

**Redescription of  
*Trogulus nepaeformis* (Scopoli, 1763),  
an often misinterpreted harvestman species  
from the south-eastern fringe of the Alps  
(Opiliones: Trogulidae)**

***Ponovni opis  
Trogulus nepaeformis* (Scopoli, 1763),  
*pogosto napačno vrednotene vrste  
suhih južin z obronkov južnih Alp  
(Opiliones: Trogulidae)***

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**Abstract**

In terms of taxonomy and systematics, the harvestman genus *Trogulus* Latreille, 1802 is one of the most complex arachnid taxa in Europe. Although many problems have been resolved and a number of new species described in last decennia so far, the diversity within several species subgroups within the genus has not been satisfactorily disentangled. One such understudied subgroup is the *nepaeformis* species-group of medium-sized troguli, partly because we are still missing a thorough reconsideration of the first described species *Trogulus nepaeformis* Scopoli, 1763. At the same time, this is the first harvestman species described from the territory of Slovenia. Here we provide the redescription of Scopoli's species to set a firm base for revising

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the whole *nepaeformis* species-group. *Trogulus nepaeformis* is characterized by short, stout and evenly dorsally bent stylus of glans penis with blunt tip, and acinous receptaculum seminis consisted of eight balloon-shaped and one short-tubular vesicles.

**Key words:** Arachnida, Idrija, *nepaeformis* species-group, Slovenia

### Izveček

V taksonomskem in sistematskem smislu je rod suhih južin plošček, *Trogulus* Latreille, 1802, med najbolj zapletenimi taksoni pajkovcev v Evropi. V zadnjih desetletjih so bile razrešene mnoge težave in opisane številne nove vrste ploščkov. Kljub temu raznolikost znotraj nekaterih skupin še vedno ni zadovoljivo razjasnjena. Med temi so srednje veliki ploščki iz skupine *nepaeformis*, deloma zato, ker prva opisana vrsta iz skupine, *Trogulus nepaeformis* Scopoli, 1763, še vedno ni podrobno proučena in opisana v skladu z modernimi standardi. Obenem je to prva vrsta suhih južin, opisana z ozemlja Slovenije. Tu podajamo ponovni opis Scopolijeve vrste z namenom, da pripravimo verodostojno osnovo za revizijo celotne skupine *nepaeformis*. Za *T. nepaeformis* je značilno kratko, čokato šilo glans penis, in grozdaste semenske vrečke iz osmih balonastih in ene kratkocevaste ampule.

**Ključne besede:** Idrija, pajkovci, skupina vrst *nepaeformis*, Slovenija

## Introduction

Trogulidae Sundevall, 1833 is a family within the harvestman suborder Dyspnoi Hansen & Sørensen, 1904, and involves the genera *Anarthrotarsus* Šilhavý, 1967, *Anelasmacephalus* Simon, 1879, *Calathocratus* Simon, 1879, *Kofiniotis* Roewer, 1940 and *Trogulus* Latreille, 1802 (MARTENS 1978; SCHÖNHOFER 2009, 2013). All trogulids are litter- and soil-dwelling and display a conserved morphology adapted to the habitat and, consequently, are prone to a large degree of cryptic diversity (SCHÖNHOFER 2009, 2013). Additionally, and in *Trogulus* in particular, several external shapes and structures are hard to research. This is because all trogulids produce a presumably tanning secretion, which is probably released by diffusion through areas of thin cuticle, and glues substrate particles onto the surface, which hardens into a soil-encrusted, insoluble mail (WOLFF et al. 2016). For study purposes, soil encrustations may be removed by dabbing (not brushing) with a stiff brush (SCHÖNHOFER & MARTENS 2009), a time-consuming procedure, which sometimes causes damage to fine structures, such as bristles on legs, important for identification of some taxa. All this makes morphological identification rather difficult, especially within the most diverse *Trogulus* lineage B sensu SCHÖNHOFER & MARTENS (2010), which the *nepaeformis* group is part of. This lineage comprises nearly all *Trogulus* taxa inhabiting central, southern and south-eastern Europe and the Near East, in contrast to species belonging to the lineage A from the western Mediterranean area (SCHÖNHOFER & MARTENS 2010). To complicate matters, two or three medium-sized troguli species co-occur in many localities (e.g., CHEMINI 1983, 1984). Thus, although the taxonomic position of *Trogulus* in Central Europe seems straightforward, it is actually extremely complex (MARTENS 1988).

In Slovenia, beside only one *Anelasmacephalus* species, *A. hadzii* Martens, 1978, a dozen of *Trogulus* species occur, about half of which are medium-sized, mostly belonging to the *T. nepaeformis* and *T. squamatus* species-groups sensu SCHÖNHOFER & MARTENS (2010). Taxonomical problems within these groups have partly been dealt with morphologically by LATREILLE (1802), KOCH (1839), DAHL (1903), AVRAM (1971), MARTENS (1978), WEISS (1978), NEUFFER (1980), CHEMINI (1983, 1984), CHEMINI & MARTENS (1988) and WEISS et al. (1998). Beside *T. nepaeformis* (Scopoli, 1763), the following presently valid species of the *nepaeformis* and *squamatus* groups have been recognized in Slovenia: *Trogulus tingiformis* C. L. Koch, 1848, *T. closanicus* Avram, 1971, *T. martensi* Chemini, 1983 and *T. cisalpinus* Chemini & Martens, 1988.

Combining morphological and genetic information provided a progress in *Trogulus* taxonomy in the last two decennia, and revealed a much-underestimated cryptic diversity within the genus (SCHÖNHOFER 2008; SCHÖNHOFER & MARTENS 2010). This approach allowed resolving a number of open taxonomic and distributional problems (SCHÖNHOFER 2008; SCHÖNHOFER & MARTENS 2008, 2009, 2010; SCHÖNHOFER et al. 2013). In Slovenia, syntopic occurrence of up to at least three *Trogulus* forms of comparable sizes is quite usual.

For many described species, SCOPOLI (1763) produced perfect drawings allowing unambiguous recognition. Unfortunately, he did not provide either drawings or the information on locus typicus of his *Acarus nepaeformis*, i.e., *Trogulus nepaeformis* (Scopoli, 1763). Later, Scopoli's collection burned in his private house (GUGLIA 1972; PETKOVŠEK 1977; BAVDAŽ et al. 1999), and there has been no indication of type material being deposited elsewhere and must be considered lost since. Thus, the only available information on *Acarus nepaeformis* remains his textual description. At the time being, the name *T. nepaeformis* is in ample use in central Europe to denote the species allegedly described by Scopoli and redescribed under this name by MARTENS (1978) and CHEMINI (1983, 1984). Apparently, misinterpretation of Scopoli's intention often occurred (e.g., AVRAM 1971, MARTENS 1978, SCHÖNHOFER 2008), resulting in a very broad species concept of "*T. nepaeformis*", including other, partly undescribed species. For a credible approach to the remaining cryptic diversity within the *T. nepaeformis* complex it is critical to resolve the identity of Scopoli's species,

the first one described within a group of related forms. The redescription of the nominal species is crucial to resolve the central European *Trogulus* taxonomy (CHEMINI & MARTENS 1988).

In this contribution we aim 1) to establish the terra typica and locus typicus of *T. nepaeformis*, 2) to identify the most probable candidate for Scopoli's species among syntopic, morphologically similar, medium-sized troguli, and 3) to redescribe this species to provide a clear view on this crucial species and to avoid further identification confusion within the group.

## Materials and Methods

In searching for the most probable species described by Scopoli, we first analysed the original description of *Acarus nepaeformis* Scopoli, 1763 (SCOPOLI 1763) to provide any cues for establishing the terra typica, or, even more precise, the locus typicus. Besides, we reconsidered studies of the authors who evaluated Scopoli's life and work (GUGLIA 1972; PETKOVŠEK 1977; WRABER 1978; BAKER 1999; BAVDAŽ et al. 1999) with special attention to any further indications, which might help in identifying the type locality. Given that Scopoli collected *A. nepaeformis* for description in a beech forest, we also considered the distribution of the European beech (*Fagus sylvatica* L.) at potential localities in the area (KORDIŠ 1986; MARINČEK et al. 1987; DAKSKOBLER 1998; BAVDAŽ et al. 1999; GORKIČ & CERNETIČ-GREGORIČ 2000). A further relevant cue is the measure used by Scopoli in measurements of his specimens (SCOPOLI 1763; ROTTLEUTHNER 1985; BAKER 1999). Finally, we took into account the abundance and general appearance of syntopic *Trogulus* species at the potential type locality.

We analysed the harvestman fauna within the radius of 10 km around Idrija, Scopoli's town of residence, to provide information on the candidate species and selected the most credible species. For the redescription, external morphology and genitalia were studied using a Leica M205 C mounted with a digital camera Leica MC190 HD (Leica Camera AG, Germany), with Leica Application Suite X 5.1 software. Besides, we used Nikon Eclipse E800 compound microscope (Nikon, Japan), mounted with a digital Net DN100 camera and processed with NIS Elements ver. 4.20 software. Transmission and illumination from above were combined to adjust best visibility of surface structures and bristles. Digital images captured at different focal planes were stacked using Helicon Focus ver. 6.2.2. Images were manipulated for optimal quality using various applications in GIMP ver. 2.10.8. Drawings were made under an Olympus CH30 microscope (Olympus, Japan), using a drawing tube. For observation, the specimens were preserved in glycerol. Measurements are in millimetres, if not otherwise indicated.

In the redescription, we use the following abbreviations (MARTENS 1978, SCHÖNHOFER 2008, SCHÖNHOFER & MARTENS 2009):

BS basitarsus (basal, i.e., proximal tarsal article or segment), Ch chelicera, Cx coxa, DS distitarsus (distal tarsal article), Fe femur, Mt metatarsus, Pa pedipalp, Pe penis, Pt patella, Rec sem receptaculum seminis, Ta tarsus, Ti tibia, Tr trochanter.

Body length: total length from front cap to rear end of opisthosoma

Body width: maximum width of opisthosoma

Coxa II medial interdistance: distance between promedial sides of left and right coxa II

Coxa II lateral interdistance: distance between prolateral sides of left and right coxa II

Coxa IV medial interdistance: distance between retromedial sides of left and right coxa IV

Coxa IV lateral interdistance: distance between retrolateral sides of left and right coxa IV

Eye interdistance: distance between outer borders of left and right lens

Hood (head cap) length: distance between hood tip and anterior border of eyes

Hood width: maximal width of hood

## Results

### *Identification of the locus typicus*

SCOPOLI (1763) wrote his volume “Entomologia carniolica” while residing in Idrija (1754–1769), western Slovenia (in older literature Idria in the Duchy of Carniola) (KRYŠTUFEK 2023). Despite his collecting journeys to many places in Carniola (GUGLIA 1972), he putatively described most species from Idrija and its close vicinity (GUGLIA 1972; PETKOVŠEK 1977; WRABER 1978; BAKER 1999; BAVDAŽ et al. 1999). Nowadays, troguli are relatively abundant in the area and it was most probably the case in the past centuries; we thus consider Idrija and the close vicinity as terra typica of *Acarus nepaeformis*.

### *Identification of most credible candidate species*

In 206 collection efforts in 46 localities in Idrija and its close vicinity, the following harvestman species have been recorded (own unpublished data):

## CYPHOPHTHALMI

### Sironidae

*Cyphophthalmus duricorius* Joseph, 1868

## (PALPATORES)

## EUPNOI

### Phalagiidae

*Amilenus aurantiacus* (Simon, 1881)  
*Dasylobus graniferus* (Canestrini, 1871)  
*Gyas annulatus* (Olivier, 1791)  
*Lacinius dentiger* (C. L. Koch, 1847)  
*Lacinius ephippiatus* (C. L. Koch, 1835)  
*Lophopilio palpinalis* (Herbst, 1799)  
*Mitopus morio* (Fabricius, 1799)  
*Opilio dinaricus* Šilhavý, 1938  
*Opilio parietinus* (De Geer, 1778)  
*Phalangium opilio* Linnaeus, 1758  
*Rilaena triangularis* (Herbst, 1799)

### Sclerosomatidae

*Astrobonus helleri* (Ausserer, 1867)  
*Astrobonus laevipes* (Canestrini, 1872)  
*Leiobunum limbatum* L. Koch, 1861  
*Leiobunum rupestre* (Herbst, 1799)  
*Nelima sempronii* Szalay, 1951

## DYSPNOI

### Dicranolasmatidae

*Dicranolasma scabrum* (Herbst, 1799)

### Nemastomatidae

*Carinostoma carinatum* (Roewer, 1914)  
*Histicostoma dentipalpe* (Ausserer, 1867)

*Mitostoma chrysomelas* (Hermann, 1804)

*Nemastoma bidentatum schmidti* Novak, Raspotnig et Slana Novak, 2021

*Paranemastoma quadripunctatum* (Perty, 1833)

## Trogulidae

*Anelasmaocephalus hadzii* Martens, 1978

*Trogulus closanicus* Avram, 1971

*Trogulus martensi* Chemini, 1983

*Trogulus nepaeformis* (Scopoli, 1763)

*Trogulus oltenicus* Avram, 1971

*Trogulus nepaeformis* sensu Chemini 1983, 1984

*Trogulus* sp. gr. *tricarinatus* Linnaeus, 1767

*Trogulus tingiformis* C. L. Koch, 1848

Among troguli, two small-sized species: *T. oltenicus* and *T. sp. gr. tricarinatus* belong to the *tricarinatus* species-group; one medium-sized: *T. closanicus* belongs to the *squamatus* species-group, and one large: *T. tingiformis* and three medium-sized troguli: *T. martensi*, *T. nepaeformis* s. s. and *T. nepaeformis* sensu CHEMINI (1983, 1984) belong to the *nepaeformis* species-group (cf. SCHÖNHOFER 2008; SCHÖNHOFER & MARTENS 2010). Among these, *T. closanicus* preferred humid, deep organic habitats, *T. tingiformis* humid, deep humus and stony habitat, and *T. martensi* and *T. nepaeformis* sensu Chemini inhabit open woodlands and scrublands and are absent in beech forests. According to the ratios of the potential candidate species in syntopy (*nepaeformis* : *closanicus* : *tingiformis* : *nepaeformis* sensu Chemini  $\approx$  100 : 4 : 2 : 2), we selected the most abundant species in the beech forests at Idrija as the most credible candidate to identify *T. nepaeformis* as intended by Scopoli.

SCOPOLI's (1763: 390) original description is as follows: "1070. ACARUS *Nepeformis*. - long. lin. 4. *Diagn.* Color & Facies *Nepae Cimicoidis*. Totus punctis eminentibus confertis scaber. Reperti non semel inter *Muscos*, ad *Fagorum* radices. Oblongus, depressus instar folii, coloris terrei, iners valde. Antennae moniliformes. Pedes antici & medii breviores. Os ovatum. Pedes secundi & postici corpore longiores." (In translation: "1070. ACARUS *Nepeformis*. – Length 4 lines. *Diagnosis.* Colour and appearance as in *Nepa Cimicoides*. Entirely coarse because of tubercles. Found several times in moss at beech roots. Oblong, leaf-like depressed, soil-coloured, quite motionless. Antennae necklet-shaped. Fore and middle legs shortest. Mouth oval. Second and hind legs longest."). This description is by far incomplete in terms of today's nomenclatural code. Hypothetically, it might refer to either any medium-sized *Trogulus* species or to small individuals of *T. tingiformis*, what deserves a detailed analysis.

In his descriptions, SCOPOLI (1763; *Explicatio*) used the Paris line for size indication, showing lines in three Paris twelfths – lineae; tres unciae Parisinae (BAKER 1999). This is somehow astonishing because the use of either the Vienna line or the Southern line would be expected. This is for the reason that the Vienna line was derived from the "Vienna foot", 'Wiener Fuss', which was in use in Central Europe ongoing from about 1760, while the Southern line was in use at the northern Adriatic coast, the nowadays western and central Slovenian inland, Istria and Friuli (ROTTLEUTHNER 1985: Küstenland, Krain, Istrien, Friaul). The printed Paris line in SCOPOLI (1763) measured 2.24 mm (BAKER 1999), while the Vienna line measured 2.195155 mm, and the Southern line 2.063305 mm (ROTTLEUTHNER 1985). Since Scopoli measured specimens very precisely, often citing quarters, thirds and halves of the line (e.g.,  $5\frac{2}{3}$  for *Nepa cinerea*), his measurements were accurate at about 0.5 mm, and his *Acarus nepeformis* measured about  $9.0\pm 0.5$  mm. These measures comply with females of only one, the most abundant *Trogulus* species found in Idrija and its vicinity.

Accordingly, the following assumption is required. Neglecting the sexual dimorphism and not taking genitalia into account in his description, Scopoli cited measures of larger individuals – as usually applied by ancient entomologists and arachnologists – females in this case. Scopoli's comparison of the colour and the habitus of *T. nepaeformis* with the Saucer bug, *Ilyocoris cimicoides* (Linnaeus, 1758), Naucoridae (GOGALA et al. 1994), in SCOPOLI (1763) quoted sub *Nepa*, refers to the anterior portion of this water bug and the hood of troguli; although the shape and colour comply with all medium-sized troguli, it best fits with the same species. Scopoli used the name antennae for the hood horns, and likely interpreted the space below the hood with chelicerae and pedipalps as the "mouth".

In his descriptions, Scopoli cited only few specific localities, which were interpreted by PETKOVŠEK (1977), WRABER (1978), BAKER (1999) and BAVDAŽ et al. (1999). Scopoli's notation that *T. nepaeformis* had been found several times in moss between beech roots is a case of unspecific location citation (cf. BAKER 1999). Nevertheless, it is obvious that Scopoli inspected more localities close to his living place. In his time, Scopoli's house in Idrija was very probably located close to a beech forest. Nowadays, the beech forests are restricted to the northern and some other very steep slopes at Idrija. The nearest *Fagetum* is about 300 m away from Scopoli's house, as several buildings have been built in between in the last decennia.

For wood needs, the mercury mine in Idrija owed and exploited a large forest area in Idrija and its surroundings in the past, which included also clear-cuts in the 18<sup>th</sup> and 19<sup>th</sup> centuries, while moderate steep slopes were already used as meadows and pastures in the 18<sup>th</sup> century (M. Lužnik, personal comm.). Afterwards, great care was implied for forest reconstitution. Nowadays, the beech is the dominant species in various habitats from the lowland to the highest localities in nearly all climatogenous forest phytocenoses in the region (KORDIŠ 1986; DAKSKOBLER 1998; GORKIČ & CERNETIČ-GREGORIČ 2000). In this respect, the area is in harmony with Scopoli's microhabitat description.

For all the above consideration: The perfectly fitting body size, its abundance greatly exceeding the abundances of the other similar species around Idrija, and reasoning that Idrija is most likely the type locality, we conclude that *T. nepaeformis* s. s. described by Scopoli is the species redescribed below.

### **Redescription of *Trogulus nepaeformis* (Scopoli, 1763)**

Class Arachnida Lamarck, 1801  
Order Opiliones Sundevall, 1833  
Suborder Dyspnoi Hansen & Sørensen, 1904  
Family Trogulidae Sundevall, 1833  
Genus *Trogulus* Latreille, 1802

### **SCOPOLIJEV PLOŠČEK, *Trogulus nepaeformis* (Scopoli, 1763)**

#### **Etymology**

Scopoli denoted the appearance of the species similar to the water bug *Ilyocoris cimicoides* (Linnaeus, 1758) (SCOPOLI 1763, sub *Nepa*), while the Slovenian name is selected to denote the *Trogulus* species described by Scopoli.

#### **Diagnosis**

Medium-sized *Trogulus* species of the *nepaeformis* species-group sensu SCHÖNHOFER (2008) and SCHÖNHOFER & MARTENS (2010) with ~ roundly shaped head cap (hood), small eyes

bordered with black ring; with short, stout, evenly dorsally bent stylus of glans penis with blunt tip; receptaculum seminis acinous, consisted of eight balloon-shaped and one short tubular vesicles; Metatarsus II: Tarsus II lengths in ♂  $\approx$  1: 1, in ♀  $\approx$  1.15: 1.

Remark: Until the detailed revision of related medium-sized troguli is provided, this diagnosis should be considered contemporary.

## Material examined

### Neotype

SLOVENIA • ♂; Pringl, Idrija; 45.99753° N, 14.01126° E; 539 m a.s.l.; mixed forest, 10 Jun. 2000, litter sift collection, L. Slana Novak and T. Novak leg.; PMSL-Opiliones-TN 234/2000. (PMSL = Prirodoslovni muzej Slovenije, Ljubljana = Slovenian Museum of Natural History, Ljubljana; this material is a part of the Central Collection of Opiliones at PMSL; TN: Tone Novak identification code).

### Further material of the species considered

SLOVENIA • Brusovše, Idrija; 1 ♂, 1 ♀, 1 juv.; 46.00° N, 14.03° E; 339 m a.s.l.; Jun. 1997; M. Vončina leg. (TN 1712/1998). – 8 ♂♂, 12 ♀♀, 4 juv.; Pringl, Idrija; 46.00° N, 14.01° E; 539 m a.s.l.; 10 Jun. 2000; L. Slana Novak and T. Novak leg. (TN 234/2000). – Ibid.; 1 ♂, 2 ♀♀, 2 juv.; 10 Jun. 2000; L. Slana Novak and T. Novak leg. (TN 117/2000). – Ibid.; 1 ♂; 01 Aug. 2000; T. Novak leg. (TN 384/2000). – Ibid.; 2 ♂♂, 6 ♀♀, 2 juv.; 14 Jul. 2001; B. Bertoncelj and T. Novak leg. (TN 226/2001). – Idrija; 19 ♂♂, 65 ♀♀, 32 juv.; 46.00° N, 14.01° E; 441 m a.s.l.; B. Bertoncelj and T. Novak leg. (TN 237/2001). Spodnja Idrija; 5 ♂♂, 2 ♀♀, 7 juv.; 46.03° N, 14.04° E; 570 m a.s.l.; 10 Jun. 2000; L. Slana Novak and T. Novak leg. (TN 145/2000). – Marija Snežna, Avče; 1 ♂, 3 ♀♀, 1 juv.; 46.10° N, 13.69° E, 311 m a.s.l.; 02 Aug. 2000; T. Novak leg. (292/2000). All PMSL. – Idrija; 4 ♂♂; 440 m a.s.l., 46.00° N, 14.03° E; 31 May 2004; L. Slana Novak and T. Novak leg. (Coll. J. Martens CJM 3832 in SMF = Senckenberg Forschungsinstitut und Naturmuseum, Frankfurt am Main, Germany); 9 ♀♀, dito CJM 3833).

Further specimens will be deposited at the museums of natural history in Vienna, Austria and Geneva, Switzerland.

### Redescription

#### Male, neotype

Body 7.24 long, 2.85 wide, oblong-oval (dorsal view), strongly dorso-ventrally depressed (~ half as high as wide), with evenly round-arched head cap (hood) in front of prosoma–hood lateral indentation, 0.65 long, 1.17 wide; distance between hood apex and hood–prosoma lateral indentation 0.85; hood consisted of two latero-anterior prosoma projections (horns, branches) with long, bristle-tipped, papillate tubercles on medial borders, protruding radially and densely covering space between horns, and shorter papillate tubercles on lateral horn borders protruding ventrally, declining their size distally; eye mound relatively low, ~ 2.00 times as wide as long, 0.31 times as high as long, eyes on mound halves separated by intermediate depression; eyes small, lens diameter 0.11, bordered with blackish ring, eye interdistance 0.65, interocular distance 0.44; body with dense, relatively large, flat, dome-shaped tubercles (smooth papillae) giving coarse appearance, and sparse short bristles; heavily earth-incrusted.

Chelicerae proportionally large, Ch basal article ~ 0.2 times as long as body, proximal third of basal article stout, with large lateral and smaller medial humps inferiorly, wrinkled medially,



distal portion abruptly narrowing to  $\frac{3}{4}$  height, smooth; distal article widening distally until fingers; basal article with 3 short, rigid bristles antero-apically, 2–3 such bristles on distal article apically, and row of few bristles medio-ventrally; basal article and fingers brown, distal article dark beige, mottled with brown spots, fingers with black base and black-tipped. Ch basal article length 1.42, distal article length 1.27, movable finger length 0.51.

Pedipalps very short, leg-shaped, slender, Pa-Fe proximal half widening distally, distal half with parallel dorsal and ventral margins (lateral view). Article lengths in Table 1.

Penis 2.23 long, strongly dorso-ventrally depressed, base widest, proximally roundly indented; truncus, except distal  $\sim$  sixth, hard-chitinous, truncus proximal half slightly tapering distally, followed by portion with  $\sim$  parallel margins, and distal, thin-chitinous portion slightly tapering up to glans; thin-chitinous portion with velum-shaped, shallow fold dorsally, extending obliquely anteriorly around truncus until ending ventrally para-medially (dorsal view); glans hard-chitinous, conical,  $\sim$  0.10 times as long as truncus, stylus stout, at base  $\frac{3}{4}$  as wide as glans terminally,  $\sim$  0.6 times as long as glans, both ventral and dorsal stylus margins  $\sim$  arch-bent dorsally, glans tip blunt.

Legs relatively short, robust, subcylindrical, blackish in old individuals, greyish-brown in younger individuals, Ta brownish; except Ta articles with scattered flat dome-shaped tubercles, more widely spaced than on body, with relatively dense, long bristles, longest  $\sim$  0.12. Article lengths in Table 1. Tarsal formula (as in all *Trogulus* species in both sexes): I 2, II 2, III 3, IV 3. Mt II: Ta II lengths  $\approx$  1: 1. Cx II pro-medial interdistance: 2.32, Cx II pro-lateral interdistance: 3.10, Cx IV retro-medial interdistance: 2.86, Cx IV retro-lateral interdistance: 3.68.

Female (n=1)

Body 8.66 long, 3.51 wide; as in ♂.

Chelicerae as in ♂. Ch basal article length 1.58, distal article length 1.45, movable finger length 0.57.

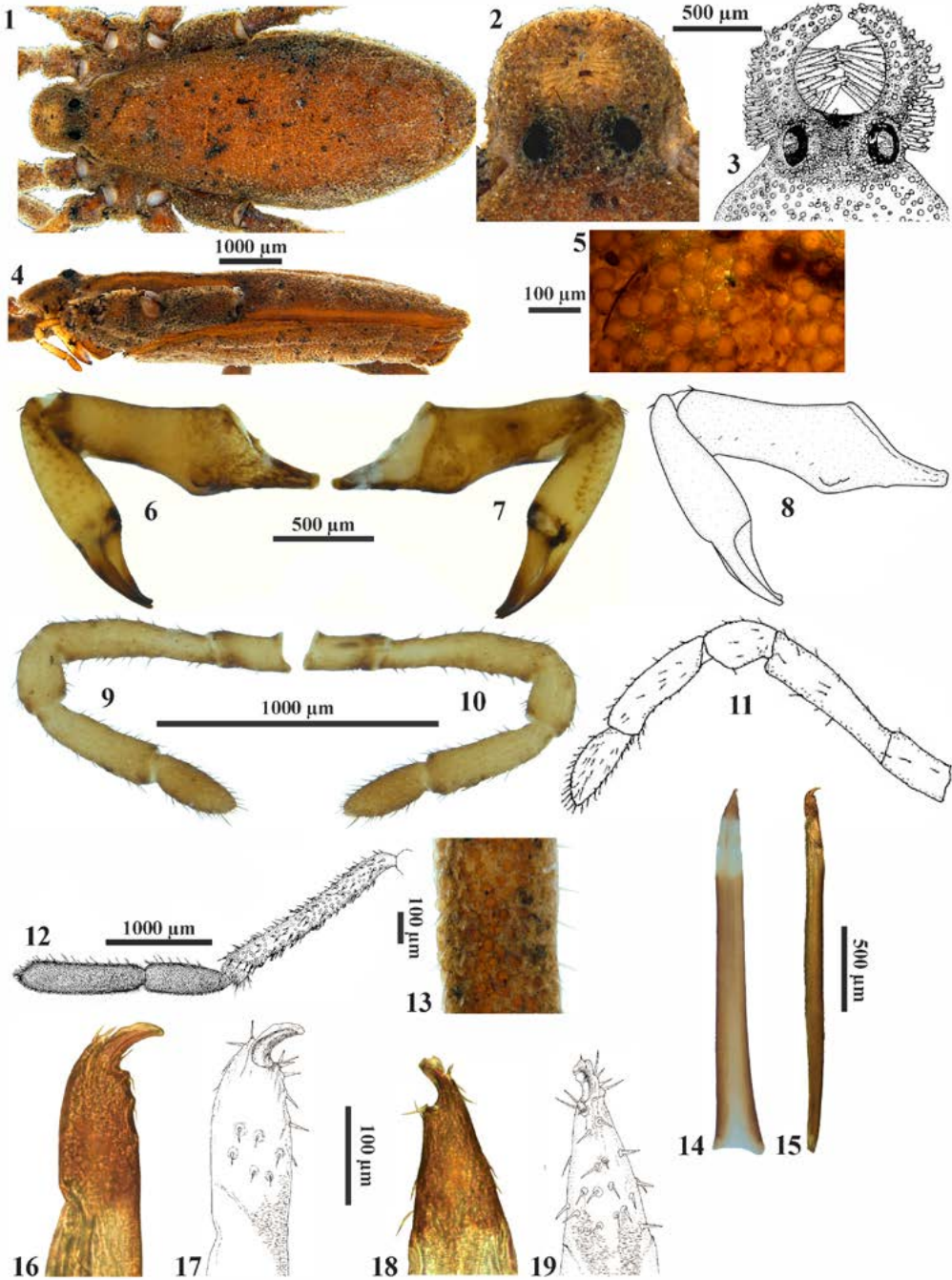
Pedipalps as in ♂. Article lengths in Table 1.

Ovipositor 1.72 long, Rec sem acinous, consisted of eight balloon-shaped and one short-tubular vesicles.

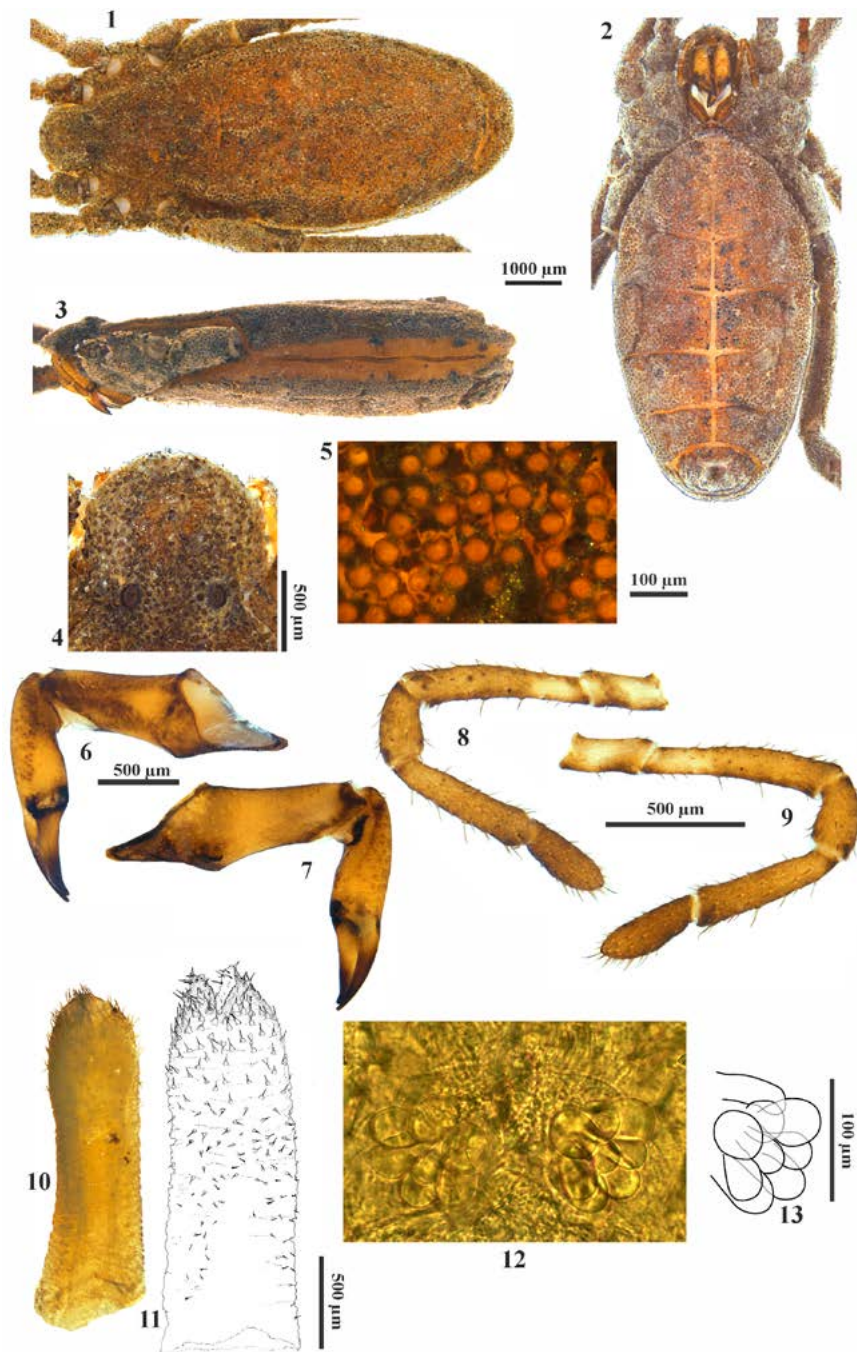
Legs. As in ♂. Article lengths in Table 1. Mt II: Ta II lengths  $\approx$  1.15: 1.

**Table 1.** *Trogulus nepaeformis* (Scopoli, 1763), neotype, male (female in parentheses). Length of appendage segments in millimetres in individuals from Idrija, Slovenia.

	Trochanter	Femur	Patella	Tibia	Metatarsus	Tarsus	Total length
Pedipalp	0.33 (0.36)	0.67 (0.73)	0.32 (0.32)	0.50 (0.56)	–	0.37 (0.38)	2.19 (2.35)
Leg I	0.74 (0.79)	1.67 (1.81)	0.94 (0.98)	1.20 (1.21)	1.11 (1.26)	0.64 (0.62)	6.30 (6.67)
Leg II	0.67 (0.92)	2.92 (3.19)	1.14 (1.75)	1.67 (1.32)	2.03 (2.24)	2.02 (1.75)	10.45 (11.17)
Leg III	0.72 (0.77)	1.93 (1.93)	0.99 (1.10)	1.37 (1.53)	1.52 (1.67)	0.77 (0.73)	7.30 (7.73)
Leg IV	1.00 (1.12)	2.40 (2.88)	1.24 (1.27)	1.90 (1.98)	2.09 (2.23)	0.86 (0.82)	9.49 (10.30)



**Plate I:** *Troglus nepaeformis* (Scopoli, 1763), neotype, male. 1 Body, dorsal view. 2, 3 Hood. 4. Body, lateral view. 5 Scutum microsculptures. 6–8 Chelicera: medial, lateral, medial views. 9–11 Pedipalp: medial, lateral, medial views. 12 Leg II: metatarsus and tarsus. 13. Leg II, femur armament. 14, 15 Penis, dorsal, lateral views. 16, 17 Glans lateral view. 18, 19 Glans, dorsal view. Photo T. Novak & P. Kozel, drawings T. Novak.



**Plate II:** *Trogulus nepaeformis* (Scopoli, 1763), female. 1–3 Body; dorsal, ventral, lateral views. 4 Hood. 5 Scutum microsculptures. 6, 7 Chelicera: medial, lateral views. 8, 9 Pedipalp: medial, lateral views. 10, 11 Ovipositor. 12, 13 Receptacula seminis.

## Remarks on taxonomy

*Acarus Nepaeformis* Scopoli, 1763 was placed in the correct arachnid order, Opiliones, by LATREILLE (1802) who in accordance with the present edition of the Code Art. 24.2.3 (ICZN 1999) acted as the First Reviser and renamed it as *Trogulus nepaeformis* (Scopoli, 1763) (SCHÖNHOFER 2013). *Trogulus nepaeformis* s. s. is very similar to an until now unresolved number of additional species belonging to the *nepaeformis* species-group sensu SCHÖNHOFER (2008) and SCHÖNHOFER & MARTENS (2010), which have constantly been cited under this name. The revision of the group is currently at the very beginning. So far, only few authors authentically refer to *T. nepaeformis* s. s. in the territory of Slovenia (SCOPOLI 1763; MRŠIĆ 1997; NOVAK & GRUBER 2000; TARMAN 2003; BLICK & KOMPOSCH 2004; NOVAK et al. 2006, 2007; KLENOVŠEK et al. 2013a, b; LIPOVŠEK et al. 2021). Although body length and width are considerably variable, on the one hand, the genital morphology (penis, receptacula seminis) and measures of metatarsus II (Table 2) proved to be very constant allowing unambiguous identification of the species. However, any synonymy within the *nepaeformis* species-group cannot be provided until the revision of the group is completed. For example, a number of populations from other areas are not congruent with this redescription presented here, especially in various parts of the Alps, also varying with elevation. Furthermore, populations on the Balkan Peninsula are to be considered, where *Trogulus* taxonomy in other groups was shown to be exceedingly complex (SCHÖNHOFER & MARTENS 2008; SCHÖNHOFER et al. 2013).

**Table 2.** *Trogulus nepaeformis* (Scopoli, 1763) variability in body length and width, lengths of Mt II, BS, DS and whole Ta II in millimetres, and Mt II/Ta II ratios in individuals from Idrija, Slovenia. Mean±StDev (min–max).

	Body length	Body width	Mt II	BS	DS	Ta II	Mt II/Ta II
♂ (n=9)	7.39±0.24 (6.94–7.67)	2.90±0.09 (2.77–3.07)	2.02±0.05 (1.93–2.01)	0.82±0.03 (0.78–0.88)	1.23±0.03 (1.18–1.26)	2.05±0.04 (1.98–2.11)	0.99±0.03 (0.94–1.03)
♀ (n=10)	8.38±0.21 (8.05–8.67)	3.30±0.26 (2.82–3.63)	2.18±0.08 (2.11–2.32)	0.77±0.03 (0.74–0.85)	1.11±0.05 (1.03–1.22)	1.89±0.04 (1.85–2.00)	1.15±0.05 (1.10–1.23)

## Distribution

Though our comparative material from the environments of Idrija is quite rich and amounts to about hundred specimens, only a few additional localities in Slovenia have been confirmed to date. Apparently, *T. nepaeformis* covers a rather small area at the fringes of the south-eastern Alps. For the time being, its precise distributional area cannot be established prior to a revision of all medium-sized troguli within the eastern Alps and the north-western Balkans.

## Ecology

Like other ground-dwelling species, *T. nepaeformis* live in litter, soil, stone accumulations and similar spacious microhabitats, at daytime hiding under stones, dead wood on the ground, in moss, rock fissures, etc. This species seems to prefer mull humus stratum in soils on limestone and dolomite, as it is most abundant there. In nature, individuals have been found to feed on enchytraeids, small lumbricids and soft-chitinous, mostly dipteran larvae (T. Novak & L. Slana Novak, unpublished observations), but they most probably feed also on snails, as do troguli of a related species of the *nepaeformis* species-group (PABST 1953, sub *T. nepaeformis*).

## Discussion

Sharing the Alpine, central European, Dinaric, Sub-Mediterranean and Sub-Pannonian biota, most harvestmen including all troguli species in Slovenia belong to the first three biogeographical regions. There are more than ten *Trogulus* species in the country (HADŽI 1931; CHEMINI 1984; KOMPOSCH 2000; NOVAK & GRUBER 2000; NOVAK et al. 2006; SCHÖNHOFER 2009; SCHÖNHOFER & MARTENS 2009; SCHÖNHOFER & NOVAK 2011; own unpublished data). However, we still do not have a clear idea about the number of valid species in Slovenia, not to speak about valid names.

The epithet *nepaeformis* is used as a collective name for a multitude of European medium-sized troguli with the ratio of ‘distal segment: basal segment’ of tarsus II approximately 1.5: 1 (SCHÖNHOFER 2009). It is important that species of the *nepaeformis* species-group are similar in size and external morphology, but differ in genital morphology and are allopatric in most cases (SCHÖNHOFER 2009). Moreover, it is encouraging that comparable genetic distances coincide with morphospecies (SCHÖNHOFER 2009). The assumption that Scopoli collected specimens of *T. nepaeformis* in Idrija – his living and working place at that time – was essential to focus preparation of our redescription. Selecting by far the commonest species of the four medium-sized troguli around Idrija as credible candidate of Scopoli’s species was consequently much easier and most probably denotes the correct species. The designation of this neotype satisfies most qualifying conditions of article 75.3. of the ICZN. Still, delineation of this and related species is an ongoing process (article 75.3.2), and the redescription of *T. nepaeformis* serves as a base for revising medium-sized troguli and for considering the synonymy within the *nepaeformis* species-group.

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