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ON THE EXTERNAL MORPHOLOGY OF THE MALE *NEOBISIUM* *CAVERNARUM* (L. KOCH, 1873) (NEOBISIIDAE, PSEUDOSCORPIONES) FROM FRANCE

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ABSTRACT

A detailed and amended description of the external morphology of the male of the troglotic species *Neobisium cavernarum* (L. Koch 1873) from the cave Grotte d'Aubert, Ariège, France is presented. Taxonomic interrelationships with *Neobisium simoni* (L. Koch 1873) are also considered.

RÉSUMÉ

La morphologie externe du male du *Neobisium cavernarum* (L. Koch 1873), espèce troglotique trouvé dans le Grotte d'Aubert, Ariège, France, est décrite et illustrée. Les principaux caractères diagnostiques et les interrelations taxonomiques avec *N. simoni* (L. Koch 1873) sont comparés et considérés.

Key words: Pseudoscorpiones, Neobisiidae, *Neobisium cavernarum*, morphology, caves, France

INTRODUCTION

Nineteen cave-dwelling representatives of the genus *Neobisium* Chamberlin 1930 are known to inhabit caves and potholes in France (Harvey, 1991). Among these neobisiid species, *Neobisium* (*Neobisium*) *cavernarum* was erected by L. Koch in 1873 and was based upon the description of the specimen collected by E. Simon in a cave in Ariège, southern France. According to Beier (1963), Leclerc & Heurtault (1979), Heurtault

(1985) and Harvey (1991) this cave-dwelling species is distributed in several caves and potholes in southern France and Spain (Grottes de Troumajo, de Lournas, de Lestelas, du Portel, de Peyournard, gouffre du Coumat).

Since the original description by Koch (1873) and the one given by Beier (1963) are rather short by the present standards, the primary aim of this study is to give an additional description of the external morphology of three studied males of *N. cavernarum*.

MATERIAL AND METHODS

A sample of three cave-dwelling pseudoscorpions were presented to the author of this study by Dr Charles Gers (Laboratoire souterrain du CNRS, Moulis, France). Specimens were collected in the cave Grotte d'Aubert, near Moulis, St. Girons, Ariège, southern France, on three occasions: September 29, 1986, February 20, 1987, and July 30, 1987 by Dr Charles Gers. Subsequent analysis of the pseudoscorpion material revealed that all three specimens were males of *N. cavernarum*. They were carefully dissected and mounted in Swan's fluid and are presently deposited in the collection of the Institute of Zoology, Faculty of Biology, University of Belgrade, Belgrade, Yugoslavia.

SYSTEMATIC PART

DESCRIPTION. - The description of the external morphology of the male is as follows:

The carapace longer than broad and yellowish-brown (Table 1, Fig. 1). Epistome triangular and well developed (Fig. 2). Anterior eyes larger than posterior (with flattened lenses) (Fig. 1). Preocular microsetae absent. Setal formula of the carapace: 4+6+6+6 = 22.

Tergite I with six setae, tergite II carries six-seven setae. Tergite III with 10 setae whilst tergites IV-X carry 11-12 setae (tergal setation presented in Table 2).

Sternite II carries 10 small setae situated medially. Sternite III with 24 setae of unequal length. On the posterior and anterior border of this sternite eight i.e. 10 longer setae are developed, whilst 10 setae are situated in the median part of this sternite. Six short (microsetae) setae, positioned in two opposite groups are found in the middle of the anterior sternal border. Sternite IV carries nine setae along the posterior sternal border. Sternites III and IV with two suprastigmatic microsetae on each side (Fig. 4, Table 2). Sternites V-X carry 11-14 setae (sternal setation presented in Table 2).

Galea rounded and low (Fig. 3). Cheliceral palm with seven, movable cheliceral finger with one seta. (Fig. 3, Table 2). Cheliceral teeth small and of irregular shape. Fixed cheliceral finger with a larger number of teeth (14) than the movable

cheliceral finger (nine). The flagellum eight-bladed, the first blade (most proximal one) is separated from the rest of the blades. First two (most proximal blades) are serrated on their anterior side; other blades diminish in size from the distal to the proximal end of the flagellum.

The manducatory process bears four long setae. The pedipalpal articles are reddish-brown. The movable pedipalpal finger carries four, whilst the fixed pedipalpal finger eight trichobothria (Fig. 6, Table 2.) Distally, on both pedipalpal fingers small and asymmetrical teeth are developed. Proximally, on both fingers, the teeth are rounded and close-set. The movable finger carries 59-63 whilst fixed pedipalpal finger has 76-80 teeth. Pedipalpal trochanter with tiny denticulations (Fig. 7). Pedipalpal femur with granulations that are developed on 2/3 of the femoral length (Fig. 7). All other pedipalpal articles are devoid of granulations. The chelal finger (1.15 mm) longer than the chelal palm (0.835 mm) and chelal femur (1.07 mm). The pedipalpal femur (1.07 mm) is longer than the carapace (0.815 mm). The femur is 5.35 times longer than it is broad. Trichobothriotaxy as in Table 2 and Figs. 6-7.

Tibia IV, basitarsus IV and telotarsus IV each carry a single long tactile seta (Fig. 5). Tactile setae on tibia IV and telotarsus IV are within the proximal half of the article, whilst the tactile seta on basitarsus IV is situated in the proximal fifth of this podomere. Tactile seta ratios are presented in Table 1.

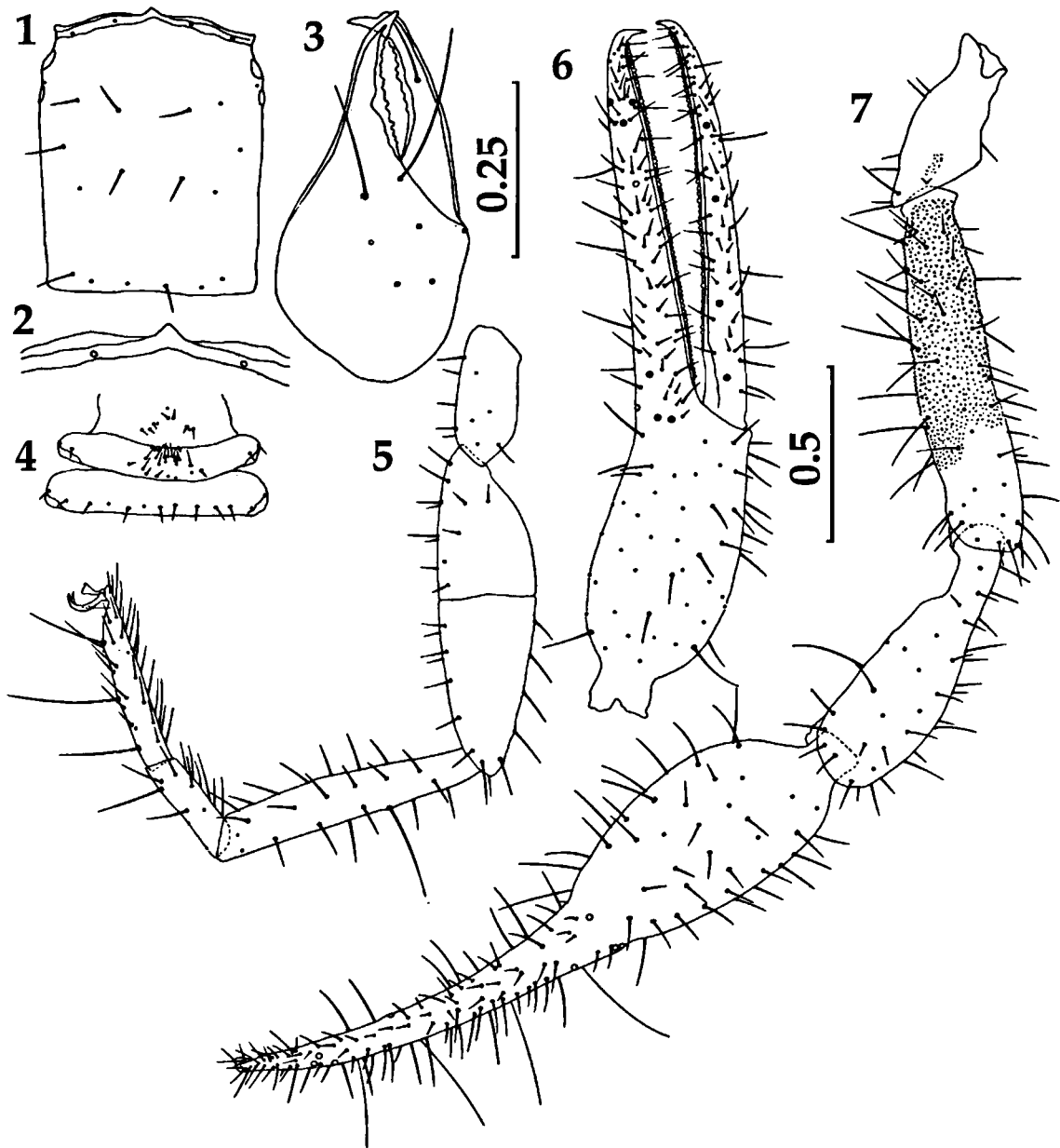
DISCUSSION AND CONCLUSIONS

Although linear measurements and morphometric ratios of certain (several) body parts of these three analysed males differ slightly from the values given by L. Koch (1873) and Beier (1963), we are of the opinion that these differences should be attributed to the intraspecific variation of *N. cavernarum*.

Dimitrijevic (1990, 2000) has studied external morphology and postembryonic development of all growth stages and both sexes of *Neobisium simoni* (L. Koch 1873). The examined specimens belonged to an epigeal population of *N. simoni* collected from humus and leaf-litter in a mixed oak forest in Moulis and Passerole, Ariège, southern France.

Table 1. Linear measurements (in mm) of certain body structures and their morphometric ratios in male of *Neobisium cavernarum* (L. Koch, 1873) and *Neobisium simoni* (L. Koch, 1873) from France.

CHARACTER	<i>N. cavernarum</i> ♂	<i>N. simoni</i> ♂
BODY		
length (1)	2.805 - 3.20	2.32 - 2.565
CARAPACE		
length (2)	0.70 - 0.815	0.64 - 0.71
breadth (3)	0.60 - 0.64	0.62 - 0.72
ABDOMEN		
length (4)	2.26 - 2.90	1.66 - 1.915
CHELICERAE		
length (5)	0.51 - 0.53	0.47 - 0.58
breadth (6)	0.24 - 0.25	0.25 - 0.275
mov. finger length (7)	0.33 - 0.34	0.33 - 0.37
ratio 5/7	1.50 - 1.61	1.42 - 1.56
ratio 5/6	2.04 - 2.21	1.88 - 2.23
PEDIPALPS		
length with coxa (8)	4.90 - 5.045	3.54 - 4.18
length without coxa (9)	4.26 - 4.415	2.98 - 3.63
ratio 9/1	1.53 - 1.775	1.43 - 1.72
coxa length (10)	0.62 - 0.63	0.48 - 0.56
trochanter length (11)	0.49 - 0.53	0.41 - 0.46
femur length (12)	1.04 - 1.07	0.80 - 0.93
femur width (13)	0.20 - 0.21	0.20 - 0.23
ratio 12/13	5.05 - 5.35	3.95 - 4.65
ratio 12/2	1.31 - 1.48	1.23 - 1.45
patella length (14)	0.825 - 0.85	0.57 - 0.70
patella width (15)	0.25 - 0.27	0.23 - 0.285
ratio 14/15	3.15 - 3.74	2.28 - 2.68
chela length (16)	1.895 - 1.975	1.42 - 1.62
chela width (17)	0.39 - 0.41	0.37 - 0.45
ratio 16/17	4.83 - 4.97	3.50 - 3.95
chelal palm length (18)	0.805 - 0.835	0.63 - 0.75
ratio 18/17	2.01 - 2.14	1.49 - 1.80
finger length (19)	1.09 - 1.15	0.78 - 0.89
ratio 19/18	1.32 - 1.39	1.05 - 1.28
LEG IV		
total length (20)	3.45 - 3.48	2.765 - 3.155
coxa length (21)	0.43 - 0.45	0.35 - 0.41
trochanter length (22)	0.40 - 0.42	0.295 - 0.38
trochanter width (23)	0.15 - 0.16	0.15 - 0.17
ratio 22/23	2.50 - 2.80	1.79 - 2.31
femorapatella length (24)	0.90 - 0.94	0.78 - 0.92
femorapatella width (25)	0.24 - 0.27	0.23 - 0.26
ratio 24/25	3.46 - 3.79	3.39 - 3.71
tibia length (26)	0.845 - 0.87	0.63 - 0.74
tibia width (27)	0.12 - 0.14	0.12 - 0.13
ratio 26/27	6.11 - 7.25	5.08 - 5.69
basitarsus length (28)	0.315 - 0.35	0.26 - 0.315
basitarsus width (29)	0.08 - 0.09	0.08 - 0.10
ratio 28/29	3.89 - 4.25	2.89 - 3.43
telotarsus length (30)	0.50 - 0.53	0.41 - 0.45
telotarsus width (31)	0.07 - 0.08	0.08 - 0.09
ratio 30/31	6.375 - 7.57	5.00 - 5.625
TS ratio - tibia IV	0.40 - 0.43	0.34 - 0.40
TS ratio - basitarsus IV	0.15 - 0.19	0.12 - 0.16
TS ratio - telotarsus IV	0.37 - 0.41	0.265 - 0.44



Figs. 1-7. *Neobisium cavernarum* (L. Koch 1873), male from Grotte d' Aubert, Ariège, France. 1, carapace. 2, epistome. 3, chelicera. 4, genital area. 5, leg IV. 6, pedipalpal chela. 7, pedipalp (scale lines in mm).

N. simoni is primarily an epigeal species inhabiting leaf-litter and humus and according to Heurtault (1985) *N. simoni* is also trogliphilic - it is found together with *N. cavernarum* in several caves in southern France. Heurtault (1985) states that "la détermination entre les deux espèces est particulièrement difficile quand les spécimens sont récoltés à différentes profondeurs de la même

grotte".

On the basis of the present study of the external morphology of three males of *N. cavernarum* and comparison of the equivalent evidence presented elsewhere (Dimitrijevic, 1990, 2000) for *N. simoni*, a more sound distinction between *N. cavernarum* and *Neobisium simoni* can be made. These two species can be mutually distinguished upon

Table 2. Number of setae and teeth on various body structures in *N. cavernarum* (L. Koch) and *N. simoni* (L. Koch) from France.

CHARACTER	<i>N. cavernarum</i> ♂	<i>N. simoni</i> ♂
CARAPACE		
Anterior row	4	4
Ocular row	6	6
Median-intermedian row	6	5 - 8
Posterior row	6	6 - 8
Total number of setae	22	21 - 24
Microsetae	0	0
TERGITES		
I	6	6 - 9
II	6 - 7	9 - 11
III	10	9 - 12
IV	11 - 12	10 - 11
V	11 - 12	10 - 11
VI	11 - 12	11 - 12
VII	10 - 11	9 - 12
VIII	10 - 11	9 - 12
IX	10 - 11	9 - 11
X	10 - 11	9 - 10
STERNITES		
II	10	9 - 16
III	24	21 - 37
	(16	(10 - 19
	8)	11 - 16)
IV	9	9 - 12
V	13	12 - 17
VI	13	12 - 14
VII	12 - 14	10 - 14
VIII	12 - 14	10 - 13
IX	11 - 13	9 - 11
X	11 - 12	9 - 13
III: stigmal microsetae	2	2 - 5
IV: stigmal microsetae	2	2 - 5
CHELICERAE		
Movable finger	1	1
Fixed finger	7	6 - 7
PEDIPALPS		
Manducatory process	4	4
Pedipalpal coxa	6	6 - 7
Trichobothria - movable finger	4	4
Trichobothria - fixed finger	8	8
CHELICERAE		
Movable finger: number of teeth	8 - 10	6 - 10
Fixed finger: number of teeth	12 - 15	8 - 16
PEDIPALPS		
Movable finger: number of teeth	59 - 63	54 - 65
Fixed finger: number of teeth	76 - 80	59 - 70

the basis of the following differences: the pedipalpal femur granulation (more prominent and well developed in *N. cavernarum*), femur length/breadth ratio (5.05-5.35 in *N. cavernarum* vs. 3.95-4.65 in *N. simoni*), by the presence/absence of small tubercles situated on the external and proximal part of the pedipalpal femur (present in *N. simoni* vs. absent in *N. cavernarum*), as well as by

some morphometric ratios (Table 1).

As pointed out earlier by Heurtault (1985) the absence of studies devoted to the biometrics and morphological variation of pseudoscorpion species poses great problems for the systematics of this arachnid group. Future complex investigations of pseudoscorpion populations, and especially of cave-dwelling species, will give better

insight both of intra- and interspecific variability.

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