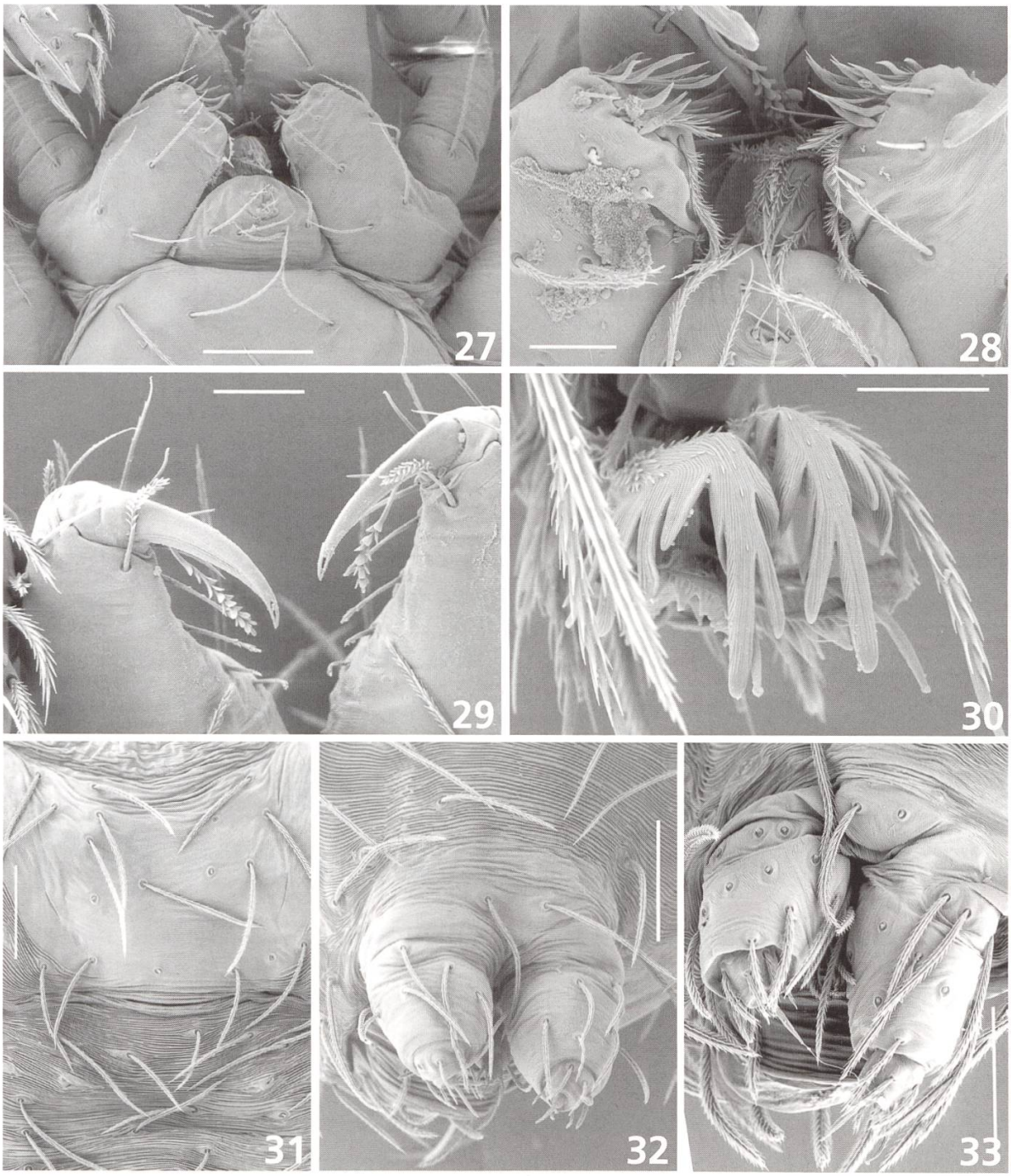


Figs. 23–26. ***Cortestina thaleri*** **KNOFLACH gen. nov., sp. nov., male. Male palp, prolateral (23) and retrolateral view (24). Leg IV (25), leg I (26), prolateral view. Specimens from Innsbruck, 5. July 2006 (23–24), 12. Sept. 2005 (25) and 15. Sept. 2005 (26). Scale bars: 0.1 mm. Femur IV not enlarged compared to femur I, leg I spineless.**

Leg measurements (mm) males (n=2):

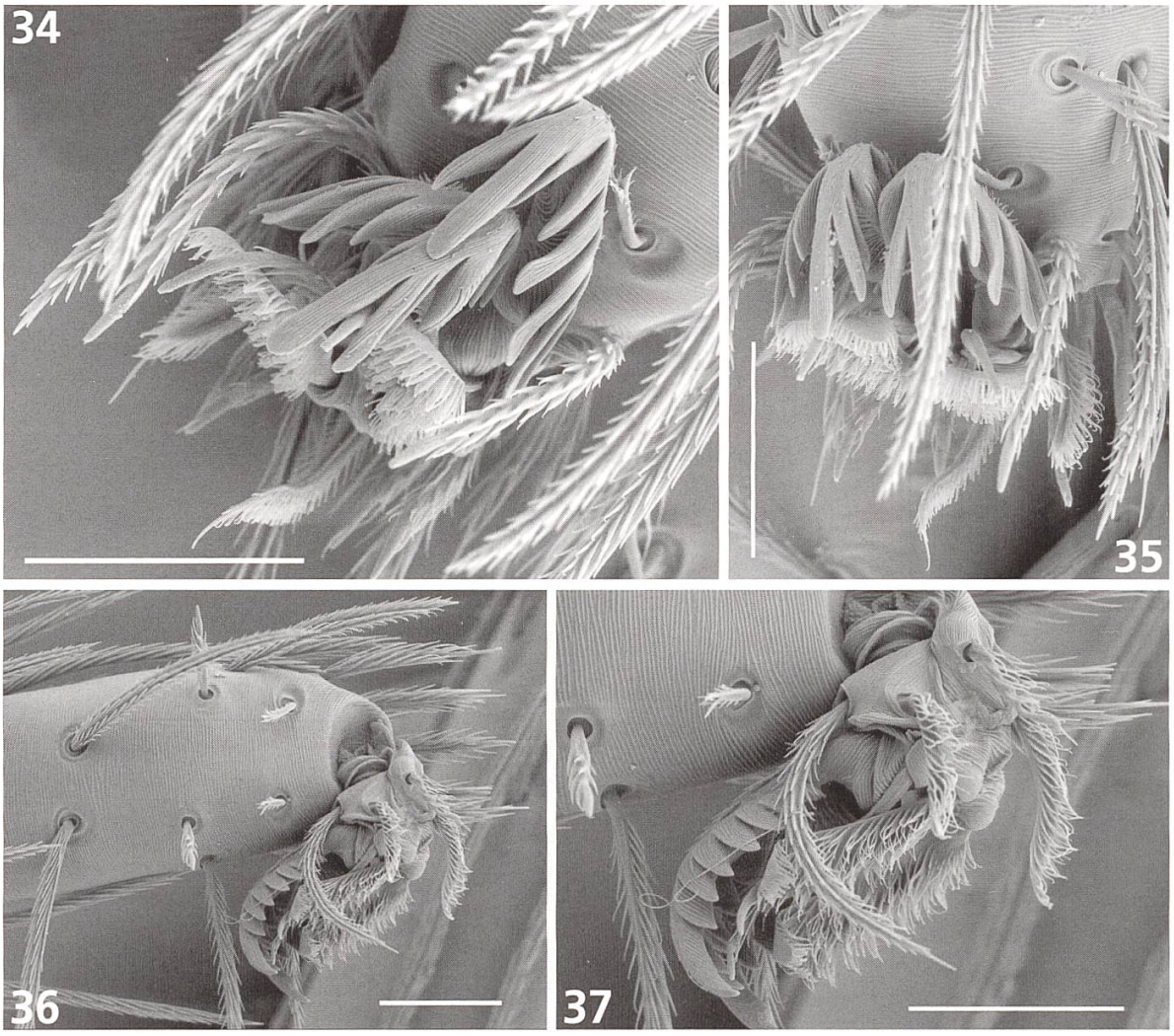
	Femur	Patella	Tibia	Metatarsus	Tarsus	Total
I	0.28/0.27	0.15/0.16	0.21/0.20	0.21/0.22	0.15/0.16	1.00/1.00
II	0.28/0.28	0.15/0.16	0.22/0.22	0.22/0.23	0.16/0.15	1.02/1.03
III	0.23/0.25	0.14/0.14	0.16/0.18	0.18/0.19	0.11/0.11	0.82/0.86
IV	0.30/0.30	0.16/0.16	0.26/0.27	0.23/0.24	0.15/0.14	1.11/1.12

Somatic features: *C. thaleri* KNOFLACH sp. nov. is a representative of the soft-bodied "Oonopidae molles" sensu Simon (1893a), which now are considered as subfamily Oonopinae (Saaristo 2001). There is no scutum on the abdomen, neither dorsally nor ventrally (Figs. 1–4, 43, 59). Carapace elongate (Figs. 11, 38) and strikingly flattened (Figs. 4–6, 13, 40), not markedly



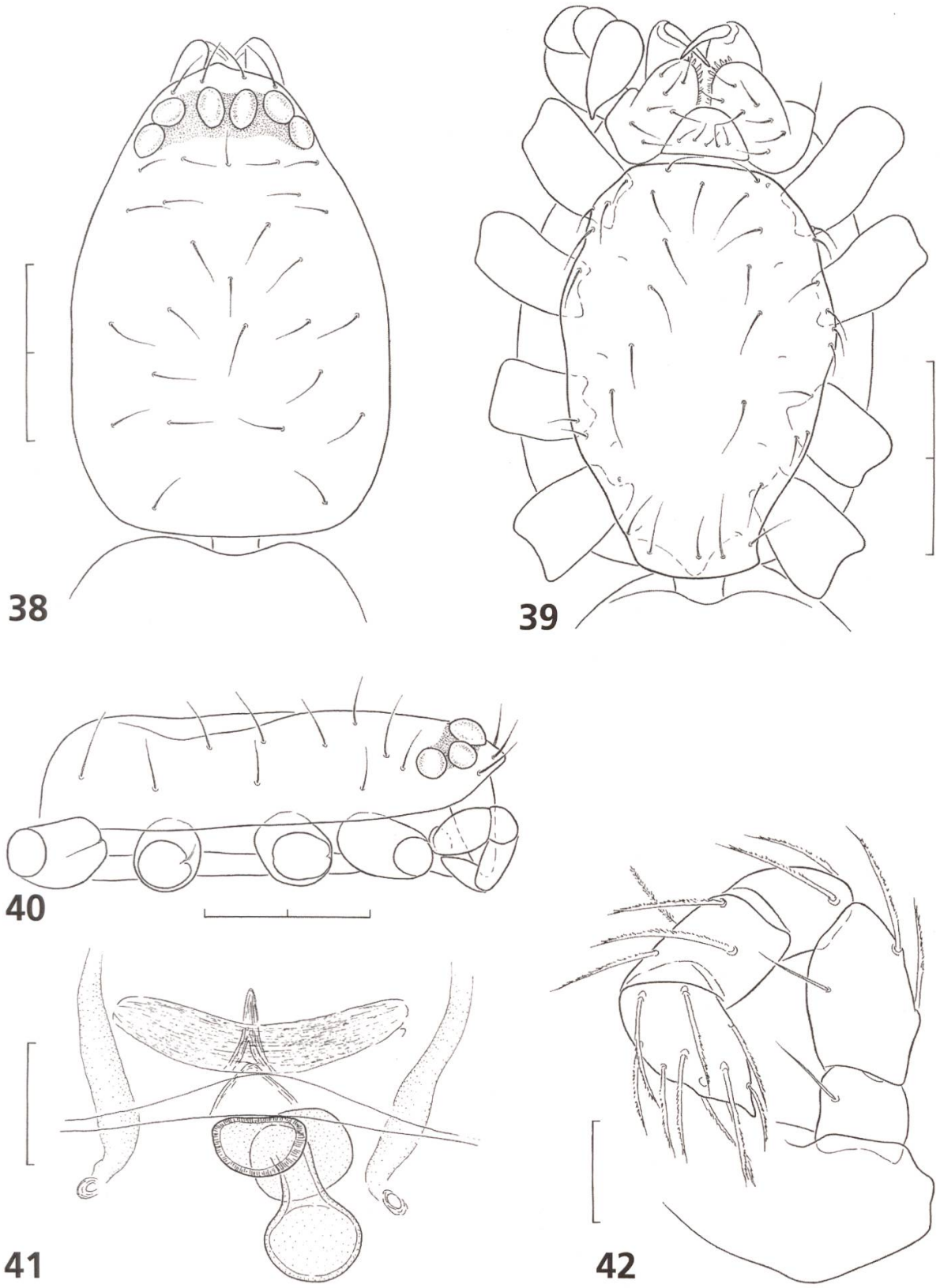
Figs. 27–33. ***Cortestina thaleri*** **Knoflach gen. nov., sp. nov. Juvenile (27, 29, 30, 32) and male (28, 31, 33). Gnathocoxae and labium (27, 28). Chelicerae, posterior view (29). Tarsal claw of leg I, oblique dorsal view (30). Epigaster (31). Spinnerets (32, 33). Specimens from Innsbruck, 9. and 10. Aug. 2006. Scale bars: 0.05 mm (27, 31–33), 0.02 mm (28, 29) and 0.01 mm (30). Gnathocoxae not modified, epigaster without fusules of epiandrous glands.**

tapering in front. Clypeus narrow and arched upwards, thereby forming a small, slightly pointed protuberance (Figs. 7, 8, 11, 13, 40). This cusp present in both sexes and also in juveniles sometimes is faint. Clypeus accompanied by four setae (Figs. 7, 11, 14, 38). Posterior median eyes and anterior lateral eyes aligned transversally (Figs. 11, 38), occupying entire anterior width of carapace. Median eyes largest (Figs. 1, 11, 38), widely separated from posterior lateral ones. Lateral eyes contiguous. Sternum flat (Fig. 13), elongate,



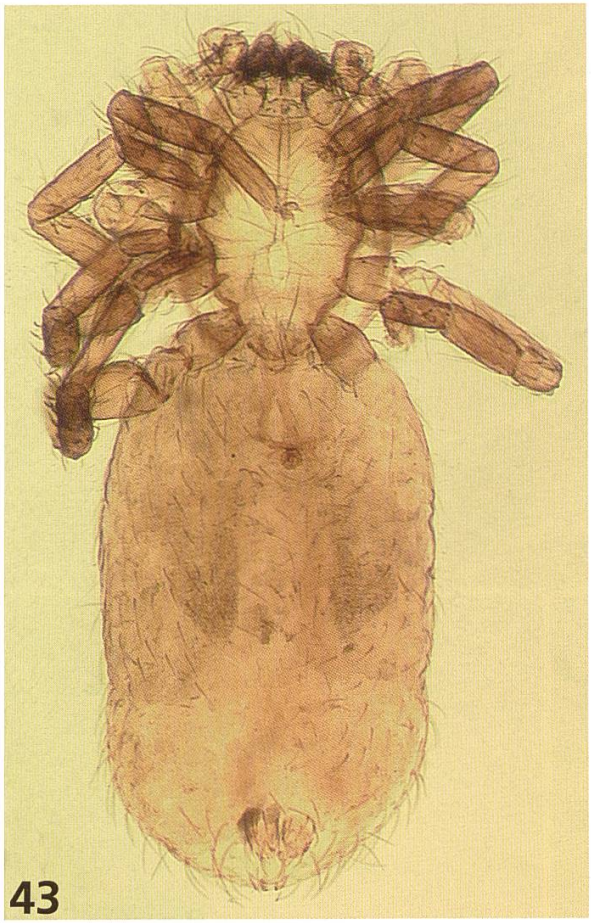
Figs. 34–37. ***Cortestina thaleri*** **KNOFLACH gen. nov., sp. nov. Tarsal claws of male leg I (34–35) and female leg IV (36–37), oblique dorsal view (34–35) and lateral view (36–37). Specimens from Innsbruck, 10. Aug. 2006. Scale bars: 0.02 mm. Note double-sided serrulation of claw.**

smooth, without pits, ending rather broad and truncate (Figs. 9, 10, 12, 39, 43). Gnathocoxae longer than wide, converging, with an apical tuft of broad bristles (Figs. 27, 28), without modifications. Labium wider than long, well separated from sternum (Figs. 9, 10, 12, 15, 17, 27, 39). Anterior border of labium evenly rounded, not excavated (Figs. 9, 10, 27, 28). Chelicerae without protuberances and without teeth (Figs. 16, 29), two distinct lobate hairs near cheliceral fangs present. Mouthparts not sexually dimorphic. Legs stout, without strong setae (Figs. 1, 2, 25, 26). Coxae elongate and slender, the anterior longer than posterior ones (Figs. 9, 10, 12, 39). Femur IV not considerably enlarged as compared to leg I (Fig. 1, Figs. 25 versus 26). Distal leg segments not tapering. Tarsal claws of legs strongly serrated, bearing a double row of teeth, which results in an antler-shaped appearance (Figs. 30, 34, 35). Claws situated on pronounced onychium adjoined by two strong acicular setae and two large, broad spatulate setae (Figs. 34–37), which apparently serve adhesion. Another three smaller spatulate hairs are present on base of onychium.



Figs. 38–42. ***Cortestina thaleri*** **KNOFLACH gen. nov., sp. nov., female. Prosoma, dorsal (38), ventral (39) and lateral view (40). Female genital organ, ventral view (41). Female palp, ventral-retrolateral view (42) Specimen from Innsbruck, May 2005. Scale bars 0.2 (38–40) and 0.05 mm (41–42).**

Female palp without claw, tarsus tapering, tibia with one trichobothrium (Fig. 42). Trichobothria pinnate, their bothria with several ridges (Figs. 46–48). Setae of body and legs serrate (Figs. 18, 20, 28, 31, 32, 33, 36, 46, 50). Tar-



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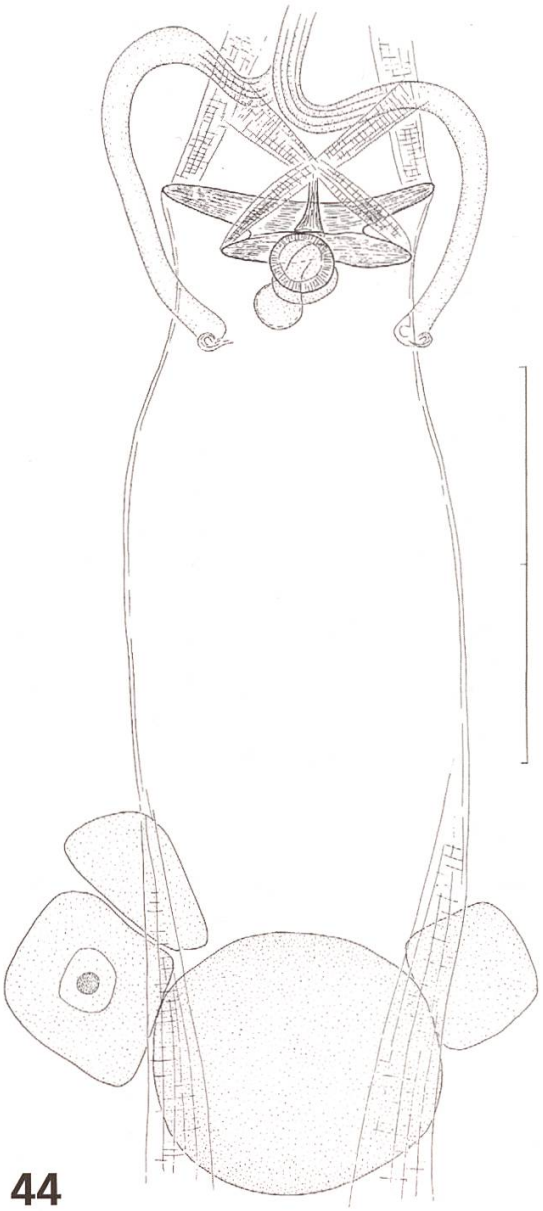

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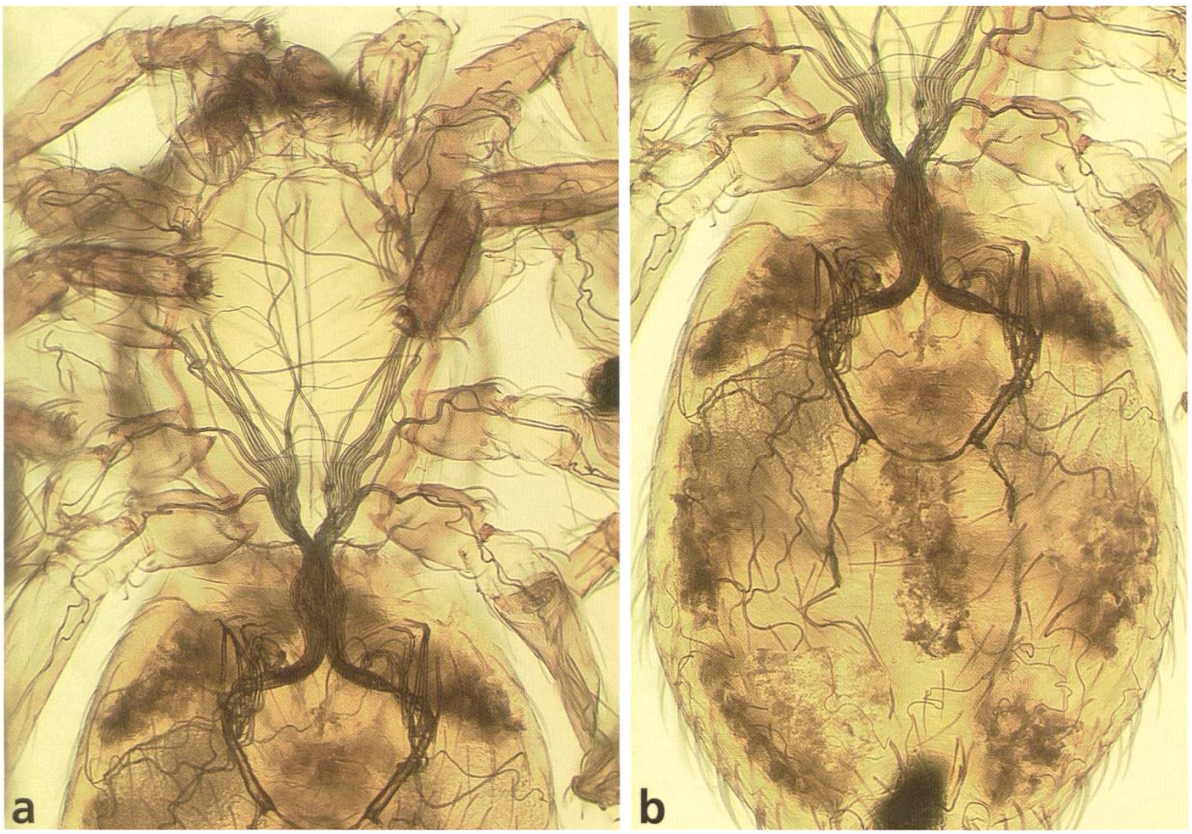
Figs. 43–44. ***Cortestina thaleri*** **KNOFLACH gen. nov., sp. nov., female ventral view (43), with details of genital organ (44) and uterus with matured egg cell. Specimen from Innsbruck, 5. June 2004 (43–44). Scale bar: 0.2 mm.**

sal organ slit-like, accompanied by ridges (Figs. 50, 51). Male epigaster obviously devoid of epiandrous glands (Fig. 31). Colulus with two setae (Fig. 33), in juvenile not raised (Fig. 32). Six spinnerets verified (in female, male and juvenile), with anterior laterals being largest (Figs. 32, 33). The posterior spinnerets appear to be largely reduced, minute remnants of the posterior laterals hard to recognise.

Colouration: Ground colour of male and female body pale yellow to orange brown (Fig. 59). Carapace pale yellow brown with reticulate greyish markings at sides. Eyes surrounded by dark pigmentation. Sternum pale yellow with thin dark margins. Legs pale yellow, brown or reddish brown. Abdomen uni-



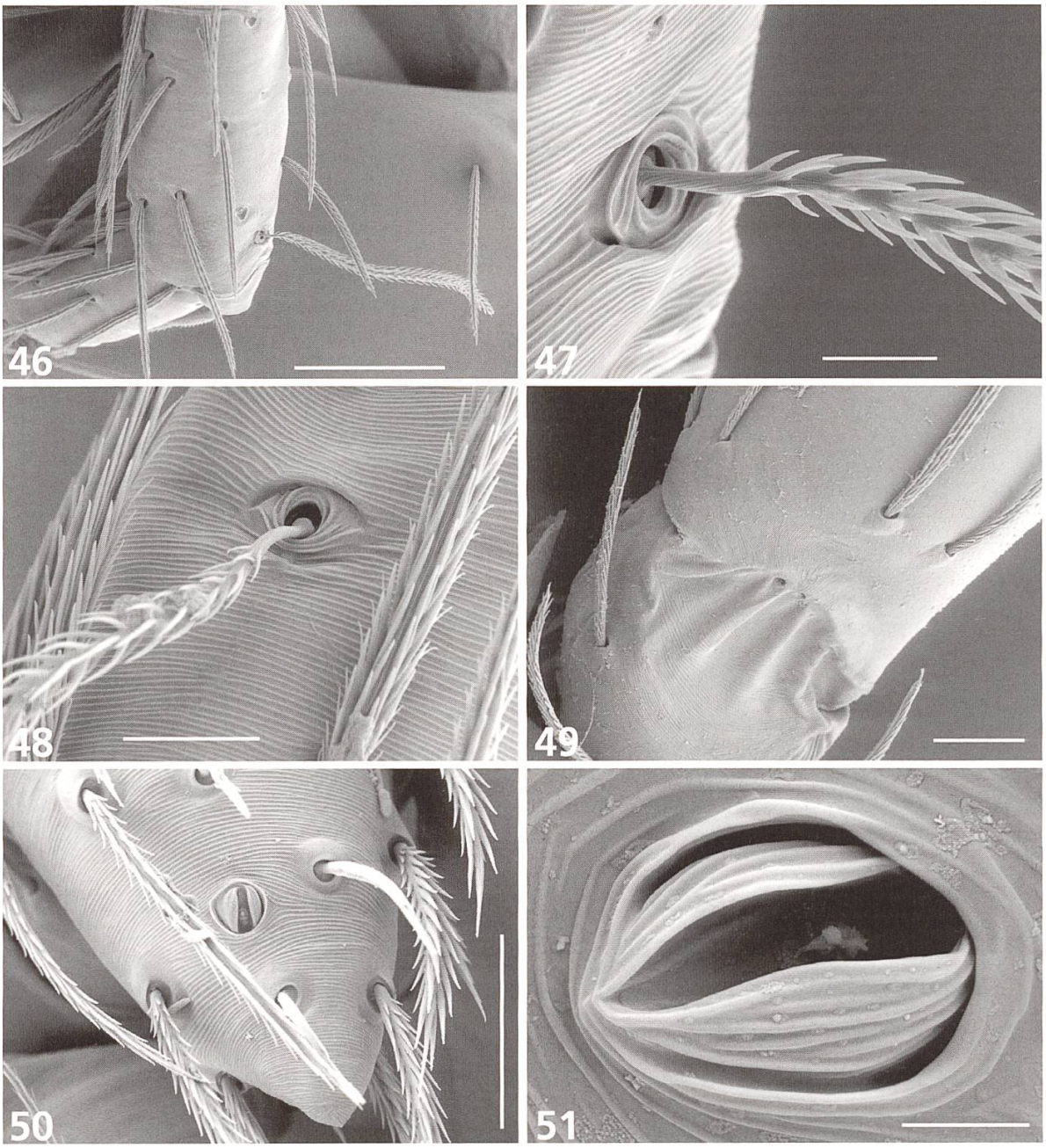
Figs. 45a, b. *Cortestina thaleri* KNOFLACH gen. nov., sp. nov. Tracheal system of freshly preserved female. Prosoma (a), opisthosoma (b). Female from Innsbruck, 6. Oct. 2006.

formly light brown or reddish brown, sometimes with some dusky patches. Mature specimens are darker and ruddier than juveniles.

Respiratory system (Figs. 45a, b): Anterior spiracles hard to recognise. The book lungs appear to be replaced by tracheae. They consist of several tracheal tubes. Posterior spiracles well separated, but connected by a transverse bridge. Such intertracheal connectives are said to prevent the tracheal vestibule from collapsing (Lamy 1902, Purcell 1909, Ramírez 2000). Tracheal trunks ramify to thick bundle of tracheoles within epigaster, passing through petiolus and branching in prosoma, some entering legs and leading to tarsi. Several abdominal tracheoles present, one at immediate entrance of trunk.

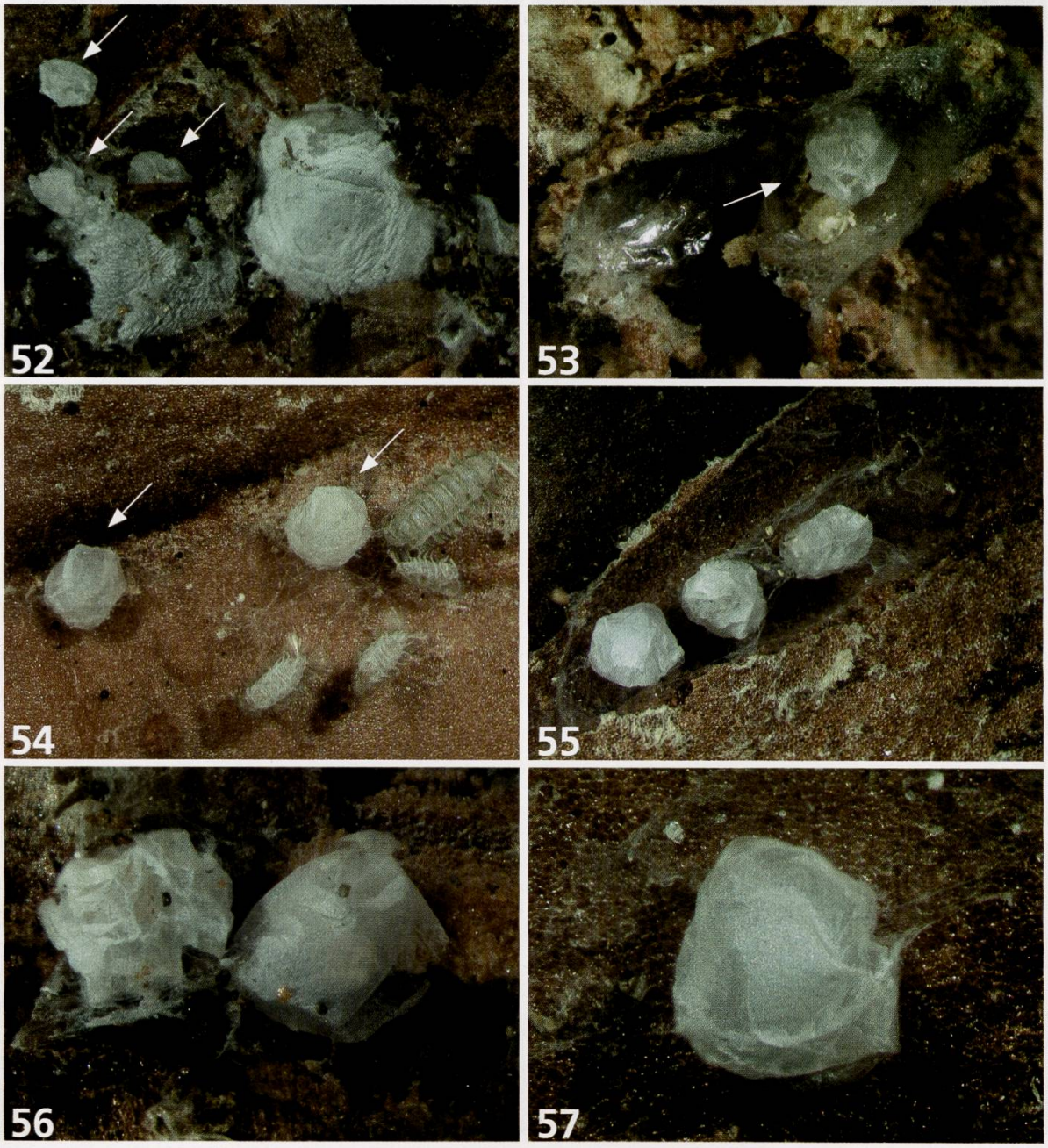
Male palp (Figs. 5, 10, 17–24): Male palp kept towards gnathocoxae, though these are not pouched. Neither tibia nor patella enlarged or swollen (Figs. 19, 23, 24). Tibia with one trichobothrium. Cymbium and bulbus genitalis not fused. Sperm duct rather wide, short and thus not of complicated course (Figs. 23, 24). Embolus short, stout and slightly curved and twisted, without lateral protuberances.

Female genital organ (Figs. 41, 44): scarcely sclerotised and hard to recognise (Fig. 43). A transverse bifurcate plate and an anterior apodeme form the sclerotised part where muscles insert crosswise (Fig. 44). The median receptaculum is rather small, ca. 0.03 mm in diameter, but seemingly bipar-



Figs. 46–51. ***Cortestina thaleri*** **Knoflach gen. nov., sp. nov., female (46–49), juvenile (50) and male (51). Metatarsus IV with trichobothrium (46). Trochanter femur joint (49). Distal part of palp with tarsal organ (50). Tarsal organ of palp, detail (51). Specimens from Innsbruck 9.–10. Aug. 2006. Scale bars: 0.05 mm (46), 0.02 mm (49, 50), 0.01 mm (47, 48) and 0.002 mm (51).**

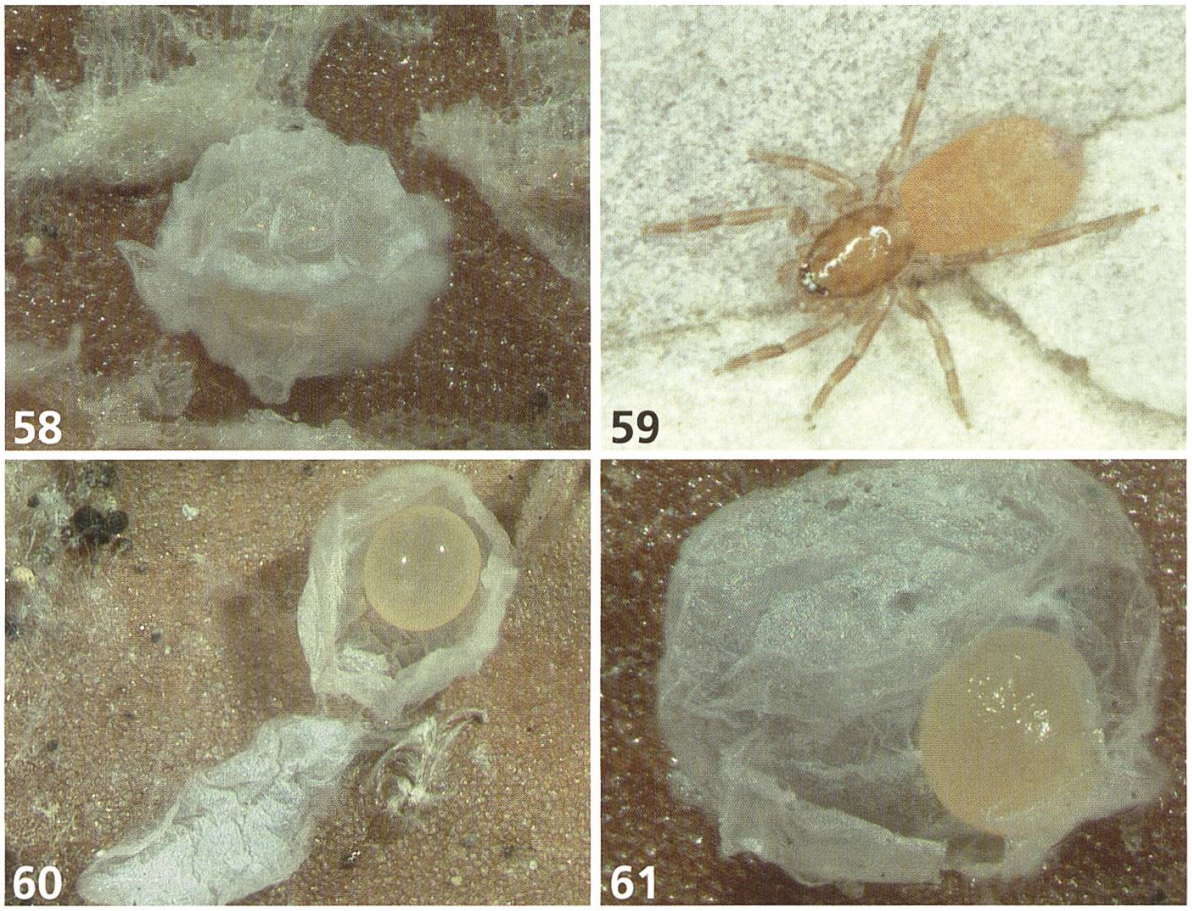
tite. A heavily sclerotised, globular ventral part is connected to a transparent, less sclerotised dorsal one, which narrows and coils up anteriorly and which may represent the actual sperm storage organ (compare also Forster & Platnick 1985: 216). Both parts are situated posterior to epigastric furrow. In one female the ovary appeared to be unpaired and contained only a few egg cells (Fig. 44). The uterus externus is fairly wide and long (0.3 mm in one female, Fig. 44), its entrance presumably manipulated by the special muscle-sclerite-system, as already known for *Silhouettella loricatula* (Roewer, 1942) and *Opopaea fosuma* Burger, 2002 (see Burger & al. 2002, 2006). For detailed



Figs. 52–57. ***Cortestina thaleri*** **KNOFLACH gen. nov., sp. nov., egg sacs. Arrows point to egg sacs in close vicinity of salticid nests (52), within a microlepidopteran cocoon (53) and close to *Polyxenus* exuviae (54). Egg sacs from Innsbruck, 22. March 2006 (52, n=3) 25. Jan. 2006 (53, n=1), 18. Jan. 2006 (54, n=2), 5. May 2006 (55, n=3), Dec. 2005 (56, n=2; 57, n=1). Automontage photos.**

analyses of female genitalia of other oonopids see Burger & al. (2006) and Dumitrescu & Georgescu (1983, 1987).

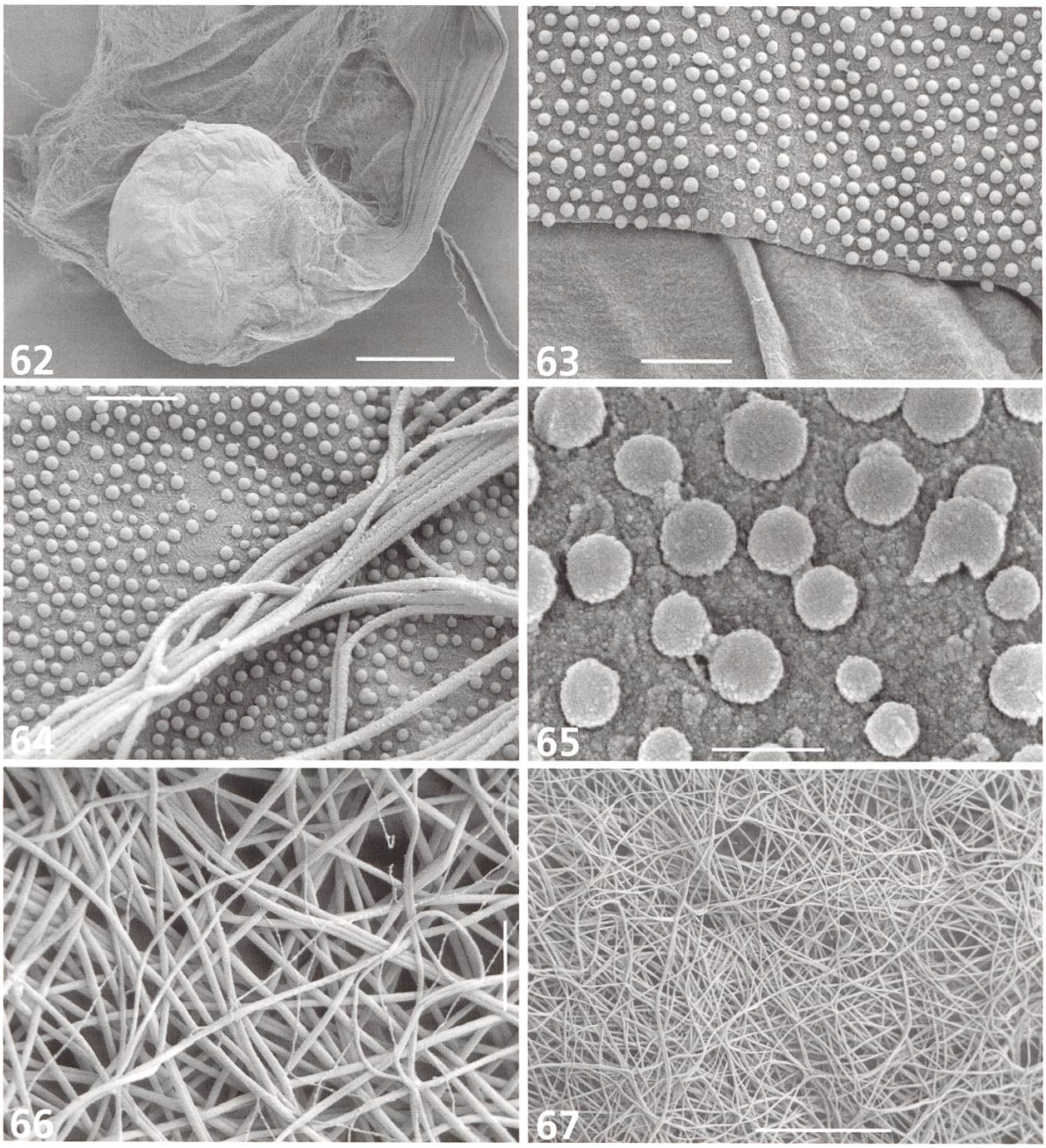
Natural history: *C. thaleri* KNOFLACH sp. nov. seems to be a special inhabitant of bark of pine tree (*Pinus nigra* and *Pinus sylvestris*). Its extreme flat and slender body as well as its small size can be interpreted as an adaptation to corticolous life. The spiders move cautiously and are not able to jump. They are negative phototactic and positive thigmotactic. When disturbed they disappear in minute chinks. Their adhesive forces are rather strong, presumably



Figs. 58–61. ***Cortestina thaleri*** **KNOFLACH gen. nov., sp. nov., egg sacs (58, 60, 61) and female habitus (59). Egg sac with wrinkling envelope and translucent single egg (58). Opened egg sac revealing single large egg (60, 61). Specimens from Innsbruck, Dec. 2005 (58, 61), 2. June 2005 (59), 29. Jan. 2006 (60). Automontage photos (58, 60–61).**

owing to the special modified spatulate tarsal hairs (Figs. 34–37). A piece of bark is hardly ever left, even after intense beating. The spiders probably prey on Psocoptera of the genus *Liposcelis*, which are very frequent under bark. In captivity, a *Liposcelis* was accepted once. Moreover, *C. thaleri* KNOFLACH sp. nov. is often found close to webs of other spiders, where prey remains offer possible ressources. The web of *C. thaleri* KNOFLACH sp. nov. is an inconspicuous, delicate silk chamber (Fig. 3), which is used for resting and moulting.

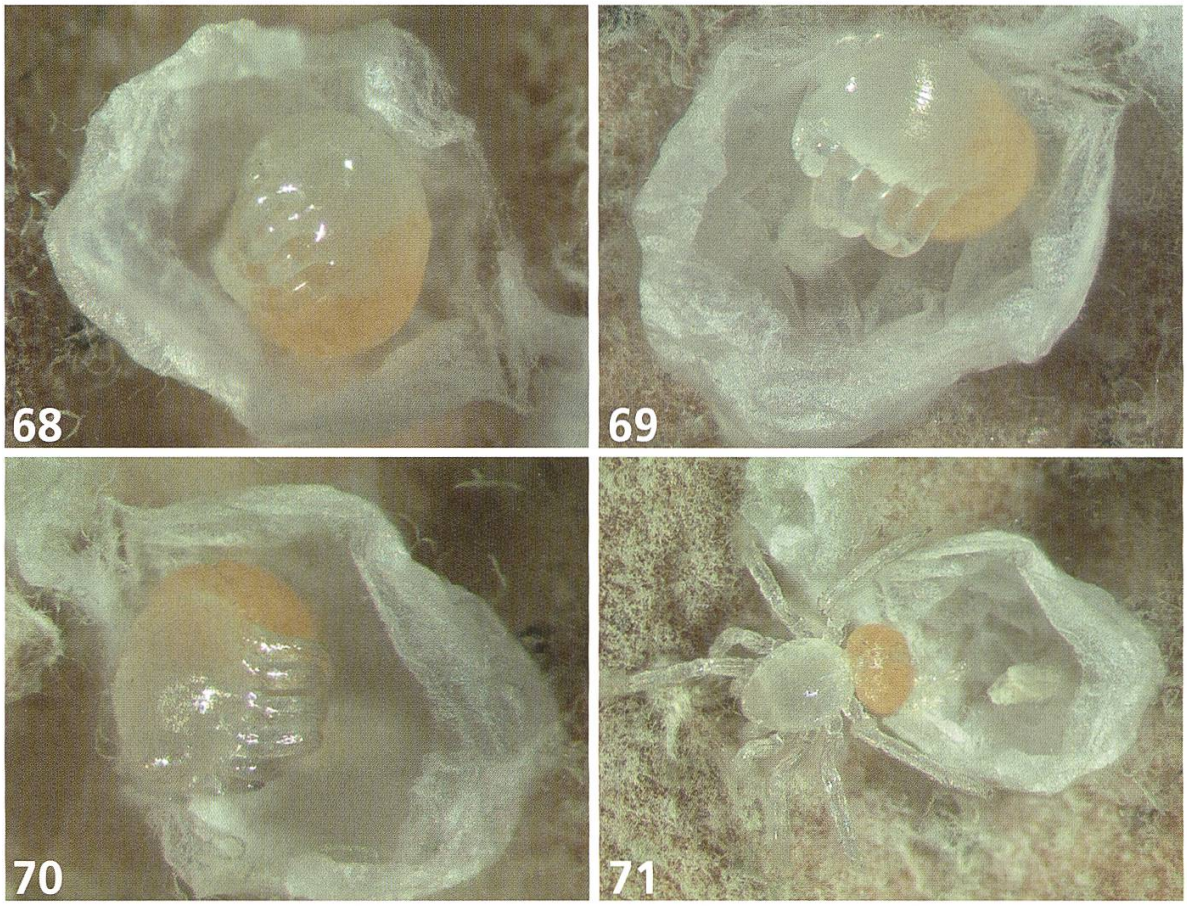
The globular, 0.8–1.1 mm large egg sacs show a bright white envelope, sometimes smooth, sometimes creased (Figs. 52–58). These are densely woven and contain silk threads of various diameter (Figs 62, 66, 67). More than 50 egg sacs were investigated. They all contained only a single, large-sized, yellowish egg (Figs. 60, 61, 62), or a single egg sheath in already hatched cocoons. The eggs measured ca. 0.5 mm in diameter (min–max 0.47–0.53, n=4; see also Fig. 62), thus exceeding the abdominal width of the female or at least that of the epigastric furrow. Evidently, for egg laying the epigastric furrow must be extremely widened in order to release such a large egg and the egg itself must be ductile. The chorion surface is regularly granu-



Figs. 62–67. *Cortestina thaleri* KNOFLACH gen. nov., sp. nov., opened egg sac. Surface of chorion (63–65) and vitelline membrane (63). Details of silk envelope (66–67). Scale bars: 0.2 mm (62), 0.01 mm (67) and 0.002 mm (63–64, 66), and 500 nm (65).

lated, the vitelline membrane smooth (Figs. 63–65). Up to three or four egg sacs were regularly found close together under small scales of bark (Figs. 52, 54–56), once even eight. Remarkably, the egg sacs often are deposited in the vicinity, sometimes inside nests of other spiders, mainly of *Salticus zebraneus* (see Fig. 52), once close to a *Micaria* nest, and once in the cocoon of a Lepidopteran (Fig. 53). It appears that these foreign webs are used as shelters.

Embryonic development lasted 22 days (n=1; room temperature) from egg-laying until peeling off the egg sheath. The following incomplete prelarval stage (Figs. 68–69) took another 22 days until hatching of first instar



Figs. 68–71. ***Cortestina thaleri*** **KNOFLACH gen. nov., sp. nov., opened egg sac of Fig. 60. Praelarvae in different phases (68–70), early phase (68), shortly before moult (70). First free instar (71) just leaving egg sac. Innsbruck, Jan. to March 2006. Automontage photos.**

(Figs. 70–71), which then leaves the egg-sac (Fig. 71). Postembryonic development outside egg sac: Body dimensions of all well preserved specimens have been recorded. According to the available measurements (Fig. 72) it may be assumed that *C. thaleri* KNOFLACH sp. nov. needs three stages to reach maturity, the incomplete prelarval stage not taken into consideration. Two freshly hatched juveniles (empty circles, Fig. 72) allow to define the first complete stage. Adult males and females, juveniles and cocoons were caught throughout the year. Thus, development is not synchronised with the annual cycle. Once an adult male was found alive though motionless under a 5 mm thick piece of bark in January at -15°C. Evidently, there is no strictly confined reproductive period. This eurychronous life cycle apparently is a consequence of the special reproductive strategy of *C. thaleri* KNOFLACH sp. nov. Continuous production of single eggs leads to strong overlap of generations.

Distribution, habitat: *C. thaleri* KNOFLACH sp. nov. was collected in human influenced areas from an isolated group of pines, a thirty year old park in Innsbruck (Austria), and a garden in Gais (Northern Italy). Its origin still is uncertain. Further findings probably will clarify whether this species is autoch-

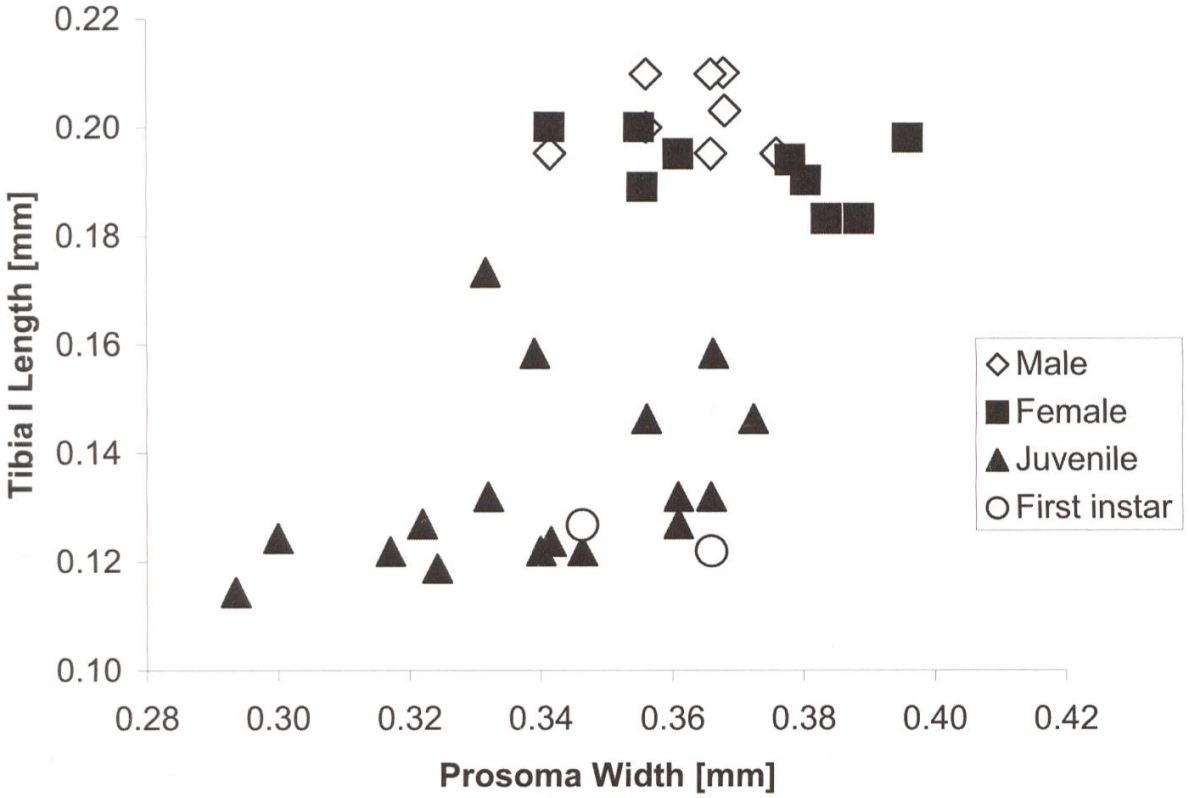


Fig. 72. Relation of prosoma width versus Tibia I length in different stages of *Cortestina thaleri* KNOFLACH gen. nov., sp. nov. Empty circles show spiderlings directly observed after hatching und thus define first complete stage.

thonous or a newcomer. As Oonopidae are assumed to be easily transported by man, especially with plants or phoretically (Miller & Zitnanska 1976, Koponen 1997, Pekar & Gajdos 2001, Saaristo 2001), recent introduction cannot be excluded. In studies of bark-dwelling spiders on pine trees in Central Europe, Oonopidae have not been listed (e.g. Horvath & Szinetár 1998, Horvath & al. 2004 in Hungary; Marc 1990, in France; Simon 1991, Simon & al. 2001, Wunderlich 1982, in Germany).

Most specimens of *C. thaleri* KNOFLACH sp. nov. were hand-collected at 2–4 m stem height of *Pinus nigra* and *P. sylvestris*, only one female was trapped in an arboreal stem eclector. Pitfall traps in the vicinity of pines and beating samples did not yield the oonopid. The species is considered to be a special bark inhabitant of pine trees. It remains in this microhabitat also during winter, which means that it is resistent towards unfavourable and varying conditions. On the other hand, pine trees show a fissured or scaly bark and thus offer a gradient of microclimate conditions (Nicolai 1986). In this mosaic of microareas, the spiders have the opportunity to avoid inhospitable places. Survival of the cold winter season obviously is no problem. Spiders of all stages were found underneath fairly exposed pieces of bark sometimes even at low temperatures in winter. This fact may indicate climatic adaptation and

thus a wider autochthonous occurrence of a hitherto overlooked species. On the other hand eurychronous phenology argues against nativeness of the species, since eurychronism is an exceptional pattern in our seasonal temperate climate in spiders of this stratum. Such life history is typical of troglobitic and synanthropic spiders which live in environments with constant climatic conditions (Tretzel 1954, Schäfer 1976). This also holds for ground-dwellers (Toft 1976, Kropf 1997 a.o.). However, a few other bark-dwelling spiders are known to be eurychronous as well, such as *Segestria senoculata* (see Wunderlich 1982, Nicolai 1986). Apart from effects of prey availability, age and thus permanence of the habitat in general may reflect the life cycles of its inhabitants. In Linyphiidae, eurychronous, multivoltine species, so-called phenological generalists, were found to be more common in younger and disturbed habitats, while the proportion of stenochronous species with strong phenological specialisation and synchronisation of reproduction increased in older habitats (Draney & Crossley 1999). This reflects the high percentage of common aeronauts being eurychronous in Linyphiidae (Merrett 1969). Notwithstanding, in Oonopidae eurychronism may be mainly correlated with their minute body size and accordingly low reproductive outcome. It is present in *Oonops* species (Harvey & al. 2002) and in synanthropic *Tapinesthis inermis* (Simon, 1882) (see Kraus 1967) as well. *C. thaleri* Knoflach sp. nov. obviously occupies in an open niche without much competition. Future collection in more subnatural habitats will allow a better understanding of these interpretations.

In the habitat of *C. thaleri* Knoflach sp. nov., the following other spiders were found under bark: Segestriidae: *Segestria senoculata* (Linnaeus, 1758); Araneidae: *Nuctenea umbratica* (Clerck, 1757); Linyphiidae: *Moebelia penicillata* (Westring, 1851), *Stemonyphantes lineatus* (Linnaeus, 1758); Theridiidae: *Achaearanea lunata* (Clerck, 1757), *Dipoena torva* (Thorell, 1875), *Steatoda bipunctata* (Linnaeus, 1758), *Steatoda castanea* (Clerck, 1757), *Keijia tincta* (Walckenaer, 1802), *Theridion blackwalli* O. P.-Cambridge, 1871; Dictynidae: *Lathys humilis* (Blackwall, 1855); Anyphaenidae: *Anyphaena accentuata* (Walckenaer, 1802); Gnaphosidae: *Micaria subopaca* Westring, 1861; Thomisidae: *Coriarachne depressa* (C. L. Koch, 1837); Philodromidae: *Philodromus fuscomarginatus* (De Geer, 1778); Salticidae: *Macaroeris nidicolens* (Walckenaer, 1802), *Salticus zebraneus* (C. L. Koch, 1837).

Comparative remarks and discussion

Spiders show a great diversity in respiratory systems (Levi 1967, Forster 1980), even at family level (Forster 1959, Opell 1998). Mostly, a complementary sys-

tem of the two components book lung and tracheae is given (Opell 1998). In only a few taxa, in Orthognatha and Dysderoidea, the respiratory organs have remained in anterior position. Oonopidae also belong to that group. As size reduction involves an increased surface-volume ratio and a higher metabolic rate, small spiders bear a greater risk of water loss. This problem might be counteracted by behavioural provision through staying in a humid environment, by an increase of sclerotization, or by transformation of the respiratory organs (Levi 1967). In small spiders transformation from book lungs to tracheae is demonstrated to be a result of ecological factors. Tracheae presumably are more efficient than book lungs and may help to avoid desiccation (Forster 1959, Levi 1967), which might be of importance in dry microhabitats or in bark habitats. This probably can explain the modified respiratory system of the soft bodied *C. thaleri* Knoflach sp. nov., with book lungs being transformed to tracheae (Figs. 45a, b). *C. thaleri* Knoflach sp. nov. seems to be rather resistant towards dryness, as the spiders survive several days in glass vials without water supply. In other Oonopidae book lungs are maintained, as in *Silhouettella loricatula* (see Burger & al. 2006), whereas they are completely missing in *Ischnothyreus peltifer* (Simon, 1891) and others (see Levi 1967).

The spinning apparatus of *C. thaleri* Knoflach sp. nov. consists of six spinnerets, which is known for all dysderoids (Forster & Platnick 1985). However, the posterior spinnerets are largely reduced and close together. Size and arrangement resemble that of *Orchestina pavesii* (Simon, 1873), whereas in *Oonops tubulatus* Dalmas, 1916, all spinnerets are well developed (Machado 1945) as well as in *Orchestina simoni* Dalmas, 1916 (see Dalmas 1916). In *Orchestina*, the posterior spinnerets have a common base (Dalmas 1916, Machado 1945). Apparently, there is a tendency to spinneret reduction within this family.

Little is known on the natural history of dwarf six-eyed spiders, sexual behaviour being excluded here. Oonopidae usually show rapid and saccadic movements (Simon 1893a), but *Oonops* is moving slowly and jerkily (Bristowe 1948, 1958; Harvey & al. 2002). This helps to escape predation. Representatives of the genus *Orchestina* are even able to jump with their thickened femora IV. They perform great leaps when disturbed (Simon 1893a, Dalmas 1916). *C. thaleri* Knoflach sp. nov. neither moves notably fast nor in saltations. Aeronautic dispersal so far has not been recorded in this family (Bristowe 1948, 1958).

Several oonopid species were reported as scavengers in the webs of larger spiders. *Oonops pulcher* Templeton, 1835 was found in England associated with the web of *Amaurobius* and *Tegenaria atrica* C.L. Koch, 1843 (see Bristowe 1948, 1958; Le Gros 1948), *Oonops domesticus* Dalmas, 1916 in

Corsica in the burrow of *Cteniza sauvagesi* (Rossi, 1788) (see Wiehle 1953), *Orchestina* in Italy underneath *Oecobius* webs (Brignoli 1972) and *Tapinesthis inermis* as well as *Oonops domesticus* in Italy in the periphery of webs of *Amaurobius erberi* (Keyserling, 1863) and *Zoropsis spinimana* (Dufour, 1820) (see Hansen 1992). The regular occurrence of *C. thaleri* Knoflach sp. nov. close to webs of other spiders thus is not surprising, being indicative of a kleptoparasitic or commensal way of life. However, in bark habitats numerous spider webs may regularly occur close together owing to microareas with more favourable microclimatic conditions (see Nicolai 1986). At least usage of salticid nests as shelters or for depository of egg sacs can be affirmed for *C. thaleri* Knoflach sp. nov.

Observations on prey capture were given for *Oonops* species (Bristowe 1948, 1958), Sciaridae and Cecidomyidae having been refused. Parker (1991) suggested mites to be the main prey. The mysterious *Orchestina* sp. ? from Essex was observed to feed on psocids (Ruffell & Kovoor 1994). The bark-dwelling erigonine spider *Moebelia penicillata* (Westring, 1851) had been preyed upon twice by *Tapinesthis inermis* in Venice (Hansen 1992). No firm observations exist for *C. thaleri* Knoflach sp. nov. Psocids or prey remains may be relevant.

As expected, the number of eggs in Oonopidae is low according to their small body size and thus implies a "k-selected strategy". This is evidently given in *C. thaleri* Knoflach sp. nov., showing the lowest reproductive outcome by deposition of single eggs. Simon (1893a) describes floccose cocoons with only a few eggs for Oonopidae. For *Oonops procerus* Simon, 1882, which occurs under stones in France and Spain, white discoidal egg sacs were observed, containing 3–4 large eggs. In this species, females apparently guard the cocoon "la femelle se tient sur son cocon à découvert" (Simon 1882). Also *Oonops domesticus* and *O. pulcher* were observed guarding their white egg sacs of ca. 0.6 mm diameter with two eggs (Blackwall 1864, Bristowe 1958, Parker 1991, Hansen 1992).

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