

MORPHOLOGY OF JUVENILE STAGES, DURATION
OF THE DEVELOPMENT OF *NANHERMANNIA* cf. *CORONATA* BERLESE, 1913
(ACARI, ORIBATIDA, NANHERMANIIDAE)

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ORIBATIDA
NANHERMANNIA CF.
CORONATA BERLESE
1913
JUVENILE STAGES
MORPHOLOGY

SUMMARY: The morphology description of juvenile stages and redescription of adult of oribatid mite *Nanhermannia* cf. *coronata* Berlese, 1913 (Oribatida, Nanhermanniidae) is presented, illustrated and compared with similar species: *N. nanus* (Nicolet) and *N. comitalis* (Berlese). Moreover the duration of development in the laboratory conditions was studied. All specimens were found in the material from strongly humidify soil with needles of pine forest in Nizhniy Novgorod area (Russia).

INTRODUCTION

The family Nanhermanniidae contains more than 60 species from 8 genera: *Bicyrthermannia* Hammer, *Cosmohermannia* Aoki et Yoshida, *Cyrthermannia* P. Balogh, *Dendrohermannia* P. Balogh, *Masthermannia* Berlese, *Nanhermannia* Berlese, *Nippohermannia* P. Balogh and *Notohermannia* P. Balogh (SENICZAK 1991). Adult mites grow up to 0,4-1,2 mm in length. Their dark brown-colored body is elongated, with a rounded rostrum and oval notogaster. The bothridium is well developed, with setiform sensillus. Notogastral plate contains 15 pairs of setae (seta f_1 lost).

The genus *Nanhermannia* includes more than 30 species (SUBÍAS 2004), which are widely widespread and recorded in the Holarctic and Neotropical Regions. Although studies on the duration of development and the morphology of immatures of *Nanhermannia* were carried on earlier, they were really casual. Only 2 species: *N. nanus* (Nicolet) and *N.*

comitalis (Berlese) have been described detailed so far (SENICZAK 1991, KRIVOLUTSKY 1995).

In present paper the morphology of juvenile stages of *Nanhermannia* cf. *coronata* Berlese, 1913 and the duration of its development are described, illustrated and compared with similar species: *N. nanus* (Nicolet) and *N. comitalis* (Berlese). Authors accepted definition of *N. cf. coronata* after WEIGMANN (2006).

MATERIAL AND METHODS

All immatures and more than 100 adults of *N. cf. coronata* were extracted in March-May 2005-2006, from strongly humidify soil with needles of pine forest in Nizhniy Novgorod region (Russia). All samples were collected by Sergey ERMILOV, one-two times per week in March-May 2005-2006: 1 – the Borok Park (Urenskiy district, Uren city), 2 – the Kozinskiy Forest (Balachninskiy district).

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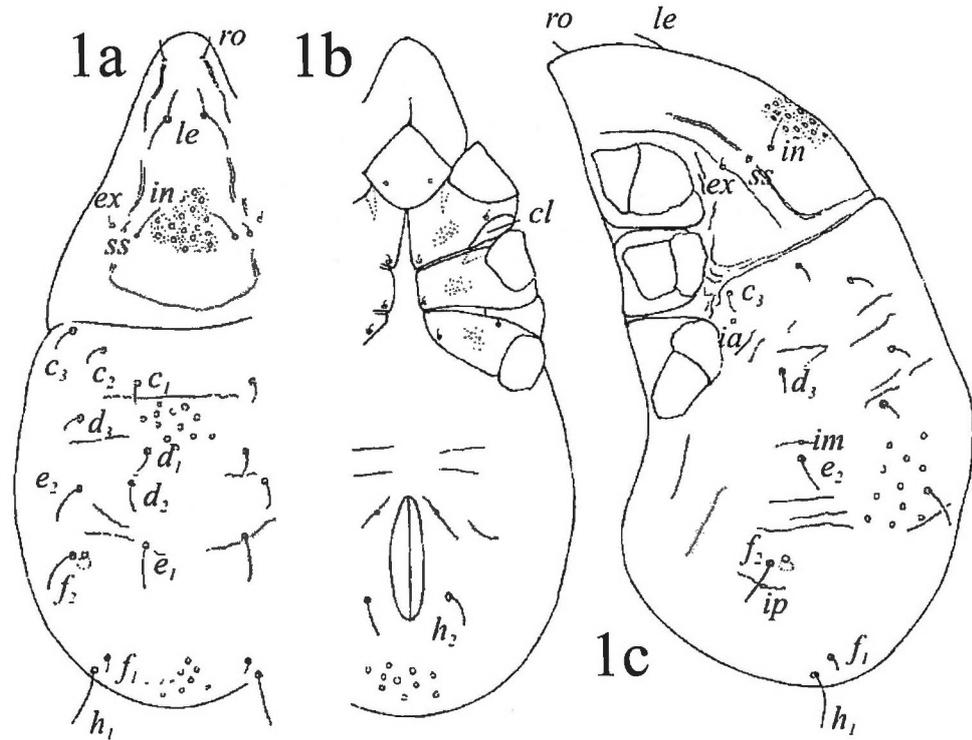


FIG. 1. *Nanhermannia cf. coronata*, larva. — Dorsal (a), ventral (b) and lateral (c) view.

The cultivation technique follows instructions of Russian acarologists (SITNIKOVA 1959, SHALDYBINA 1969, ERMILOV *et al.* 2004). The experiment was carried on in thermal case at temperature 22-23° C. and 100 % humidity. Groups of 15-25 adults were bred in plastic boxes (diameter: 3-4 cm, height: 1,5-2 cm) and immatures in the culture chambers (diameter: 1 cm, height: 1,5 cm). All boxes and chambers were put in exicators, one-third filled by water. Mites were fed with dry leaves, lichens, mosses, pleurococcal algae (*Pleuroco* "*Acus* sp.) and crude potato. The terminology used in present papers follows that of GRANDJEAN (TRAVÉ and VACHON 1975 for references).

RESULTS

1. DESCRIPTION LARVA (FIGS. 1-2) Body length: 249-298 μm ; body width: 116-132 μm ; colour: white-light brown. Rostrum rounded. Surface of prodorsal plate covered with small, oval pits and light points on a brown background. Setae *ro* thin, half length of

distance between their bases. Setae *le* and *in* thin and smooth. Setae *ex* very short. Sensilli and bothridia weakly developed (in some specimens sensillii and setae *ex* absent, their alveolae visible). Oval notogaster covered with round spots and rare, cross-section and longitudinal folds. With 12 pairs thin and smooth setae (the shortest *c*₂ as long as *ro*, the longest *h*₁ twice length of *le*; fine setae *f*₁ present). Oval opening of opisthosomal gland (*gla*) situated very close to seta *f*₂. Genital plates lacking. Pairs of epimers separated. Epimeral setation: 2-1-2. Clapared's organ (*cl*) developed. Legs monodactylous (legs setation is given in TABLE 2).

NYMPHS The nymphal morphology similar in each stage. Pigmentation of cuticle during development amplified. Sculpture of prodorsal and notogastral plates similar to larval. Central part of prodorsum porose, with formed a pattern like an upside down letter T. Notogastral plate with 15 pairs of extended setae (*h*₃, *p*₁, *p*₂, *p*₃ present; seta *f*₁ lost). Oval opening of opisthosomal gland (*gla*) situated very close to seta *f*₂. Legs monodactylous (legs setation is given in

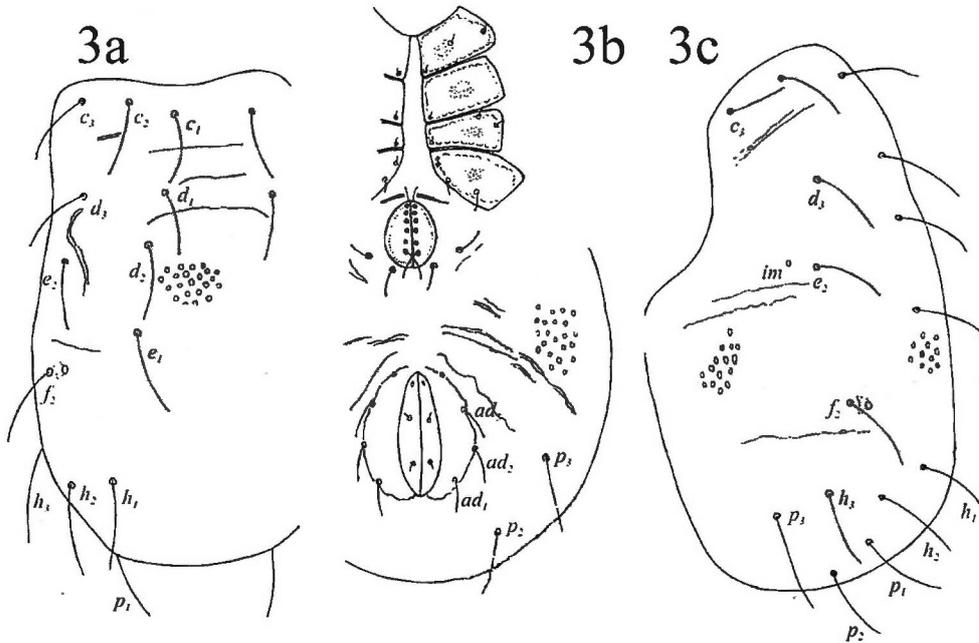
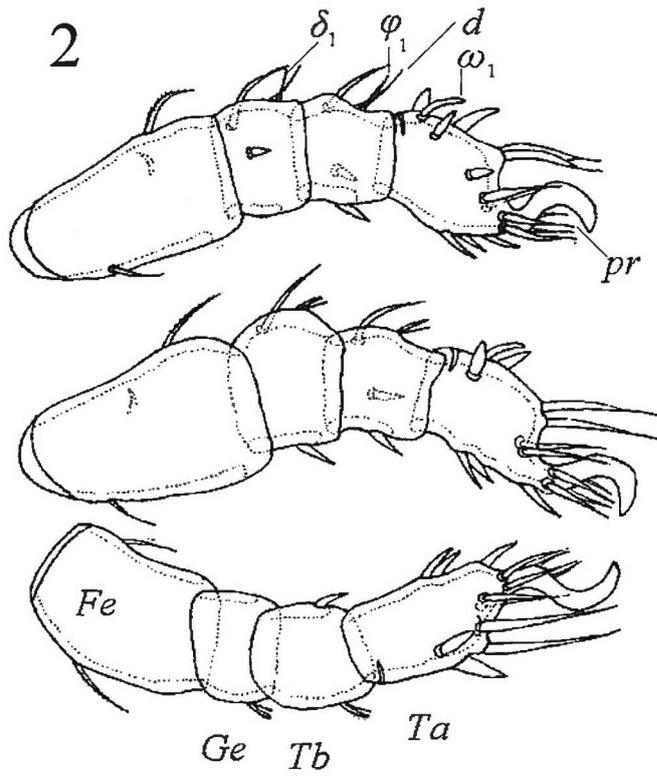


FIG. 2. *Nanhermannia* cf. *coronata*, larva. — Legs setation.

FIG. 3. *Nanhermannia* cf. *coronata*, tritonymph. — Dorsal (a), ventral (b) and lateral (c) view.

Character	Larva	Protonymph	Deutonymph	Tritonymph	Adult
Body length	249-298 μm	298-365 μm	348-464 μm	481-564 μm	531-591 μm
Body width	116-132 μm	132-149 μm	166-182 μm	215-265 μm	249-282 μm
Length of <i>ro</i>	8 μm	16-20 μm	16-24 μm	24-32 μm	36-49 μm
Length of <i>le</i>	8-16 μm	16-20 μm	20-28 μm	28-32 μm	49-57 μm
Length of <i>in</i>	12-20 μm	16-28 μm	28-41 μm	41-45 μm	69-82 μm
Length of <i>ss</i>	tiny	tiny	tiny	tiny	57-73 μm
Epimeral setation	2-1-2	3-1-2-1	3-1-2-3	3-1-3-3(4)	3-1-3-4
Genital setae	-	1	4	7	9
Aggenital setae	-	-	1	2	2
Anal setae	-	-	-	2	2
Adanal setae	-	-	3	3	3

TABLE 1. The comparison of chosen morphological characters of ontogeny stages of *N. cf. coronata* Berlese 1913.

Leg	Larva	Protonymph	Deutonymph	Tritonymph	Adult
I	0-2-4-5-16	0-2-4-5-16	0-4-4-6-16	1-5-5-6-19	1-5-6-8-23(24)
II	0-2-4-5-14	0-2-4-5-14	0-4-4-5-15	1-6-5-5-18	1-8-7-7-23(24)
III	0-2-2-3-13	1-2-2-3-13	2-2-2-3-13	3-2-3-3-15	4(5)-4-4-5-18
IV	-	0-0-0-0-7	0-2-2-3-13	0-2-3-3-15	1-2-4-5-18

TABLE 2. The comparison of legs setation of *N. cf. coronata*

TABLE 2). Protonymphal genital plates with 1 pair of setae; aggenital, anal and adanal setae lacking; epimeral setation: 3-1-2-1; Clapared's organ lost. Deutonymphal genital plates with 3 pairs, aggenital plates – with 1 pair, adanal plates – with 3 pairs of setae; epimeral setation: 3-1-2-3. Tritonymphal genital plates of with 7 pairs, aggenital plates with – 2 pairs, anal plates – with 2 pairs and adanal setae – with 3 pairs of setae; epimeral setation: 3-1-3-3(4). Tritonymphal notogaster with long setae (the shortest c_3 do not reach the bases of d_3) (FIG. 3).

ADULT (FIGS. 4-11). Body length: 531-597 μm ; body width: 249-282 μm ; colour: brown. Prodorsal plate triangular, with crest-like bumps in the posterior part. The sculpture similar to nymphal (pits, points or thin puncturation, turned T-shaped Figure). Setae *ro*, *le* and *in* setiform, longer than distance between their bases. Sensilli clavate and scopate from mid-length. Setae *ex* short, sometimes absent. The sculpture of notogaster alveolate (light spots on a brown background). Notogastral plate with 15 pairs of long setae, one and a half longer than distance between their bases and bases of setae below. The alveolae of f_1 not visible. Oval opening of opisthosomal gland (*gla*) situated close to seta f_2 . The ovipositor (length: 102-123 μm) cylindrical, hollow,

with three blades on the tip and 14 pairs of setae, covered with longitudinal, wavy folds. Ventral part of the body covered with oval and round pits, as in notogaster. Genital plates with 9 pairs and aggenital plates with 2 pairs of long setae. Two pairs of short anal setae and 3 pairs of long adanal setae (setae *ad* longer than distance between their bases). On the epimera developed 4 apodems: apo_1 , apo_2 , apo_{sj} , apo_3 . Epimeral setation: 3-1-3-4. On the ep_3 and ep_4 setae long, smooth.

Gnathosoma. Infracapitulum (114-123 μm \times 61-73 μm), with 6 pairs of setae (or_1 - or_3 , *a*, *m*, *h*). Rutelli unspecialized, wide, terminate with blades. On the internal surface of rutelli visible V- or U-shaped crest covered with cilia. Pedipalps 49-57 μm in length, setation of pedipalps: 1-0(1)-1-7. Oblong chelicerae (length: 118-123 μm) covered with dot punctation. The dorsal part of chelicerae with 2 setae (seta *chb* long and smooth, seta *cha* like a small thorn).

Legs monodactylous (legs setation is given in TABLE 2).

The comparison of chosen morphological characters of ontogeny stages of *N. coronata* is given in TABLE 1.

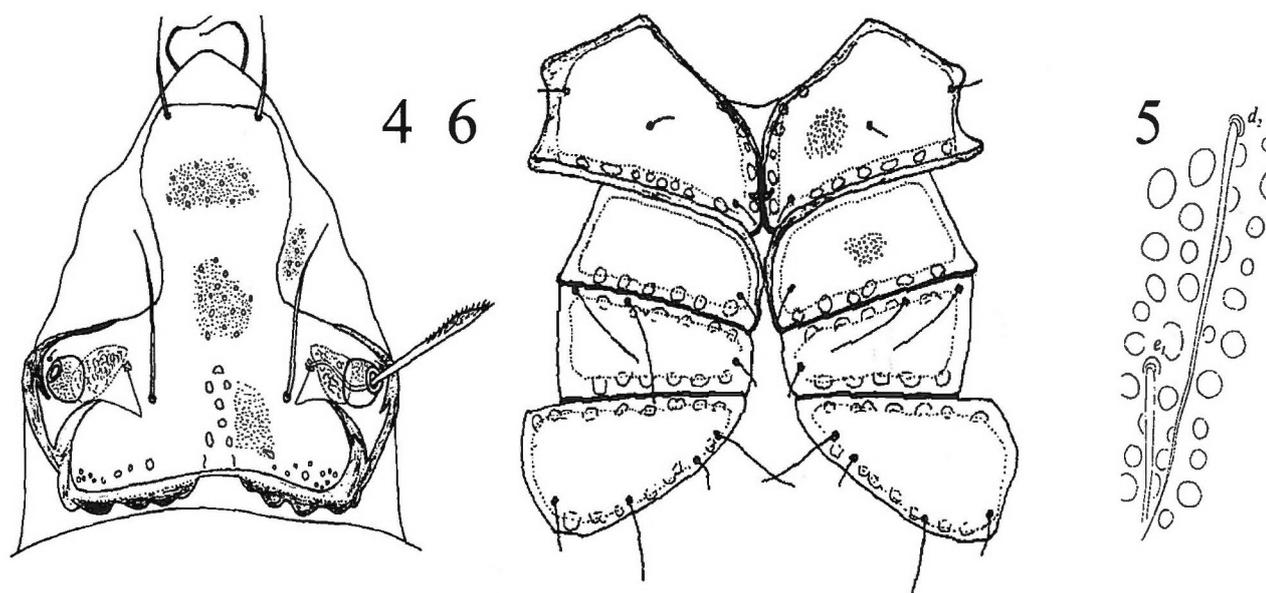


FIG. 4-6. *Nanhermannia* cf. *coronata*, adult. 4. — Prodorsum. 5. — Seta d_2 . 6. — Epimeral setation.

2. THE CULTIVATION AND THE DURATION OF DEVELOPMENT: All examined adults of *N. cf. coronata* were females. Juvenile stages and adults, placed in boxes and culture chambers, were searching the food actively. Adults preferred pleurococcal algae and a crude potato, immatures – pleurococcal algae. In the end of May females started to lay on oval and transparent eggs ($215-249 \mu\text{m} \times 116 \mu\text{m}$) on a used food and filter paper. Mostly single eggs were layed, more seldom – in pairs and small groups (up to 6 eggs). The oviposition has lasted until late autumn. In the spring and summer new generation of mites hatched. In the end of summer and in the autumn there were mainly winterer juvenile stages. Eggs were layed during all females' life, until the moment of their death (spring-summer for winter adults, summer-autumn for adults wintered as juvenile stages). Specimens, which total development has lasted a one year ("not winterer"), did not lay eggs in experiment. The terms of embryonal and postembryonal development of *N. cf. coronata* are given in TABLE 3. Briefly, females give only one generation per year in conditions of the Nizhniy Novgorod area (Russia). After a year, mature adults lay eggs from May and are gone before autumn. Therefore the life cycle of *N. cf. coronata* (from an egg

up to sexually mature adult) lasts about one year, whereas ontogeny (from an egg up to natural death) takes 1-1,5 year.

Stage	The duration of development (in days)		
	Minimum	Maximum	Average
Egg	6	8	6.5 ± 0.2
Larva	13	20	15.3 ± 0.6
Period of rest (moult)	4	8	5.7 ± 0.3
Protonymph	11	31	20.6 ± 1.3
Period of rest (moult)	5	11	7.1 ± 0.3
Deutonymph	12	26	19.6 ± 0.9
Period of rest (moult)	6	12	9.0 ± 0.4
Tritonymph	9	26	16.9 ± 1.4
Period of rest (moult)	10	13	11.0 ± 0.2
All development	105	124	112.0 ± 1.4

TABLE 3. The development duration of *N. cf. coronata* (temperature 22-23°C)

DISCUSSION

The development of immatures of *Nanhermannia* cf. *coronata* Berlese, 1913 is very similar to *N. nanus* (Nicolet) and *N. comitalis* (Berlese). Notogaster of larva has 12 pairs of setae, including setae f_1 . From

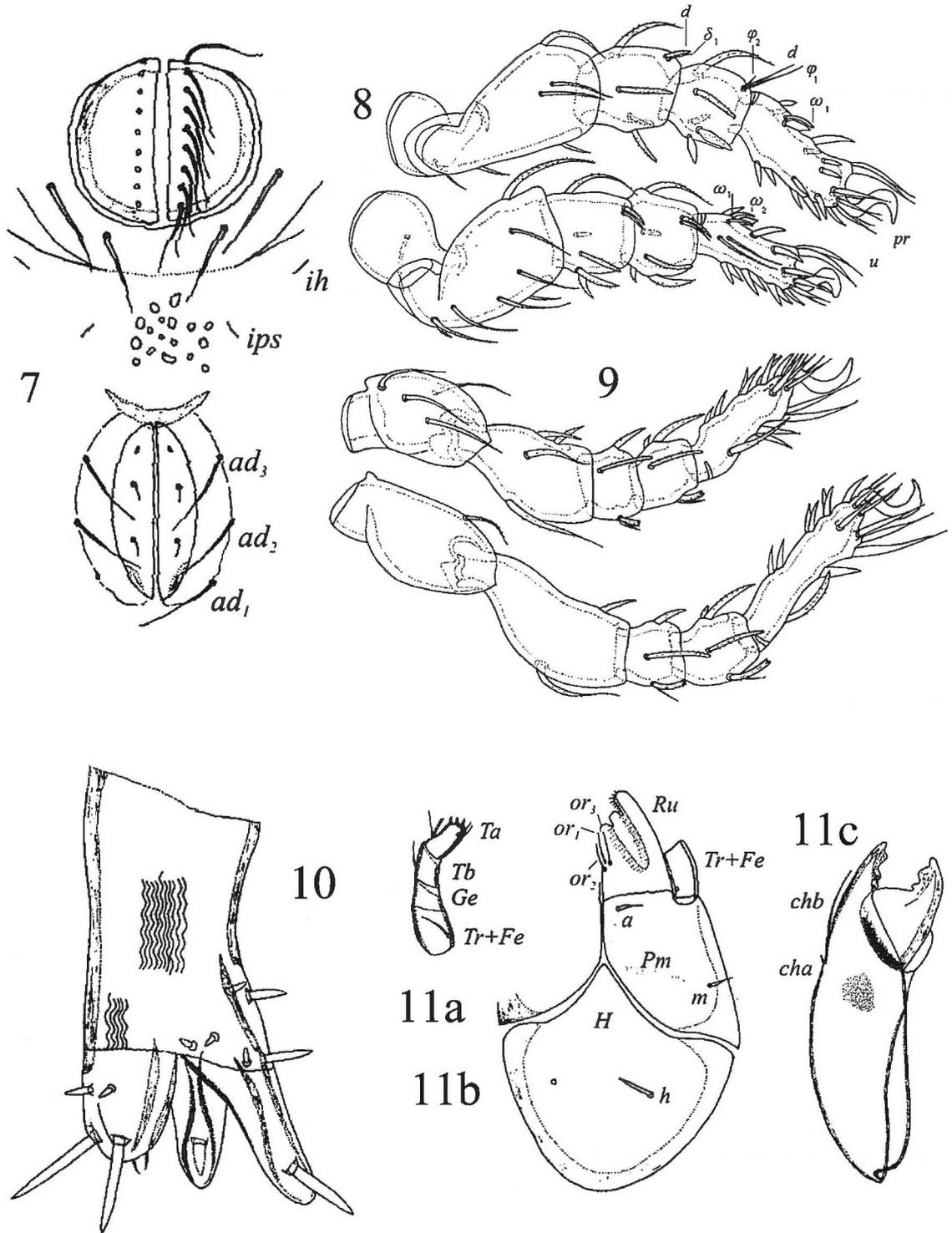


FIG. 7-9. *Nanhermannia* cf. *coronata*, adult. 7. — Ano-genital region. 8. — Setation of legs I and II. Dorsal (a), ventral (b) and lateral (c) view. 9. — Setation of legs III and IV. FIG. 10-11. *Nanhermannia* cf. *coronata*, adult. 10. — Ovipositor. 11. — Pedipalpa (a), infracapitulum (b) and chelicera (c).

Stage	Characters	<i>N. cf. coronata</i>	<i>N. nanus</i>	<i>N. comitalis</i>
Larva	Body length	249-298 μm	316 μm	323 μm
	Body width	116-132 μm	146 μm	153 μm
	Length of <i>in</i>	12-20 μm	30 μm	30 μm
Protonymph	Body length	298-365 μm	381 μm	386 μm
	Body width	132-149 μm	173 μm	203 μm
	Length of <i>in</i>	16-28 μm	50 μm	47 μm
	Epimeral setation	3-1-2-1	3-1-2-1	3-1-2-1
Deutonymph	Body length	348-464 μm	476 μm	502 μm
	Body width	166-182 μm	201 μm	223 μm
	Length of <i>in</i>	28-41 μm	73 μm	60 μm
	Epimeral setation	3-1-2-3	3-1-3-3	3-1-3-3
Tritonymph	Body length	481-564 μm	606 μm	626 μm
	Body width	215-265 μm	292 μm	322 μm
	Length of <i>in</i>	41-45 μm	96 μm	63 μm
	Epimeral setation	3-1-3-3(4)	3-1-3-4	3-1-3-4
Adult	Body length	531-591 μm	575 μm	640-660 μm
	Body width	249-282 μm	250 μm	330-380 μm
	Length of <i>in</i>	69-82 μm	-	-
	Alveolae of <i>f</i> ₁	not visible	not visible	visible
	Epimeral setation	3-1-3-4	3-1-3-4	3-1-3-4

TABLE 4. The comparison of selected morphological characters of three species of *Nanhermannia* (after Balogh et MAHUNKA 1983, SENICZAK 1991 and present studies)

the protonymphal stage the number of notogastral setae increase to 15 pairs: setae *h*₃ and setae *p* appear, setae *f*₁ lost. All ontogeny stages have a characteristic pattern of sculpture – an upside down letter T in the centro-posterior part of prodorsum with crest-like bumps in the posterior part. In all stages oval opening of opisthosomal gland (*gla*) situated very close to seta *f*₂. The genital setation develops according to formula: 1-4-7-9 and the epimeral setation – according to formula:

- larva: 2-1-2 (seta *c*₇ not included)
- protonymph: 3-1-2-1
- deutonymph: 3-1-2-3
- tritonymph: 3-1-3-3 (4)
- adult: 3-1-3-4.

The ontogeny description proved that coexistential formula given by SITNIKOVA (1975) and Balogh and MAHUNKA (1983) in the diagnosis for the genus *Nanhermannia* (3-1-3-3) is incorrect. Present studies and SENICZAK's observations (1991) have clearly shown that in tritonymphal and adult stage of *Nanhermannia* genus the epimeral setation reaches 3-1-3-4. The comparison of

selected characters of all stages of *Nanhermannia coronata*, *N. nanus* and *N. comitalis* is given in TABLE 4.

The taxonomic problem around synonymization of *N. nanus* (Nicolet, 1855), *N. dorsalis* (Banks, 1896) and *N. coronata* Berlese, 1913 has been widely discussed by different authors so far. Some of them (e. g. JACOT 1937, SUBÍAS 2004) have used *N. coronata* as a synonym of *N. dorsalis*, some of them (e.g. WILLMANN 1931, KARPPINEN 1971) – as a synonym of *N. nanus*. Additionally NORTON and KETHLEY (1989) suggested that American specimens of *N. coronata* are in fact *N. dorsalis*. Nevertheless, WEIGMANN (2006) proposed that the species *N. cf. coronata* sensu Berlese, 1913 is a valid species, which differs from *N. nanus* by crest-like bumps in the posterior part of the prodorsum (*N. nanus* has long, tooth-shape projections). Further investigation of the type specimen in the Berlese collection, topotypic material in Florida and comparison of development of these three species are necessary to completely resolve *N. coronata* problem.

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