On the biodiversity of pseudoscorpions in Croatia: *Neobisium curcici* (Pseudoscorpiones: Neobiidae), a new cave-dwelling species from Dalmatia (Croatia)

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**Abstract**

The thorough analysis of a pseudoscorpion sample collected in the Jama pod Gažnovcem Pit, Stilja, near Vrgorac, Dalmatia (Croatia) resulted in establishing a new pseudoscorpion taxon – *Neobisium curcici* n. sp. The main diagnostic features of the type specimens studied are illustrated, carefully analysed and compared to the closest congeners. The taxonomic interrelationships and the geographic distribution of the new pseudoscorpion species are briefly discussed.

**Key words:** Pseudoscorpions, Neobiidae, cave-dwelling fauna, *Neobisium curcici*, new species, Dalmatia, Croatia.

**Introduction**

The Dinaric karst that runs along the coast of the Adriatic Sea is abundant in subterranean forms – caves, pits and ponors (Beier 1939; Ćurčić 1988). The subterranean fauna of the Dinaric karst is rich in pseudoscorpion species. Although many new taxa (species and genera) have been established in the past 30 years mainly by Ćurčić (1987, 1988) and Ćurčić *et al.* (2002, 2006, 2008, 2010, 2011, 2012a, b, 2013), it is still insufficiently investigated. The representatives of the genera *Chthonius* C. L. Koch and *Neobisium* Chamberlin are known to inhabit caves and pits. Of these, the majority are endemic and relict troglobitic forms (Ćurčić *et al.* 2013).

**Material and Methods**

The careful examination of a small pseudoscorpion sample collected by one of us (TR) revealed the presence of a new taxon – *Neobisium curcici* n. sp. The type specimens were carefully dissected, then mounted on slides in a gum-chloral medium (Swan's fluid), and deposited in the Collection of the Institute of Zoology, University of Belgrade - Faculty of Biology, Belgrade, Serbia.
Systematic part

Neobisiidae Chamberlin, 1930

*Neobisium* Chamberlin, 1930

**NEOBISIUM CURCICI DIMITRIJEVIĆ, NEW SPECIES**
(Figs. 1–16; Table 1)

**Etymology** – The new taxon is named after late Prof. Dr. Božidar P. M. Ćurčić, the most prominent Serbian arachnologist, whose studies laid the foundations to pseudoscorpiological investigations in the second half of the XX century in Serbia.

**Material examined** – Holotype male, a paratype male and a paratype tritonymph from the Jama pod Gažnovcem Pit, Stilja, near Vrgorac, Dalmatia, Croatia (Fig. 17), collected by hand under stones on 29 October 2014 by Tonći Rađa. It is not unusual to erect a new species on the grounds of a sparse material collected and examined, sometimes even on a single specimen available (Ćurčić et al. 2003; Henderickx and Vets 2000; Heurtault 1975; Mahnert 1982; Muchmore 2000).

**Description.** – Carapace considerably longer than broad (Fig. 1; Table 1). Epistome triangular, apically rounded (Fig. 2). Neither eyes nor eye-spots developed. Carapacal setae arranged in four rows. Anterior row bears four setae, six or seven setae in ocular row, whilst intermediary row has eight setae. Four setae present in posterior row. Preocular microsetae not developed.

All abdominal tergites entire, smooth and uniseriate. Pleural membrane granulostriate. Tergites I-X carry 4-4-4-6(4)-7-7-7-8(7)-7-8 setae. Sternite II bears 17 setae; sternite III with 19 or 22 anterior and median setae. Twelve or thirteen setae developed on the posterior margin of sternite III. Three pairs of suprastigmatic microsetae on sternite III. Sternite IV with 10 or 14 posterior setae and three suprastigmatic microsetae along each stigma (Fig. 8). Setation of sternites V-X as follows: 14(15)-13-12(13)-14-11(13)-10(11). Setal designation follows Beier (1939).

Female genital area unknown.

Cheliceral spinneret (galea) inconspicuous, almost absent (Fig. 3). The teeth on fixed cheliceral finger (9–12) large, particularly the first two, diminishing in size in proximal direction. Movable cheliceral finger carries six or eight teeth. Six setae found on cheliceral palm and a single seta on movable cheliceral finger. Cheliceral flagellum 8-9-bladed. Of these, the two distalmost blades pinnate anteriorly (Fig. 4). Movable cheliceral finger slightly longer than cheliceral palm (Table 1).

Manducatory process has four long acuminate setae. Pedipalpal articles smooth and elongate (Fig. 5). Pedipalpal tibia slightly dilated distally.

Fixed pedipalpal chelal finger carries 137 or 141 teeth, while 123 or 128 teeth found on movable chelal finger (Fig. 6). The teeth on movable chelal finger do not reach the level of trichobothrium b, whilst the teeth on fixed chelal finger end before the level of ib (Fig. 6). Four trichobothria present on movable chelal finger and eight trichobothria on fixed chelal finger (Fig. 6).

Pedipalpal femur 8.53 times as long as broad; this article more than twice as long as carapace (Table 1). Pedipalpal patella (tibia) 6.16 times as long as broad. Pedipalpal chela length/breadth ratio 8.22. Pedipalpal chelal fingers 1.47–1.50 times as long as chelal palm (Table 1).

Tibia IV, metatarsus IV and tarsus IV each carry a tactile seta. The tactile seta situated in the proximal part of tibia IV. Tactile setae on both metatarsus IV and tarsus IV located in the proximal thirds. Subterminal tarsal seta furcate, each branched, with a few spinnules. Tarsal claws sickle-shaped, smooth and slender (Fig. 7).

The linear measurements (in mm) and morphometric ratios of different body structures presented in Table 1.

**Tritonymph** – Carapace considerably longer than broad (Fig. 9). Epistome small, apically rounded (Fig. 10). Neither eyes nor eye-spots developed. Preocular microsetae absent. Setal carapacal formula as follows: 4-6-6-4 = 20.
Figures 1–8 - *Neobisium curcici* n. sp., holotype male from the Jama pod Gažnovcem Pit, Stilja, near Vrgorac, Dalmatia, Croatia: 1 – carapace; 2 – epistome; 3 – chelicera; 4 – flagellum; 5 – pedipalp; 6 – pedipalpal chela; 7 – leg IV; 8 – male genital area. Scale = 0.25 mm (Figs. 2–4, 8) and 0.50 mm (Figs. 1, 5–7).
Figures 9–16 - *Neobisium curcici* n. sp., paratype tritonymph from the Jama pod Gažnovcem Pit, Stilja, near Vrgorac, Dalmatia, Croatia: 9 – carapace; 10 – epistome; 11 – chelicera; 12 – sternites II-IV; 13 – flagellum; 14 – pedipalp; 15 – pedipalpal chela; 16 – leg IV. Scale = 0.50 mm (Figs. 9, 14–16) and 0.25 mm (Figs. 10–13).
Table 1. Linear measurements (in mm) and morphometric ratios in *N. curcici* n. sp., *N. svilajae* Dimitrijević & Rađa, and *N. davidbengurioni* Ćurčić & Dimitrijević. Abbreviations: MM = males, M = male, T = tritonymph.

| Character                      | *N. curcici* n. sp. | *N. svilajae* | *N. davidbengurioni* |
|--------------------------------|---------------------|---------------|----------------------|
|                                | MM                  | T             | M                    | M                    |
| Body                           |                     |               |                      |                      |
| Length (1)                     | 4.205–4.44          | 4.21          | 3.71                 | 4.22                 |
| Cephalothorax                  |                     |               |                      |                      |
| Length (2)                     | 1.355–1.44          | 1.09          | 1.14                 | 1.23                 |
| Breadth (2a)                   | 0.99–1.06           | 0.89          | 0.855                | 0.94                 |
| Ratio 2/2a                     | 1.36–1.37           | 1.22          | 1.33                 | 1.31                 |
| Abdomen                        |                     |               |                      |                      |
| Length                         | 2.89–3.00           | 3.12          | 2.57                 | 2.985                |
| Chelicerae                     |                     |               |                      |                      |
| Length (3)                     | 0.96–1.01           | 0.71          | 0.845                | 0.77                 |
| Breadth (4)                    | 0.47–0.51           | 0.40          | 0.41                 | 0.37                 |
| Length of movable finger (5)   | 0.59–0.63           | 0.48          | 0.54                 | 0.49                 |
| Ratio 3/5                      | 1.60–1.63           | 1.48          | 1.56                 | 1.57                 |
| Ratio 3/4                      | 1.98–2.04           | 1.775         | 2.61                 | 2.08                 |
| Pedipalps                      |                     |               |                      |                      |
| Length with coxa (6)           | 12.11–12.93         | 8.07          | 12.13                | 0.085                |
| Ratio 6/1                      | 2.88–2.91           | 1.92          | 3.27                 | 2.39                 |
| Length of coxa                 | 1.08–1.17           | 0.91          | 0.97                 | 0.94                 |
| Length of trochanter           | 1.00–1.06           | 0.76          | 0.88                 | 0.845                |
| Length of femur (7)            | 2.90–3.09           | 1.98          | 3.03                 | 2.58                 |
| Breadth of femur (8)           | 0.34–0.37           | 0.285         | 0.285                | 0.28                 |
| Ratio 7/8                      | 8.35–8.53           | 6.95          | 10.63                | 9.21                 |
| Ratio 7/2                      | 2.14–2.145          | 1.82          | 2.66                 | 2.10                 |
| Length of patella (tibia) (9)  | 2.28–2.48           | 1.43          | 2.62                 | 2.06                 |
| Breadth of patella (tibia) (10)| 0.37–0.40           | 0.305         | 0.315                | 0.305                |
| Ratio 9/10                     | 6.16–6.20           | 4.67          | 8.32                 | 6.75                 |
| Length of chela (11)           | 4.85–5.13           | 2.99          | 4.63                 | 3.66                 |
| Breadth of chela (12)          | 0.59–0.63           | 0.55          | 0.50                 | 0.54                 |
| Ratio 11/12                    | 8.14–8.22           | 5.44          | 9.26                 | 6.78                 |
| Length of chelal palm (13)     | 1.96–2.05           | 1.28          | 1.85                 | 1.61                 |
| Ratio 13/12                    | 3.25–3.32           | 2.33          | 3.70                 | 2.98                 |
| Length of chelal finger (14)   | 2.89–3.08           | 1.71          | 2.78                 | 2.05                 |
| Ratio 14/13                    | 1.47–1.50           | 1.335         | 1.50                 | 1.27                 |
| Leg IV                         |                     |               |                      |                      |
| Total length                   | 8.155–8.855         | 5.715         | 9.36                 | 6.82                 |
| Length of coxa                 | 0.68–0.805          | 0.57          | 0.63                 | 0.61                 |
| Length of trochanter (15)      | 0.79–0.815          | 0.63          | 0.835                | 0.70                 |
| Breadth of trochanter (16)     | 0.295–0.34          | 0.22          | 0.23                 | 0.21                 |
| Ratio 15/16                    | 2.40–2.68           | 2.86          | 3.63                 | 3.33                 |
| Length of femur + patella (17) | 2.465–2.74          | 1.66          | 2.985                | 2.10                 |
| Breadth of femur + patella (18)| 0.305–0.37          | 0.24          | 0.24                 | 0.22                 |
| Ratio 17/18                    | 7.405–8.08          | 6.92          | 12.44                | 9.545                |
| Length of tibia (19)           | 2.24–2.48           | 1.43          | 2.66                 | 1.77                 |
| Breadth of tibia (20)          | 0.19–0.20           | 0.15          | 0.15                 | 0.13                 |

..continued on the next page
Table 1. (Continued)

| Ratio 19/20 | 11.24–11.79 | 9.53 | 17.73 | 13.615 |
| Length of metatarsus (21) | 0.825–0.87 | 0.59 | 0.94 | 0.71 |
| Breadth of metatarsus (22) | 0.14–0.15 | 0.13 | 0.13 | 0.11 |
| Ratio 21/22 | 5.50–6.21 | 4.54 | 7.23 | 6.36 |
| Length of tarsus (23) | 1.11–1.19 | 0.935 | 1.31 | 0.93 |
| Breadth of tarsus (24) | 0.14 | 0.14 | 0.11 | 0.10 |
| Ratio 23/24 | 7.92–8.50 | 5.96 | 11.91 | 9.30 |
| TS ratio - tibia IV | 0.325–0.35 | 0.27 | 0.42 | 0.21 |
| TS ratio - metatarsus IV | 0.12–0.13 | 0.11 | 0.13 | 0.16 |
| TS ratio - tarsus IV | 0.43–0.53 | 0.41 | 0.43 | 0.49 |

Abdominal tergites entire and uniseriate. Tergite setation as follows: 4-4-5-6-7-7-8-8-8. Sternite II with two short setae. Sternites III and IV carry 10 and nine setae, respectively. Sternite III with three suprastigmatic microsetae; sternite IV with two short setae along each stigma (Fig. 12). Setal formula of sternites V-X: 15-13-12-13-11-11.

Galea low. Cheliceral palm with six setae, whilst movable cheliceral finger bears a seta. Fixed and movable cheliceral fingers carry nine and six teeth, respectively (Fig. 11). Flagellum 8-bladed; of these, only two distal blades pinnate along the anterior margin (Fig. 13). All other blades smooth, they diminish in size respectively, the most proximal blade being the smallest.

Manducatory process (apex) of pedipalpal coxa with three setae.

Pedipalpal articles as in male adults, elongate and smooth (Fig. 14). Pedipalpal femur and tibia elongate, widening distally. Chelal palm shorter than chelal fingers, tibia and femur. Fixed and movable pedipalpal chelal fingers with 94 and 84 small and asymmetrically pointed teeth, respectively. On movable chelal fingers tooth ends before the level of trichobothrium b (Fig. 15).

All leg IV articles almost parallel-sided (Fig. 16). Tibia IV, basitarsus IV and telotarsus IV with a tactile seta each (Fig. 16). Subterminal tarsal setae furcate, each branched, with a few spinnules.

**Distribution** – On the grounds of the present knowledge, the newly erected pseudoscorpion species *N. curcici* is known to inhabit only its locus typicus – Jama pod Gažnovcem Pit, Stilja, near Vrgorac, Dalmatia, Croatia. It is an endemic and a relict form. Further investigations of cave-dwelling fauna in Dalmatia may result in establishing new finding places of this species; if so, that will enable better understanding of the intraspecific variability.

**Diagnosis**
The newly erected species *N. curcici* can be easily distinguished in many important aspects from the two phenetically closest congeners *N. svilajae* Dimitrijević & Rada and *N. davidbengurionii* Ćurčić & Dimitrijević (Ćurčić et al. 2002; Dimitrijević & Rada 2008) from Dalmatia. *Neobisium curcici* differs from *N. svilajae* and *N. davidbengurionii* in the total pedipalpal length (12.11–12.93 mm vs. 12.13 mm vs. 10.085 mm), the pedipalpal femur length (2.90–3.09 mm vs. 3.03 mm vs. 2.58 mm), the pedipalpal femur length/breadth ratio (8.35–8.53 vs. 10.63 vs. 9.21), the pedipalpal tibia length (2.28–2.48 mm vs. 2.62 mm vs. 2.06 mm), the pedipalpal chelal length/breadth ratio (8.14–8.22 vs. 9.26 vs. 6.78), the total number of carapacial setae (23 vs. 20 vs. 22), the setal formula of tergites I-X (4-4-4-7-7-7-7-7-7-8 vs. 4-4-4-6-6-6-7-7-7-7-7-7-7-8-7 vs. 6-6-6-5-7-7-7-7-7-7-7), the number of setae on sternite II (17 vs. 15 vs. 13), the number of teeth on movable pedipalpal chelal finger (137 vs. 175 vs. 124), in the length and breadth of the articles of leg IV, as well as in the morphometric ratios of the articles (Table 1).

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