

# ACTA ZOOLOGICA CRACOVENSIA

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Jan RAFALSKI

**Opis *Siro carpaticus* sp. n. wraz z uwagami o morfologii i systematyce *Cyphophthalmi* (Opiliones)**

**Описание *Siro carpaticus* sp. n. и заметки касающиеся морфологии и систематики *Cyphophthalmi* (Opiliones)**

**A description of *Siro carpaticus* sp. n. with remarks on the morphology and systematics of the *Cyphophthalmi* (Opiliones)**

[With 21 figures in text]

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## I. INTRODUCTORY REMARKS

Among the three known suborders of the order of Harvestmen (*Opiliones*) only one, namely *Palpatores*, is — as well-known — widely distributed in the temperate zone reaching even to the far North (Spitzbergen). The two remaining suborders: *Cyphophthalmi* and *Laniatores*, appear chiefly in the tropics and subtropics and only very scarce representatives of



both these suborders inhabit countries having a temperate climate.

*Cyphophthalmi*, the least numerous and most primitive of these three suborders is known — it is true — from all parts of the world. However, its areal is rather dispersed, which is partly the result of an unsatisfactory state of investigation of this group, partly, however, is doubtlessly an effect of its antiquity and maybe also of its relic character.

This suborder comprises only one family, *Sironidae*, which is divided into two subfamilies: *Stylocellinae* and *Sironinae*. In Europe, as yet, exclusively representatives of the subfamily *Sironinae* have been discovered; HADŽI (1933) considers them as relics of an earlier thermophilous fauna. These are the following species and subspecies:

1. *Parasiro corsicus* (E. SIMON) 1872
2. *Siro rubens* LATREILLE 1804
3. *Siro duricorius duricorius* (JOSEPH) 1868
4. *Siro duricorius corfuanus* KRATOCHVÍL 1937
5. *Siro gjorgjevici* HADŽI 1933
6. *Siro minutus* KRATOCHVÍL 1937
7. *Siro Teyrovskyi* KRATOCHVÍL 1937
8. *Siro Silhavyi* KRATOCHVÍL 1937
9. *Siro noctiphilus* KRATOCHVÍL 1940

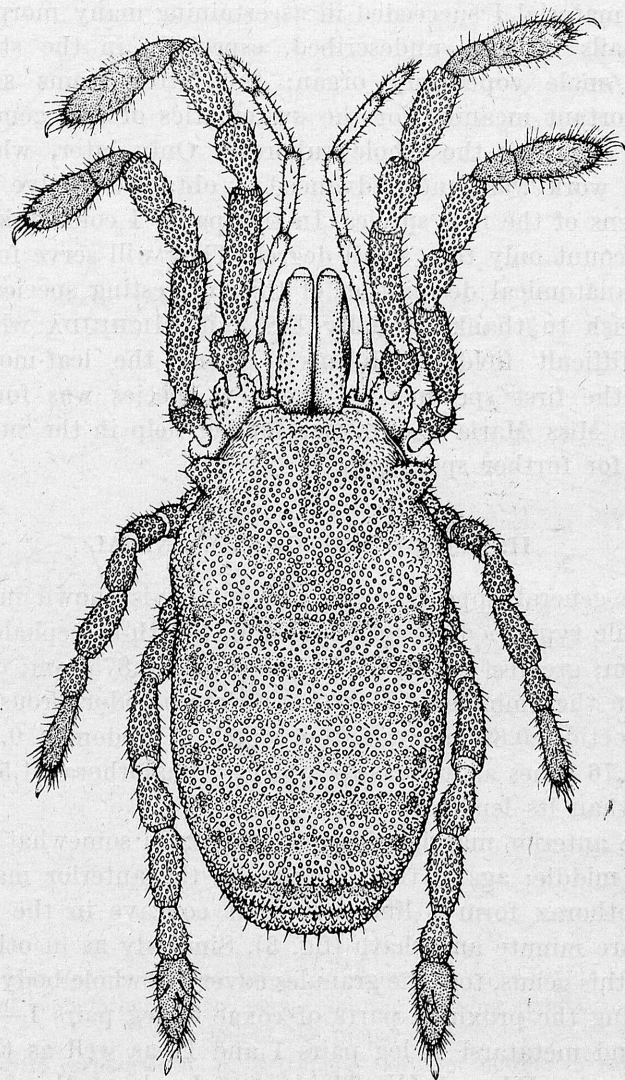
All the named species inhabit the Mediterranean basin: *Parasiro corsicus* (E. SIM.) on Corsica, *Siro rubens* LATR. in southern France, the remaining species are known only from the Balkan Peninsula, chiefly from Yugoslavia and Albania. Only *S. duricorius* (JOSEPH) shows a wider distribution; its finding places in western Slovenia and southern Carinthia were so far the most northern finding places of the suborder *Cyphophthalmi* known at all.

Most of the species of genus *Siro* LATREILLE were found only in caves, and they are known from single finding places. Only *S. rubens* LATR. and *S. duricorius* (JOSEPH) have also been found in places other than caves, under stones strongly embedded in the ground, or even in deeper horizons of forest litter.

Therefore I think it worth of special attention that a representative of the *Cyphophthalmi* was found in Poland, as



this removes the northern limit of distribution of the suborder more than 400 km further. Moreover, the found species proved new to science. I call it *Siro carpaticus* sp. n.



0 mm 0.5

Fig. 1. *Siro carpaticus* sp. n. ♂ (type).



To begin with, I had only one male specimen of the new species to my disposition and — as comparative material — two males of *Siro duricorius* (JOSEPH). In spite of the scantiness of this material I succeeded in ascertaining many morphological details hitherto undescribed, especially in the structure of the male copulatory organ; the latter seems so have an important meaning for the systematics of this genus, and maybe even for the whole suborder. Only later, when the present work was much advanced, I obtained twelve further specimens of the new species. In this paper I could take them into account only to a small degree. They will serve for a detailed anatomical description of this interesting species.

I wish to thank cordially Dr. Jan MICHEJDA who — in very difficult field conditions — sieved the leaf-mould in which the first specimen of the new species was found, as well as Miss Maria JACKIEWICZ for her help in the successful search for further specimens.

## II. DESCRIPTION OF THE ANIMAL

The general appearance of the animal is shown in fig. 1. The male type: body length 1,53 mm; length of cephalothorax 0,63 mm; greatest width of cephalothorax 0,875 mm; distance between the eminences with the outlets of odoriferous glands (*coni foetidi*) 0,80 mm; greatest width of abdomen 0,85 mm; body 1,76 times as long as its width; cephalothorax 1,58 times wider than its length.

The anterior margin of cephalothorax is somewhat convex in the middle; again, the granules on the anterior margin of cephalothorax form a line somewhat concave in the middle. They are minute and sharp (fig. 3). Similarly as in other species of this genus, too, the granules cover the whole body surface excepting the proximal parts of coxae of leg pairs I—IV, the tarsi and metatarsi of leg pairs I and II as well as the tarsi of leg pairs III and IV. These granules have the following dimensions : on cephalothorax most often a diameter of 0,009—0,013 mm, below the genital opening they are elongated and attain 0,01 by 0,025 mm, on the leg joints they are smaller, in the mean with a diameter of 0,0075—0,008 mm.



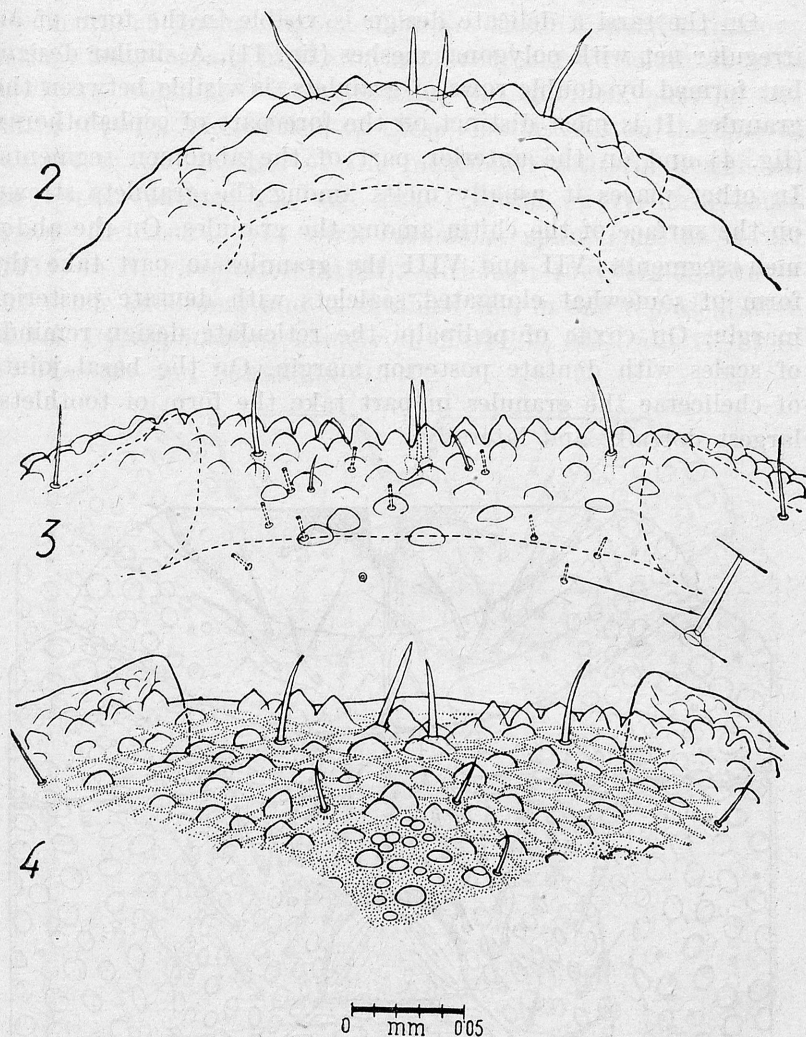


Fig. 2. *Siro duricorius* (JOSEPH) ♂ „I“ from Celerjeva Pečina — anterior margin of cephalothorax too convex on the drawing thanks to a deformation of the preparation.

Fig. 3. *Siro carpaticus* sp. n. ♂ (type) — anterior margin of cephalothorax. The dermal sens organs shown (one more enlarged shown beside); the reticular design on the cuticle not shown.

Fig. 4. *Siro carpaticus* sp. n. ♂ „I“ from Sanok — anterior margin of cephalothorax. The reticular design on the cuticle shown, the dermal sense organs not shown. In the middle low down — the beginning of the median stripe.



On the tarsi a delicate design is visible in the form of an irregular net with polygonal meshes (fig. 11). A similar design, but formed by double rows of grainlets, is visible between the granules. It is most distinct on the fore part of cephalothorax (fig. 4) and on the anterior part of the abdomen segments. In other places it usually melts among the grainlets strewn on the surface of the chitin among the granules. On the abdomen segments VII and VIII the granules in part take the form of somewhat elongated scalelets with dentate posterior margin. On coxae of pedipalpi the reticulate design reminds of scales with dentate posterior margin. On the basal joints of chelicerae the granules in part take the form of toothlets, largest dorsally and laterally.

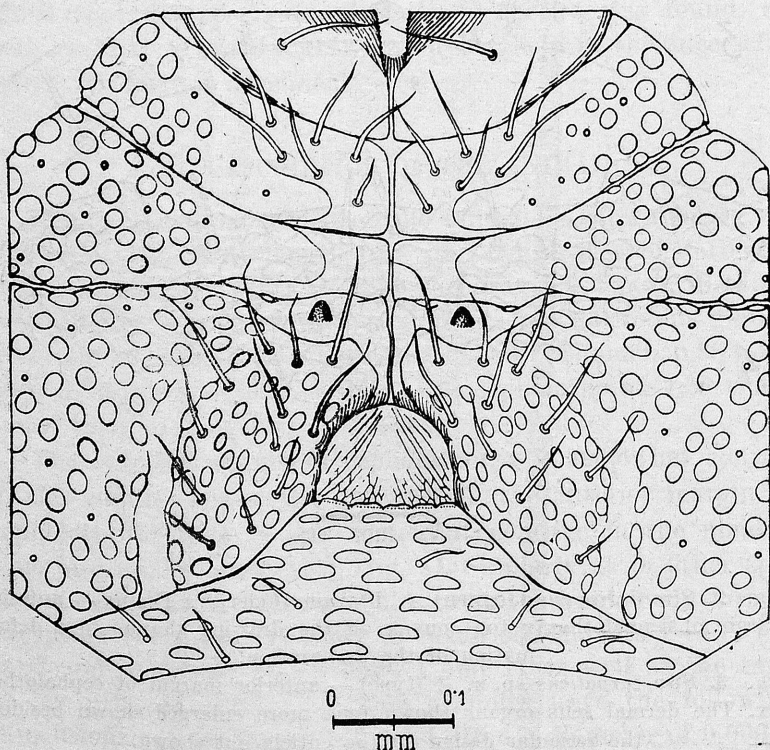


Fig. 5. *Siro duricorius* (JOSEPH) ♂ „I“ from Celerjeva Pečina — genital region and proximal parts of coxae (a section). In part not the whole hairs are shown, but only their areoles.



On the chitinous armour there are also dispersed numerous dermal sense organs in the form of very narrow channels with bowl-like widenings at their base, the channels piercing the chitin (fig. 3). The outlets of these channels lie on the line of contact of the meshes of the mentioned retiform design on the cuticle surface (see fig. 10). I found no lyriform sense organs (lirifissurae) in *Siro carpaticus* sp. n. (just as HADŽI (1933) in *S. gjorgjevici* HADŽI), although they are known in the other suborders and ascertained also in one representative of the *Cyphophthalmi*, namely in *Purcellia illustrans* H. et S. by HANSEN and SØRENSEN (1904).

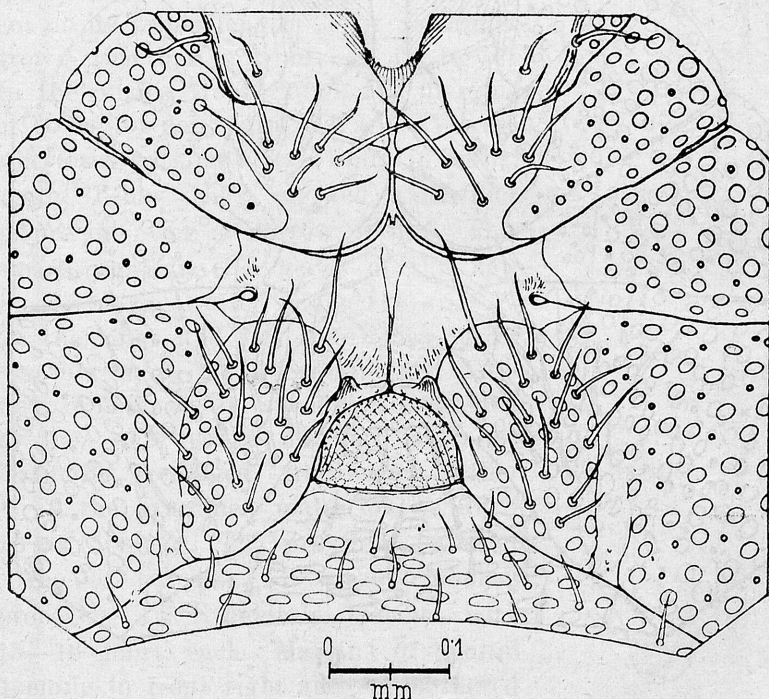


Fig. 6. *Siro carpaticus* sp. n. ♂ (type) — genital region and proximal parts of coxae (a section). In part not the whole hairs, but only their areoles.

The median stripe on cephalothorax („la strie médiane“ of KRATOCHVÍL, 1937) observed on the animals „in toto“ is indistinct and variable in length. In the male type-specimen



it reached more or less to the line connecting the ends of the eminences with the odoriferous gland outlets. In the specimens from Sanok it was longer than in the male type and divided into two parts of approximately equal length. The preparations (under a stronger enlargement) show that this stripe is formed by muscle insertions on the underside of the chitinous cuticle and corresponding small granules on the upper side (see fig. 4). It reaches in reality — in the male type as well as in the examined males and females from Sanok — to the limit of the

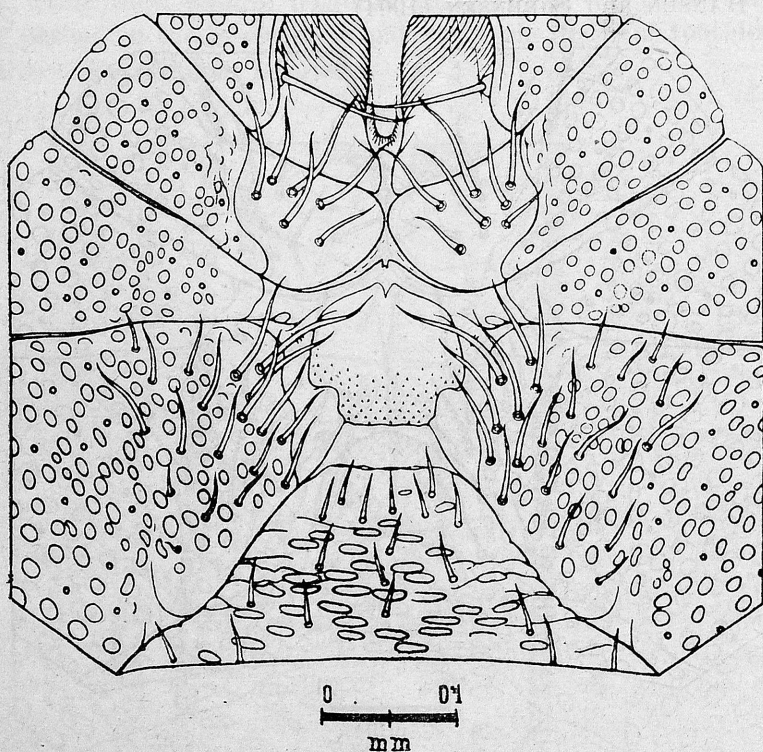


Fig. 7. *Siro carpaticus* sp. n. ♀ „I“ from Sanok — genital region and proximal parts of coxae (a section). In part not the whole hairs are shown, but only their areoles.

first part of cephalothorax (to the first furrow on cephalothorax). Therefore the image of this stripe seen on the animal „in toto“ is not real and probably depends to a great degree on the



physiological state of separate individuals. So that this character cannot possess greater systematical value.

The proximal parts of coxae of leg pair II have 7—8 hairs each (fig. 7). The proximal parts of coxae of leg pairs III and IV are ankylosed together and in the median line. In the male type this ankylosis was nearly complete, so that a kind of „sternum“ was formed. During preparation this form split partly in the median line, however, not on its whole length, as it remained grown together in front, as in fig. 7. In the males from Sanok the margins of coxae of leg pairs III and IV were ankylosed without a trace only in front; again, below they showed a distinct suture or even a narrow fissure. This means that in the males of the new species coxae of leg pairs III and IV on the right and left side may grow together more or less completely. Anyway, in none of the specimens examined by me, were coxae on both sides so distinctly removed from each other as in the examined males of *S. duricornius* (JOSEPH). The proximal parts of coxae of leg pair IV without conical processes. Arculi genitales distinct, with 15—16 hairs each. Margins of genital opening in front right and left bordered by a list running in its middle part into a broad flat toothlet (fig. 7).

Chela of chelicerae 4,5—4,6 times longer than wide. On each of their fingers (movable and fixed) there are 8 rounded but sharp-edged teeth (fig. 9).

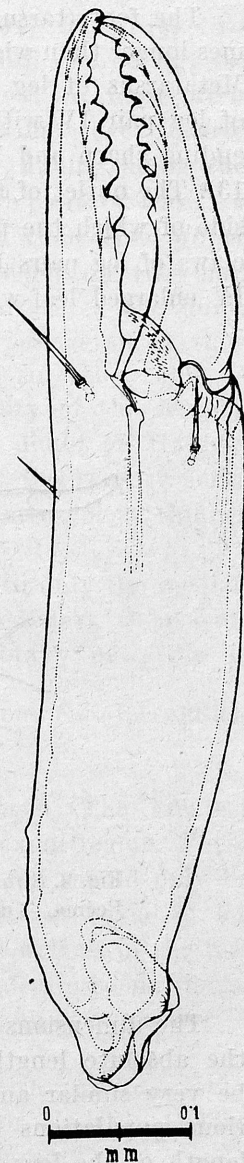


Fig. 8. *Siro carpaticus* sp. n. ♀ „II“ from Sanok — right chelicera. Frontal view.



The foot (tarsus) of leg pair I (measured laterally) 3,8 times longer than wide, and 2,1 times longer than its metatarsus. Metatarsus of leg pair I twice longer than its width. Foot of leg pair IV with dorsal spur (tubus dorsalis), the latter ending sharp and bent toward its own base (fig. 11, 12, and 13). The outlet of the tarsal gland is on an eminence from the side of which the proper spur grows (fig. 11, 12, and 13). The claws of leg pairs I and II simple. Claws of leg pairs III and IV enlarged leaf-wise on their margins.

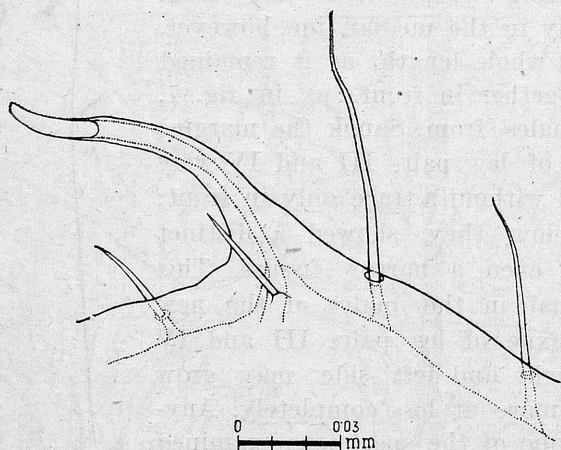


Fig. 9. *Siro duricorius* (JOSEPH) ♂ „I“ from Celerjeva Pečina — dorsal spur of foot of right leg IV from outer side.

The dimensions of legs are given on p. 11. As may be seen, the absolute length of walking legs in various species may be very similar and differ considerably in individuals of various populations of the same species. Hence, the absolute length of the legs is no particular diagnostic value.

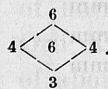
On the feet (tarsi) of the legs of both sexes three kinds of hairs may be discerned: the most numerous proper hairs or bristles (setae) set in areoles; false hairs, so-called chetoids, being only processes of the chitinous cuticle in spite of their sometimes considerable length; and peculiar sense hairs di-



discovered by HANSEN and SØRENSEN (1904). The first two kinds of hairs are visible on fig. 13, the third one on fig. 14. The false hairs, contrarily to the proper ones, are most often strongly inclined towards the joint, sometimes even nearly adherent; they, too, form dense comblets running along the joint on the ventral side of the tarsi of all pairs of legs.

The sensory hairs are lighter-coloured than the proper and false hairs, somewhat flattened, rounded on the end, and characteristically bent towards the surface of the joint. Similarly to the proper hairs in *Siro carpaticus* sp. n. they are set in areoles, however, these are not so well visible as the proper hair areoles. This worse visibility of the sensory hair areoles was probably the cause of the doubt of HANSEN and SØRENSEN (1904) who supposed that the sensory hairs rather grow straight out of a somewhat indented chitin, thinner in this place.

The penis 0,20 by 0,12 mm (fig. 18) with only the median pair of movable fingers (digiti mobiles mediales), their ends directed sideways. The formula of chaetotaxy of penis is



4. Detailed description of penis in species *Siro* LATREILLE see below.

Sexual dimorphism not very pronounced. The greatest differences in both sexes shown by the sexual region. These differences are well visible on fig. 6 and 7. It should only be stressed that in females the proximal parts of coxae of leg pairs III and IV are ankylosed together as well as in the median line, as in males. Moreover, the females have no dorsal spur on the feet of leg pair IV. The description of ovipositor — see below.

Colour of the animals uniformly brownish (LESZCZYŃSKI's paint catalogue: No. 77 „Stil de grain“ or No. 18 „Golden ochre“, the legs and pedipalps lighter-coloured.

### III. DIMENSIONS OF PEDIPALPS AND LEGS.

1. *S. duricorius* (JOSEPH), male from Kranj (Slovenia), after HADŽI (1933)



	Tr	F	Pt	Ti	Mt	Ta	Sum
ppalpus	0,18	+ 0,34	+ 0,20	+ 0,265	+	—	0,30 = 1,285 mm
pes I	0,16	+ 0,50	+ 0,22	+ 0,35	+ 0,18	+ 0,58	= 1,99 mm
II	0,16	+ 0,41	+ 0,18	+ 0,26	+ 0,15	+ 0,50	= 1,66 mm
III	0,16	+ 0,32	+ 0,18	+ 0,22	+ 0,16	+ 0,45	= 1,50 mm
IV	0,25	+ 0,43	+ 0,24	+ 0,28	+ 0,18	+ 0,56	= 1,94 mm

2. *S. duricorius* (JOSEPH), male from Kranj (Slovenia), after HADŽI (1933)

	Tr	F	Pt	Ti	Mt	Ta	Sum
ppalpus	0,19	+ 0,39	+ 0,21	+ 0,26	+	—	+ 0,29 = 1,29 mm
pes I	0,17	+ 0,48	+ 0,23	+ 0,33	+ 0,18	+ 0,56	= 1,95 mm
II	0,15	+ 0,38	+ 0,19	+ 0,26	+ 0,16	+ 0,48	= 1,62 mm
III	0,16	+ 0,32	+ 0,18	+ 0,21	+ 0,17	+ 0,45	= 1,49 mm
IV	0,24	+ 0,41	+ 0,24	+ 0,27	+ 0,17	+ 0,50	= 1,83 mm

3. *S. duricorius* (JOSEPH), male „I“ from Celerjeva Pečina (Kraina)

	Tr	F	Pt	Ti	Mt	Ta	Sum
ppalpus	0,212	+ 0,378	+ 0,242	+ 0,295	+	—	+ 0,283 = 1,410 mm
pes I	0,236	+ 0,578	+ 0,289	+ 0,419	+ 0,233	+ 0,502	= 2,257 mm
II	0,201	+ 0,484	+ 0,266	+ 0,360	+ 0,195	+ 0,395	= 1,910 mm
III	0,218	+ 0,389	+ 0,254	+ 0,342	+ 0,201	+ 0,372	= 1,776 mm
IV	0,301	+ 0,496	+ 0,289	+ 0,372	+ 0,207	+ 0,431	= 2,096 mm

4. *S. carpaticus* sp. n., male type — specimen from Wetlina (Bieszczady Mts. — Polish Eastern Carpathians)

	Tr	F	Pt	Ti	Mt	Ta	Sum
ppalpus	0,201	+ 0,384	+ 0,277	+ 0,295	+	—	+ 0,286 = 1,443 mm
pes I	0,218	+ 0,531	+ 0,289	+ 0,356	+ 0,224	+ 0,473	= 2,091 mm
II	0,201	+ 0,466	+ 0,236	+ 0,319	+ 0,195	+ 0,425	= 1,842 mm
III	0,218	+ 0,372	+ 0,224	+ 0,301	+ 0,201	+ 0,384	= 1,700 mm
IV	0,289	+ 0,472	+ 0,266	+ 0,330	+ 0,207	+ 0,425	= 1,989 mm

5. *S. carpaticus* sp. n., male „I“ from Sanok (south-east Poland)

	Tr	F	Pt	Ti	Mt	Ta	Sum
ppalpus	0,207	+ 0,389	+ 0,260	+ 0,280	+	—	+ 0,260 = 1,396 mm
pes I	0,215	+ 0,519	+ 0,268	+ 0,354	+ 0,212	+ 0,455	= 2,023 mm
II	0,207	+ 0,460	+ 0,236	+ 0,313	+ 0,195	+ 0,401	= 1,812 mm
III	0,209	+ 0,342	+ 0,224	+ 0,277	+ 0,195	+ 0,363	= 1,610 mm
IV	0,289	+ 0,448	+ 0,254	+ 0,325	+ 0,207	+ 0,413	= 1,936 mm



6. *S. carpaticus* sp. n., female „I“ from Sanok

	Tr	F	Pt	Ti	Mt	Ta	Sum
ppalpus	0,183	+ 0,360	+ 0,248	+ 0,271	—	+ 0,248	= 1,310 mm
pes I	0,201	+ 0,484	+ 0,266	+ 0,336	+ 0,221	+ 0,431	= 1,939 mm
II	0,201	+ 0,437	+ 0,224	+ 0,295	+ 0,201	+ 0,395	= 1,753 mm
III	0,212	+ 0,342	+ 0,212	+ 0,277	+ 0,195	+ 0,330	= 1,568 mm
IV	0,266	+ 0,425	+ 0,260	+ 0,325	+ 0,212	+ 0,395	= 1,883 mm

## IV. THE MATERIAL

1. *Siro carpaticus* sp. n., male (type) — Oct. 4th, 1953. Bieszczady Mts. (Polish Eastern Carpathians). Wetlina — chain, south — western slopes of Mt. Hnatowe Berdo, at an altitude of about 750 m above sea-level. Old beech forest with hazel undergrowth, near a stream. Sieved out of a very thick layer of litter by Dr. Jan MICHEJDA.

2. *Siro carpaticus* sp. n., 7 males and 4 females (only 2 males and 2 females examined more accurately) — Sept. 20th, 1954. Young (40—50 year-old?) mixed forest with prevalence of hornbeam and aspen on the south-western slopes of Mt. Orli Kamień near Sanok (south-east Poland) at an altitude of about 440 m above sea-level. An admixture of old fir, oak, and beech, as well as single younger firs, pines, and birches. On the underside of a large mossy stone, deeply embedded in the earth. Leg. Jan RAFAŁSKI and Maria JACKIEWICZ.

3. *Siro carpaticus* sp. n., male — June 17th, 1955. District Jasło (south-east Poland); mixed forest on the northern slopes over river Wisłoka, south from Żmigród Nowy, about 300 m above sea level. Chiefly fir and hornbeam, with hazel undergrowth. Sieved from litter near a stream by Zygmunt PNIEWSKI.

4. *Siro duricorius* (JOSEPH), 2 males — ex coll. Institute of Zoology, Polish Academy of Science. Inscription on label: „Dr. G. JOSEPH, Cellerowa, Krain“ (= Celerjeva Pečina).

## V. SYSTEMATICAL POSITION OF THE NEW SPECIES

I could compare *Siro carpaticus* sp. n. directly only with *S. duricorius* (JOSEPH). I know other species of the genus exclusively from the literature.



The new species seems to approach a little known species living in southern France — *Siro rubens* LATR.; its descriptions and the drawings in SIMON's book (1879), and even those of HANSEN and SØRENSEN's (1904), are unfortunately too little detailed and pertain exclusively to males. Both species are connected before all by a similar position of the outlet of the tarsal gland, and the formation of the dorsal spur (*tubus dorsalis*). Contrarily to other known species of this genus which have the outlet of this gland at the end or on the side of the spur, the former species have the outlet of the tarsal gland on an eminence from which the proper spur grows out of. Similar conditions are found, moreover, in some New Zealand species of genus *Rakaia* HIRST. Besides, to judge from the not too exact drawings of HANSEN and SØRENSEN (1904), *S. rubens* LATR. is distinguished by a similar form of the proximal parts of coxae; it also has a toothlet or granule on the lists bordering the genital opening in front, right and left. Again, it has — similarly as the new species — no conical eminence on the proximal parts of coxae of leg pair IV, as shown e. g. by *S. duricorius* (JOSEPH) — fig. 5. The presence of a toothlet on the lists bordering the genital opening and the lack of a conical eminence on the proximal parts of coxae of leg pair IV characterize also *S. gjorgjevici* HADŽI which, however, has an ordinary dorsal spur.

The new species, nevertheless; shows distinct differences as compared to *S. rubens* LATR. by following characters:

- (1) the form of cephalothorax which in the latter is strongly convex in front, while in the new species in general outline it is slightly concave in front;
- (2) a greater absolute length of the legs with smaller body dimensions;
- (3) the proportions of the foot of leg pair I which is 3,8 times as long as wide in the new species, and in *S. rubens* LATR. it is hardly 3 times longer than its width;
- (4) a different constitution (in spite of a similar form) of the proximal parts of coxae of leg pairs III and IV which in the new species are ankylosed together not only on each side (i. e. III+IV) but also in the median line, while in *S. rubens* LATR. they are not ankylosed at all;



(5) the formation of the dorsal spur (tubus dorsalis) which — it is true — has a similar position of the tarsal gland outlet in both species, but differs considerably in the details of its constitution.

*Siro carpaticus* sp. n. differs distinctly from all the remaining species of the genus by numerous characteristics, and especially by the position of the tarsal gland outlet and the formation of its dorsal spur.

The new species, alike in the dimensions of the legs and pedipalps differs so much from *Siro duricorius* (JOSEPH) by the constitution of its penis that it is necessary to create a new subgenus (which I call *Geosiro* sbg. n.) for *S. carpaticus* sp. n. and probably also for *S. rubens* LATR.

Subgenus *Geosiro* sbg. n. comprises species with only one pair of movable median fingers (digiti mobiles mediales); subgenus *Siro* LATREILLE s. str. whose typical species is *S. duricorius* (JOSEPH), comprises species with two pairs of mobile fingers (digiti mobiles mediales et laterales) on penis. Both these subgenera probably differ also by other characters, as the number of median lobes of penis and the formation of the dorsal spur, but this cannot be ascertained without an examination of other species of the genus. As the penis of other species has not been described till now, it cannot be said, too, whether the remaining species of genus *Siro* LATREILLE belong to one of these subspecies. A number of other differences between the new species and *S. duricorius* (JOSEPH) is shown in the enclosed figures, as well as structure details of the latter species.

## VI. TARSAL GLAND AND DORSAL SPUR

The tarsal gland, peculiar for the suborder, is of unknown meaning and appears only in males. HANSEN and SØRENSEN (1904) who discovered it supposed that it secretes some odoured substance orientating females of the presence of males.

The tarsal gland is contained inside the foot of leg pair IV, and its outlet is on the dorsal side of the foot, on the so-called dorsal spur (tubus dorsalis = „eminentia dorsualis“ of HAN-



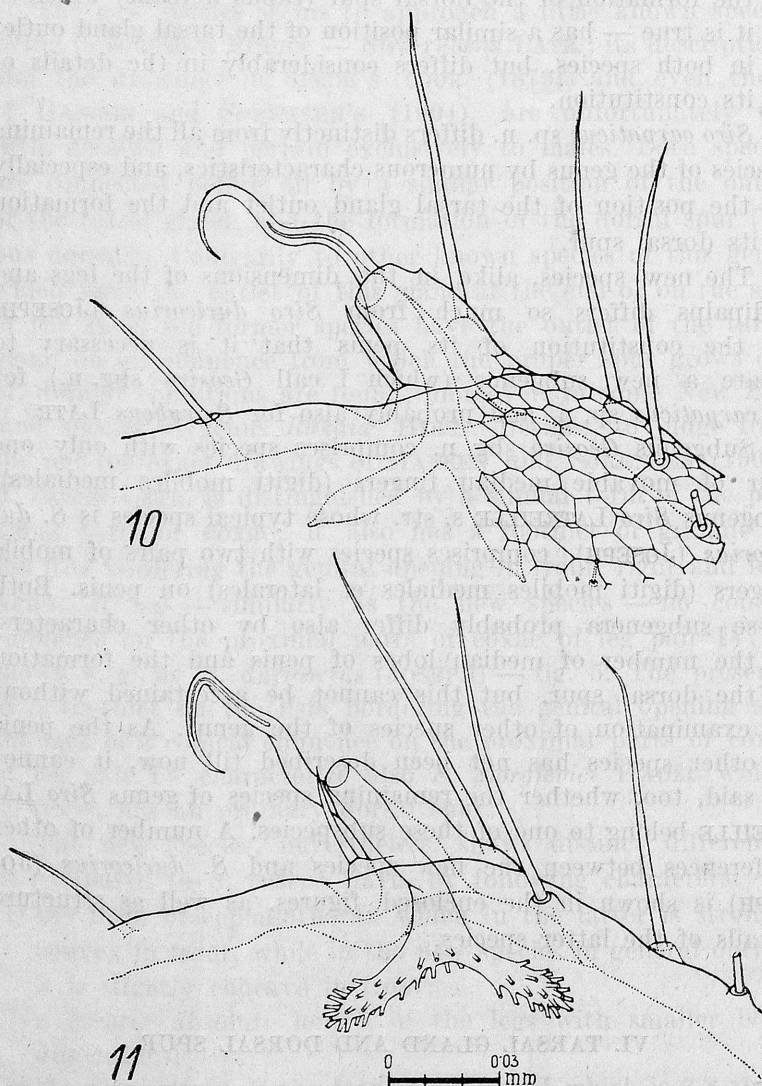


Fig. 10. *Siro carpaticus* sp. n. ♂ (type) — dorsal spur of foot of right leg IV from outer side. The duct of the tarsal gland is marked only in outline, without deferent channels. In part reticular design on the cuticle shown. Fig. 11. *Siro carpaticus* sp. n. ♂ „I“ from Sanok dorsal spur of foot of right leg IV seen from outer side with the duct of tarsal gland.



SEN and SØRENSEN (1904)). These authors observed the general outline of this gland translucent through the chitin, in *Parasiro corsicus* E. SIM. They also noticed that its deferent duct is formed by the union of two narrower ducts. Other details have not been observed till now.

I observed this gland in *Siro carpaticus* sp. n. in glycerine as translucent through the chitin as well as cut out and shredded apart. The alcohol-conserved material did not allow more subtle investigation. The gland is composite, cluster-like, composed of some 70—90 large, strongly elongated cells, being in various phases of secretional activity (fig. 13). The largest of these cells attain a length of 80 microns. In some individuals they were strongly swollen, and their nuclei were in the blind end. Each of these cells is connected with the narrow chitinous deferent channel (fig. 11). The deferent channels mouth into two wide collecting ducts, the latter unite into a deferent duct (fig. 10, 11, 13 — Dct. gl.). Through this gland runs the muscle lifting the claw (musculus levator unguiculi (fig. 13 — M. l. ung.). The outlet of the deferent duct has various positions in the different species of genus *Siro* LATREILLE, anyway it is in connexion with the dorsal spur, i. e. a tubular and usually more or less bent process of the chitinous cuticle. In most species of genus *Siro* LATREILLE the gland duct outlet is on the top (end) of the spur (see fig. 9).

In *S. noctiphilus* KRAT. it lies more or less in half the length of the spur which in this species is sharp and blind-ending. Lastly, in *S. carpaticus* sp. n. (and — to judge from the drawing of HANSEN and SØRENSEN (1904) — also in *S. rubens* LATR.) the outlet of the deferent duct lies on a thick process

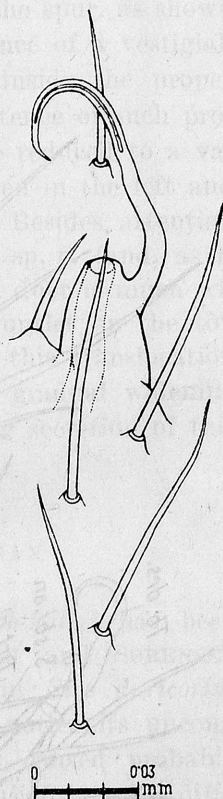
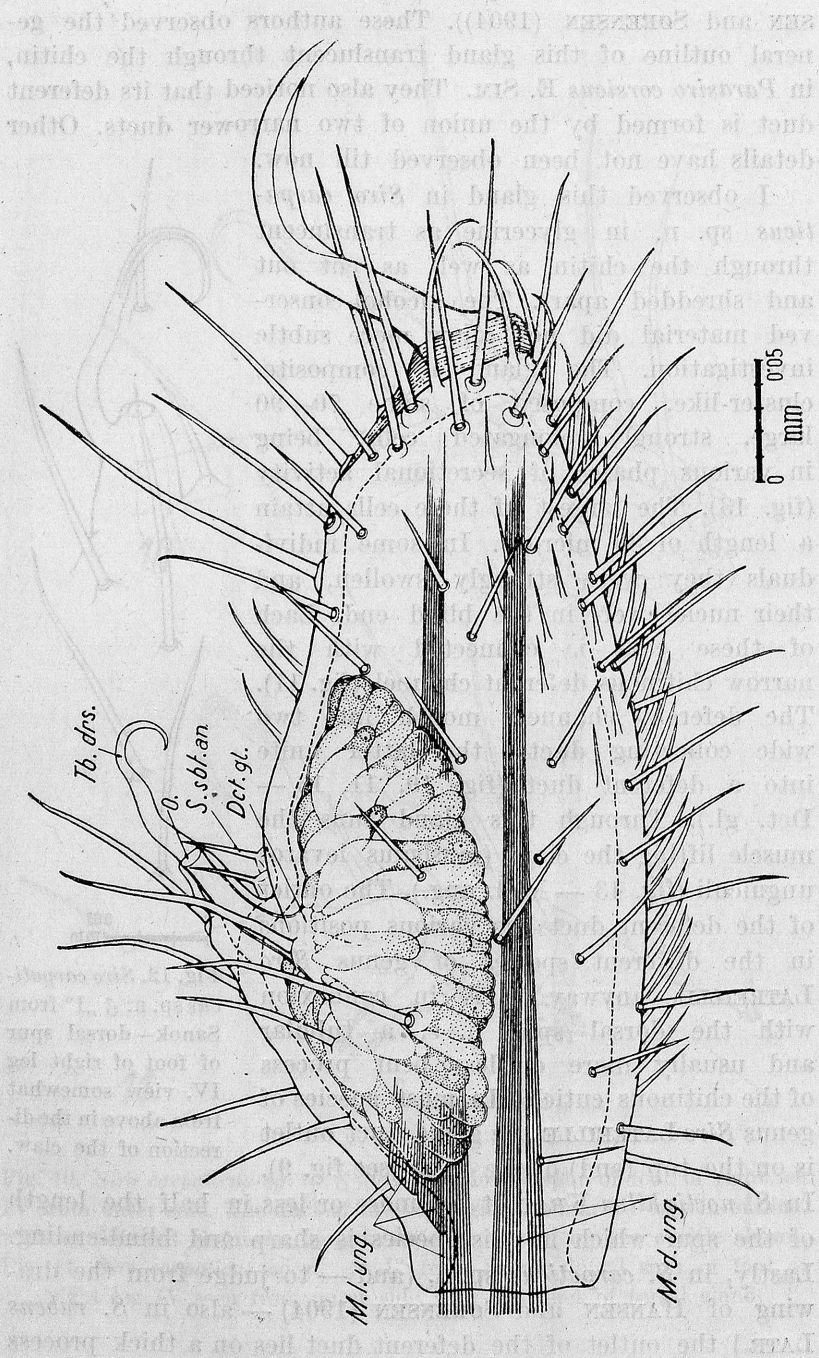


Fig. 12. *Siro carpaticus* sp. n. ♂ „I“ from Sanok—dorsal spur of foot of right leg IV, view somewhat from above in the direction of the claw.







from the side of which the proper spur grows (fig. 12). Probably the most primitive state was the position of the outlet on the end of the spur. Secondarily this outlet in its phylletic evolution could be shifted sideways and down the spur, or else onto a specially widened basal part of the spur, as shown by the said thick (wide) process. The presence of a vestigial, blind-ending, or even wholly closed duct inside the proper spur in *S. carpaticus* sp. n. testifies the existence of such progressions; and this vestigial channel may be reduced to a various degree in different individuals, and even in the left and right spur of the same animal (fig. 10 and 11). Besides, attention is drawn by the fact that in *S. carpaticus* sp. n. (and, as it seems, also in *S. rubens* LATR.) the deferent duct is much wider than in species which have the gland outlet on the top or side of the spur. Thus it may be that this translocation of the gland outlet is connected with the gradual widening the duct's diameter, caused by an increasing secretion of this gland.

#### VII. MALE COPULATORY ORGAN

The male copulatory organ in *Cyphophthalmi* has been described in the classical work of HANSEN and SØRENSEN (1904) and recently by JANCZYK (1956) in *Siro duricorius* (JOSEPH). However, these autors could not notice its uncommonly complicated constitution. This was caused probably by the small dimensions of this organ and a considerable difficulty in making satisfying microscope preparations from it. For the same reasons I, too, could not manage to learn exactly all the details of its constitution.

←

Fig. 13. *Siro carpaticus* sp. n. ♂ „I“ from Sanok — left foot of leg pair IV with translucent tarsal gland and muscels. *Tb. drs.* — dorsal spur, *s. sbt. an.* — additional bristle near spur (abnormality), *Det. gl.* — duct of tarsal gland, *o.* — outlet of duct of tarsal gland, *M. l. ung.* — muscle lifting the claw (musculus levator unguiculi), *M. d. ung.* — muscle lowering the claw (musculus depressor unguiculi).



Basing on the work of Hansen and Sørensen, KÄSTNER (1935) in his monograph on the Harvestmen in KÜCKENTHAL'S work writes: „Am einfachsten ist das Begattungsglied bei den *Cyphophthalmi* gebaut, wo es (nach HANSEN und SØRENSEN) ein kurzes ungliedertes Rohr bildet, das reichlich mit Stacheln besetzt ist“. In a word, the conviction prevailed that the most primitive of all the suborders of Harvestmen is also distinguished by the simplest copulatory apparatus. Meanwhile, quite the contrary appeared; the most complicated constitution of penis characterizes just the *Cyphophthalmi*, which is especially interesting as compared with many primitive characters of this suborder and proves its considerable specialization.

Below I give a description of penis of genus *Siro* LATREILLE basing on the examination of two species: *S. duricorius* (JOSEPH) and *S. carpaticus* sp. n. At the same time it was necessary to form a number of new terms.

*Cyphophthalmi*, contrarily to the representatives of *Laniatores* and *Palpatores*, show a short and thick penis; its end part

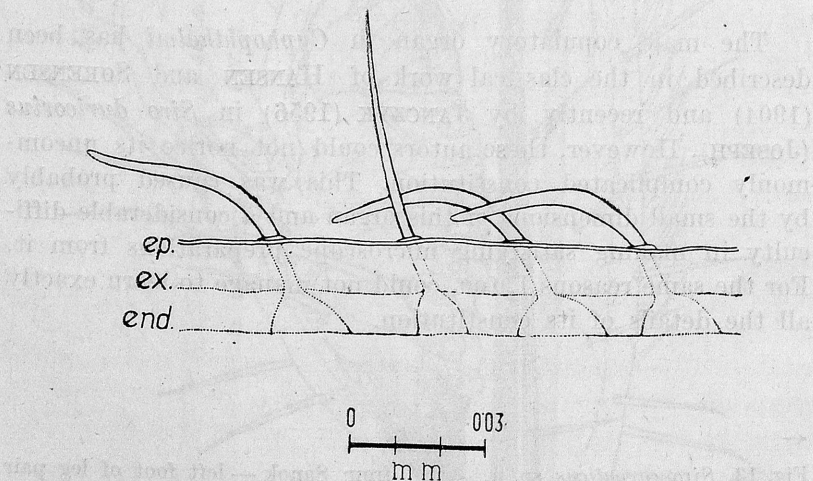


Fig. 14. *Siro carpaticus* sp. n. ♀ „I“ from Sanok — sensory hairs and ordinary bristle from foot of leg pair I. *ep.* — epicuticula, *ex.* — exocuticula, *end.* — endocuticula.



is not well separated and mobile (fig. 16). Nevertheless, there may be distinguished in it the body (corpus penis) and the terminal part (pars terminalis penis). The terminal part is separated from corpus dorsally (in front) and laterally by a transverse fold (plica transversalis penis) to which in *S. duricorius* (JOSEPH) oblique muscles are attached from inside. On the ventral (backward) side the body of penis passes over into the terminal part without a distinct limit. This terminal part of penis is more or less bent spoon-like on the dorsal side. At the base of the terminal part two lateral lobes (lobi laterales) grow from its sides. Inside this bend, between the lateral lobes, there are one or two median lobes (lobus medialis internus et externus), and one or two pairs of movable fingers, namely: the hook-like median fingers (digiti mobiles mediales), bent towards the dorsal side (the front) or sideways, their inner margins at the base seem to limit the outlet of vas deferens (genital opening of second order); and the movable lateral fingers (digiti mobiles laterales) bent hook-wise towards each other. In *S. duricorius* (JOSEPH) which has two pairs of movable fingers the lateral and median fingers form a kind of tongs on each side (fig. 17). Small transverse folds are visible on the lateral fingers, which speaks for the possibility of their bending. In the middle length of the median movable fingers grow peculiar sensory papillae (papillae sensitivae) ending by two processes each.

The whole penis is — in comparison with other parts of the body — very feebly chitinized and more or less wrinkled at rest; this suggests the supposition that it may undergo erection. The flow of blood probably extends at the same time the bristles which are nearly adherent at rest, and partly the movable fingers.

The small number of specimens of both species (five) examined in this respect as well as the difficulties already mentioned in making satisfactory microscope preparations from alcohol-conserved material did not allow to ascertain the number or course of the muscles of penis with all certainty.

In both examined species I ascertained for sure three pairs of muscles of penis, or rather three pairs of muscle-fibre bundles belonging to two compound muscles; at the same time both



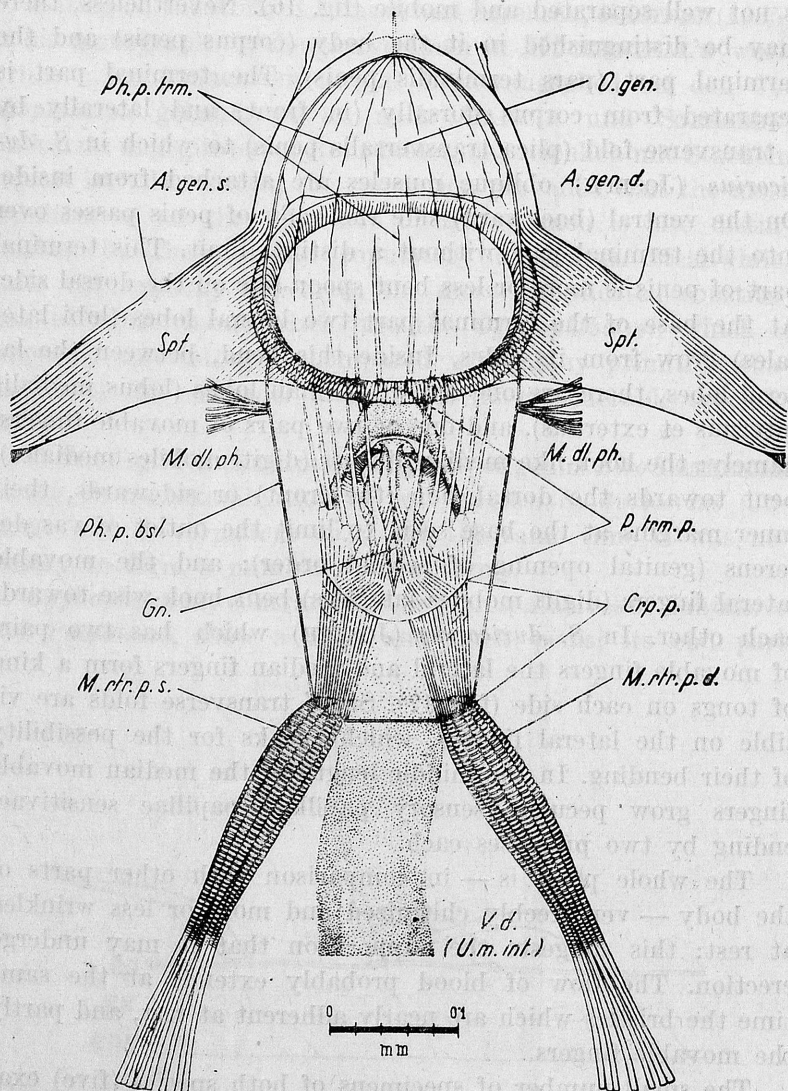


Fig. 15. *Siro duricorius* (JOSEPH) ♂ „I” from Celerjeva Pečina — penis in its case (natural position), seen from the inside of the body. Schematic except the penis-retracting muscles. *O. gen.* — genital opening, *A. gen. d.* and *A. gen. s.* — right and left genital arcs (arculi genitales), *Ph. p. trm.* — terminal part of penis case (phallotheca), *Ph. p. bsl.* — basal part of penis case, *Spt.* — partition formed by back walls of coxae of leg pair IV, *Gn.* — outlet of vas deferens (genital opening of IInd order), *Cr. p.* —



species differ somewhat one from another by their course (fig. 15, 16, and 18). These two compound muscles run from the base of penis at the sides of vas deferens in the places where from outside the penis-retracting muscles (musculi retractores penis) are inserted. In *S. carpaticus* sp. n. these two compound muscles unite in the median line, in *S. duricorius* (JOSEPH) they are completely separated.

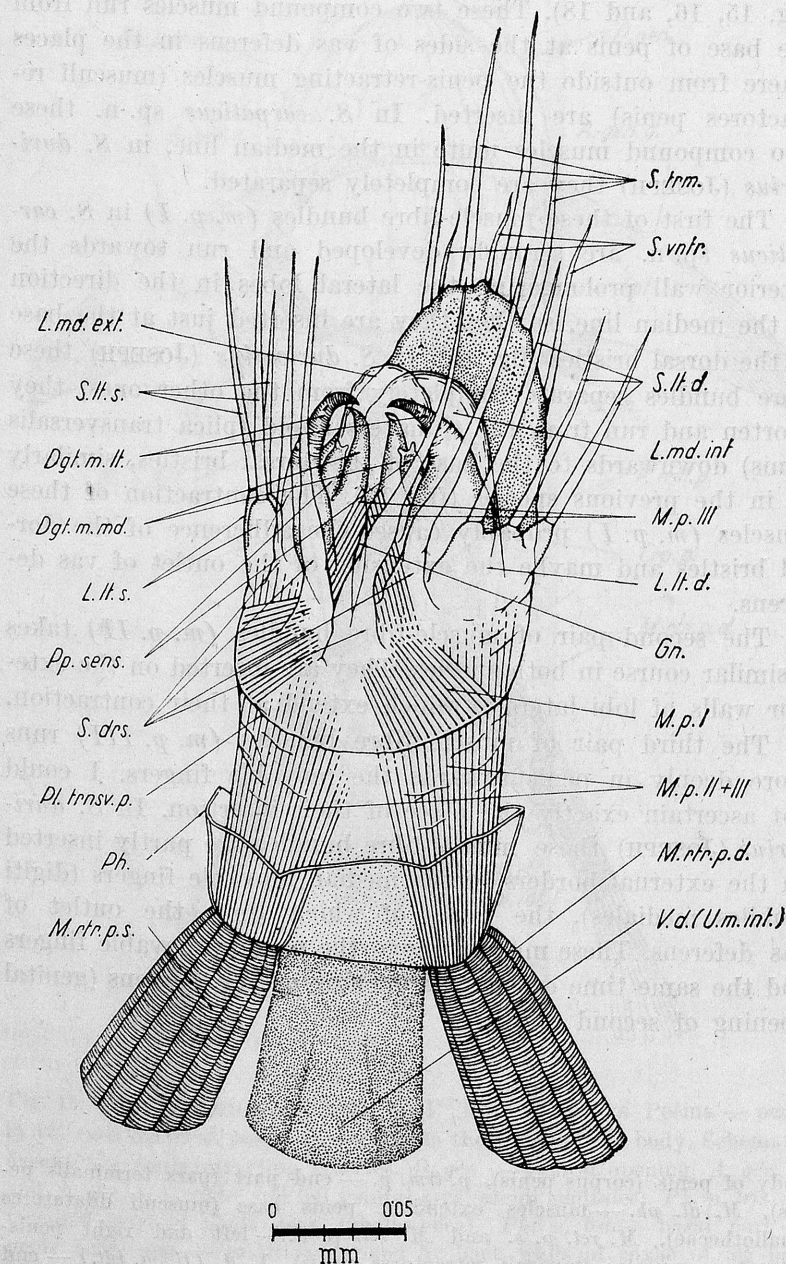
The first of these muscle-fibre bundles (*m. p. I*) in *S. carpaticus* sp. n. are strongly developed and run towards the interior wall prolongating the lateral lobes in the direction of the median line, so that they are inserted just at the base of the dorsal bristles (fig. 18). In *S. duricorius* (JOSEPH) these fibre bundles separate completely from the other ones, they shorten and run from the transversal fold (plica transversalis penis) downwards to the base of the dorsal bristles, similarly as in the previous species (fig. 16). The contraction of these muscles (*m. p. I*) probably causes the adherence of the dorsal bristles and maybe the extension of the outlet of vas deferens.

The second pair of muscle-fibre bundles (*m. p. II*) takes a similar course in both species. They are inserted on the exterior walls of lobi laterales which extend at their contraction.

The third pair of muscle fibre bundles (*m. p. III*) runs more deeply in penis towards the movable fingers. I could not ascertain exactly the place of their insertion. In *S. duricorius* (JOSEPH) these muscle-fibre bundles are partly inserted on the external borders of the median movable fingers (digiti mobiles mediales), the bases of which limit the outlet of vas deferens. These muscles move the median movable fingers and the same time extend the opening of vas deferens (genital opening of second order).

body of penis (corpus penis), *p. trm. p.* — end part (pars terminalis penis), *M. dl. ph.* — muscles extending penis case (musculi dilatatores phallothecae), *M. ret. p. s.* and *M. ret. p. d.* — left and right penis-retracting muscles (musculi retractores penis), *V. d. (U. m. int.)* — end part of vas deferens.







The described muscles have very delicate fibres and show no trace of striation whatever, neither on preparations stained by various media nor on those observed in „phase contrast“ or else in polarized light.

On the contrary a distinct striation, well visible even on unstained preparations, distinguishes the thick fibres of the penis-retracting muscles (m. retractores penis).

In *S. duricorius* (JOSEPH) these muscles in contracted state (as in fig. 15) had a length of 0,32 mm. Each was composed of about 15 thick fibres attaining 10 microns diameter in the thickest part.

The penis case (phallosheca) in its basal part (fig. 15 — *ph. p. bsl.*) is also held by two short muscles extending the case (musculi dilatatores phalloshecae) in which no striation was visible either. I did not, however, examine these muscles more exactly. It must be said, moreover, that — contrarily to *Palpatores* and *Laniatores* — the end part of the penis case (fig. 15 — *ph. p. trm.*) in *Cyphophthalmi* cannot expand out of the genital opening, as it passes through an opening in the partition formed by the back walls of coxae of leg pair IV (fig. 15 — *spt.*) and is connected with the latter's margins. This limits considerably the mobility of penis. The muscles retracting penis and the muscles extending the penis case are inserted on the ventral part of the chitinous armour.

←

Fig. 16. *Siro duricorius* (JOSEPH) — schema of structure of penis. *L. md. ext.* — outer median lobe (lobus medialis externus), *L. md. int.* — inner median lobe (lobus medialis internus), *Dgt. m. md.* — median movable fingers (digiti mobiles mediales), *Dgt. m. lt.* — lateral movable fingers (digiti mobiles laterales), *Pp. sens.* — sensory papillae (papillae sensitivae), *L. lt. d.* and *L. lt. s.* — right and left lateral lobes (lobi laterales), *Gn.* — outlet of vas deferens (genital opening of II<sup>nd</sup> order), *Pl. trnsv. p.* — transversal fold of penis (plica transversalis penis), *Ph.* — penis case (phallosheca), *V. d. (U. m. int.)* — end part of vas deferens, *M. p. I.*, *M. p. II* and *M. p. III* — muscles of penis (see text), *M. rtr. p. d.* and *M. rtr. p. s.* — right and left penis-retracting muscles (musculi retractores penis), *S. trm.* — terminal bristles (setae terminales), *S. vnt.* — ventral bristles (setae ventrales), *S. lt. d.* and *S. lt. s.* — lateral bristles (setae laterales) on right and left lobe, *S. drs.* — dorsal bristles (setae dorsales).



On penis there is a certain number of large and stiff, pointed bristles (fig. 15—18) which at least in part may be no proper bristles but so-called somatochaetae, i. e. processes

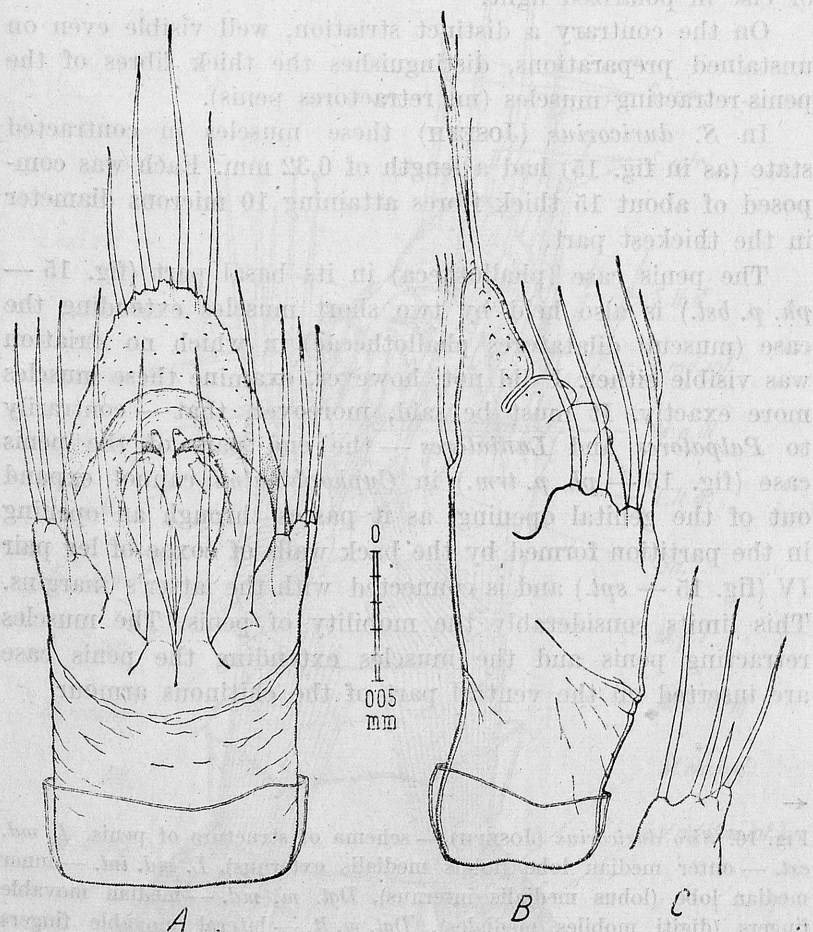


Fig. 17. *Siro duricorius* (JOSEPH) ♂ „I“ from Celerjeva Pečina — penis: A — dorsal view, B — left lateral view, C — right lateral lobe.

of the chitinous cuticle with its epithelium, or else only their lower parts are such multicellular processes which pass into the proper bristle without visible limit. This pertains especially to the dorsal bristles (setae dorsales)—see below—strongly dilated at their base in which neither a distinct limit at the



base nor a hair areole can be remarked. All these bristles — as show the drawings in the work of HANSEN and SØRENSEN (1904) — are differently placed on the penis of the different

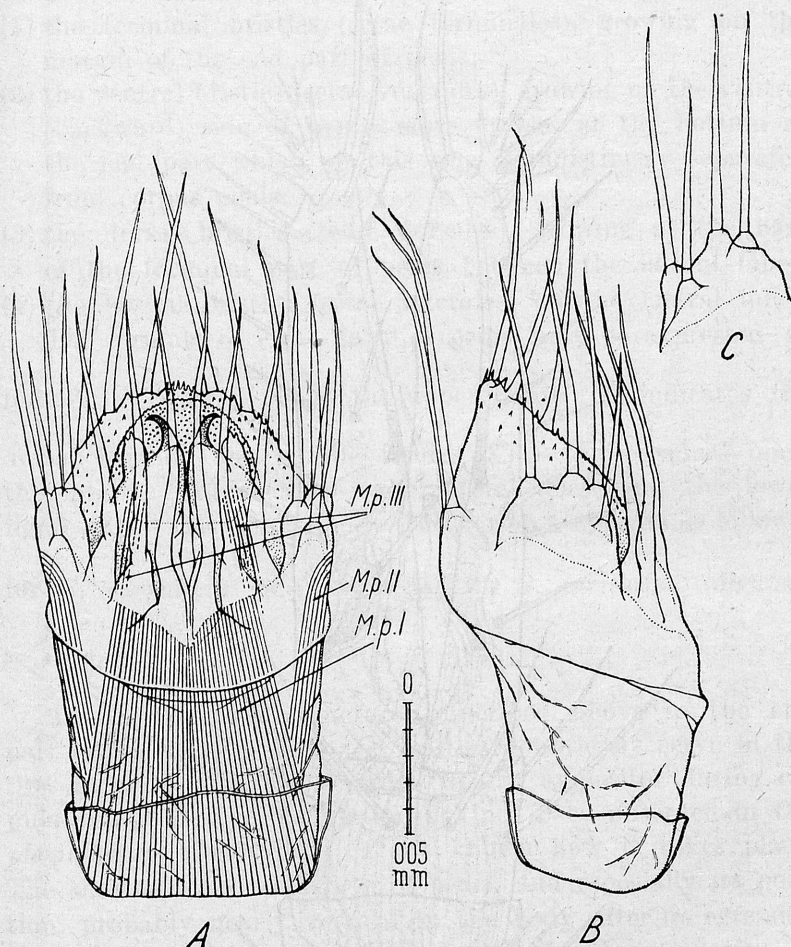
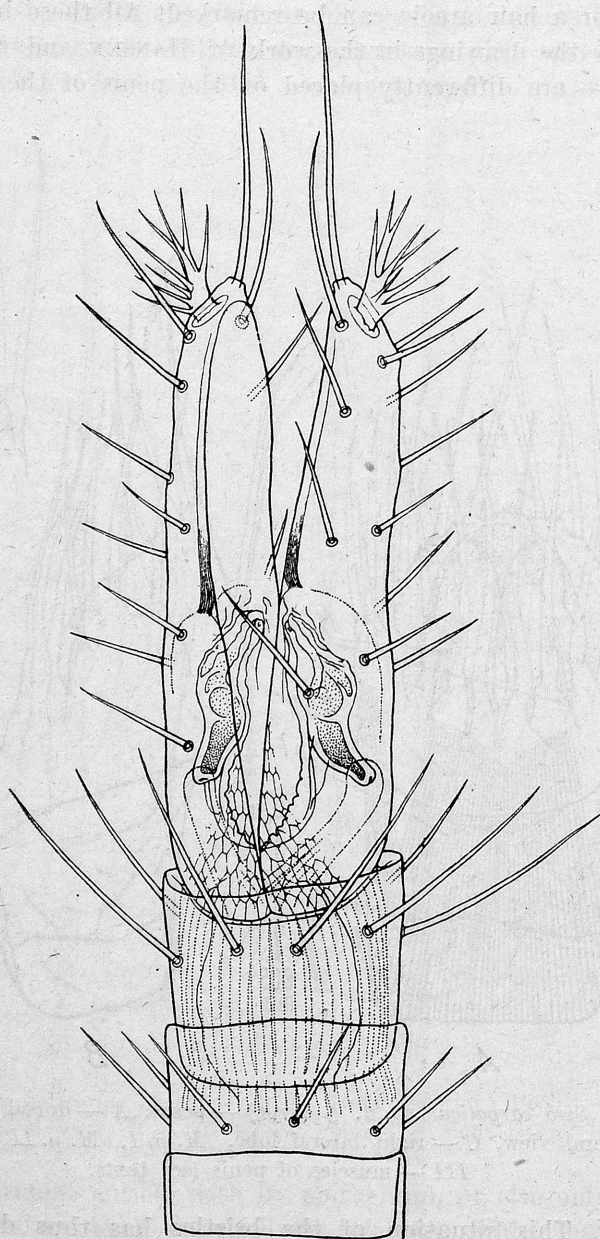


Fig. 18. *Siro carpaticus* sp. n. ♂ (type) — penis: A — dorsal view, B — left lateral view, C — right lateral lobe, *M. p. I*, *M. p. II* and *M. p. III* — muscles of penis (see text).

genera. This situation of the bristles has thus doubtlessly a great systematical meaning. In both species of genus *Siro* LATREILLE which I examined they are in principle situated in the same way but appear in different numbers; as their





0 0.05  
mm



number on the various parts of penis fluctuates only in very narrow limits, it is a good character for specific systematics. In particular, following bristles may be discerned on penis of genus *Siro* LATREILLE:

- (1) the terminal bristles (setae terminales), growing on the margin of the end part of penis;
- (2) the ventral bristles (setae ventrales), growing on the ventral (backward) side of penis, more or less at the bottom of the end part which on this side is indistinctly separated from corpus penis;
- (3) the dorsal bristles (setae dorsales), growing at the base of the terminal part of penis between the lateral lobes;
- (4) the lateral bristles (setae laterales) on the lateral lobes.

The formula of chaetotaxy of penis may be expressed as

follows:  $N \begin{array}{c} Y \\ X \\ Z \end{array} N$  — where the upper figure (Y) indicates the dorsal bristles, the middle figure (X) — the terminal ones, the lateral figures (NN) — the lateral ones, and the lower figure (Z) — the ventral ones. This formula appears as follows:

for *S. carpaticus* sp. n.  $4 \begin{array}{c} 6 \\ 6 \\ 3 \end{array} 4$ , for *S. duricorius* (JOSEPH)

$3 \begin{array}{c} 4 \\ 4 \\ 3 \end{array} 3$ .

The complicated structures described above in the end part of penis as well as the bristles doubtlessly serve in the first place to hold the terminal lips of ovipositor during copulation. It is true, copulation has not been observed in *Cyphophthalmi*, therefore it is not known how it takes place. The shortness and thickness of penis, and especially its position, probably nearly vertical to the body after its egression out of the genital opening, make impossible copulation in such way as in other Harvestmen — in which the long and thin penis reaches through the female's genital opening deep into the inside of the ovipositor hidden in the body. In all probability copulation in *Cyphophthalmi* takes place outside

←  
Fig. 19. *Siro carpaticus* sp. n. ♀ „I“ from Sanok — end part of ovipositor at rest, ventral view (explanations in the text).



the female's body; the female pushes the ovipositor out of the genital opening and its long terminal lips are held by the movable fingers and bristles of penis.

#### VIII. THE OVIPOSITOR

The ovipositor in *Cyphophthalmi* and in particular in genus *Siro* LATREILLE has been described several times already; to begin with JOSEPH (1868) took it for the penis. Its detailed description was given by HANSEN and SØRENSEN (1904) for *Purcellia illustrans* H. et S., *Parasiro corsicus* (E. SIM.) and *Siro durcorius* (JOSEPH). The ovipositor of the latter species was also described by HADŽI (1926—1927) and lately by JANCZYK (1956). HANSEN and SØRENSEN (1904) even remarked the outline of the seed containers (receptacula seminis) translucent through the chitin of the terminal lobes.

In *Siro carpaticus* sp. n. the ovipositor consists of 20 (female „I“ from Sanok) to 23 (female „II“ from Sanok) joints which — except the last one — are more or less of the same length and width. The last joint is somewhat longer than the others. Long unjointed terminal lips (lobes) are inserted on it. The length of the extended ovipositor, as prepared out of the body, is 2,0—2,3 mm, the length of the terminal lobes 0,25 mm, the mean width of the ovipositor 0,10—0,12 mm. In transversal section the ovipositor is slightly oval, not hexagonal as in *Siro durcorius* (JOSEPH) according to JANCZYK (1956).

In the end part of each lobe, somewhat to its side, there is a peculiar, multibranched bristle, composed of 8—9 very sharp thorns (fig. 19 and 20). Moreover, on the external convex surfaces (walls) of every lobe there are 10—13 ordinary bristles, most often set in three rows, three to five in one row. Attention is drawn by the terminal bristles (longer than the other ones), and especially the subterminal bristles, one of them only appearing on each lobe. Infemale „I“ from Sanok the subterminal bristle was set otherwise on each lobe, on the right one dorsally, on the left one ventrally; in female „II“ from Sanok both bristles were on the ventral side (fig. 19 and 20).



On the remaining joints of the ovipositor (except the first one) eight bristles appear on each: four dorsally and four ventrally. On the last joint these bristles are long, on the penultimate one — shorter by one half, and on the following joints they become shorter, gradually towards the base of the ovipositor. On the second joint (counted from the base) they attain only one fifth of the length of the terminal joint bristles. Lastly, on the first joint (basal joint) there are none at all.

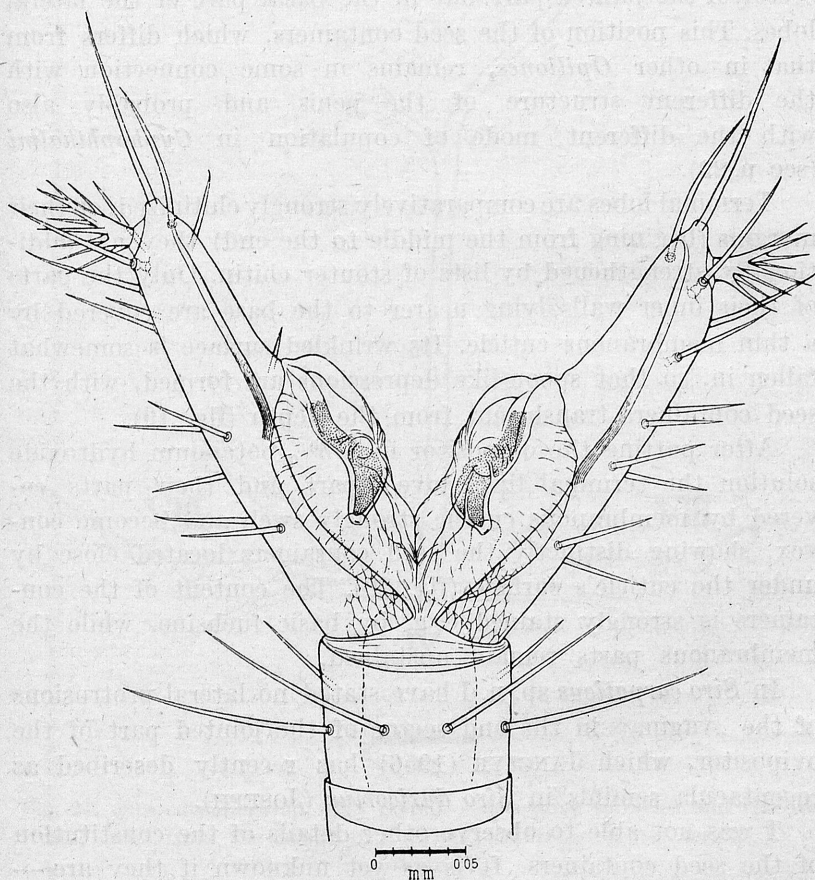


Fig. 20. *Siro carpaticus* sp. n. ♀ „II“ from Sanok — end part of ovipositor in dorsal view after applying 5% potassium hydroxide solution (see text.)



The muscular system of the ovipositor is composed of one layer of thin striate fibres adjacent to the walls of the joints. These fibres run always from the posterior border of one joint to the posterior border of the next one. In the examined specimens I stated 52—56 such fibres in the last joint. Moreover, narrow muscle-fibre bundles seem to run from the bases of the terminal lobes to the proximal ends of the seed containers (fig. 19).

The seed containers (receptacula seminis) are not placed here — as in *Eupnoi* among the *Palpatores* — inside the end sector of the jointed part but in the basal part of the lateral lobes. This position of the seed containers, which differs from that in other *Opiliones*, remains in some connection with the different structure of the penis and probably also with the different mode of copulation in *Cyphophthalmi* (see p. 29).

Terminal lobes are comparatively strongly chitinized; on their margins (beginning from the middle to the end) they are additionally strengthened by lists of stouter chitin. Only the parts of their inner walls lying nearer to the base are covered by a thin membranous cuticle. Its wrinkled surface is somewhat fallen in, so that spoon-like depressions are formed, with the seed containers translucent from the depth (fig. 19).

After putting the ovipositor in a 5% potassium hydroxide solution the terminal lips move apart and their parts covered by membranous cuticle strongly swell and become convex, showing distinctly the seed containers located close by under the cuticle's surface (fig. 20). The content of the containers is strongly stained e. g. by basic fuchsine, while the membranous parts remain unstained.

In *Siro carpaticus* sp. n. I have stated no lateral protrusions of the „vagina“ in the end sector of the jointed part of the ovipositor, which JANCZYK (1956) has recently described as receptacula seminis in *Siro duricorius* (JOSEPH).

I was not able to observe other details of the constitution of the seed containers. It is as yet unknown if they are — similarly as in the other suborders — provided also in *Cyphophthalmi* with accessory glands.



## IX. ACCESSORY SPIRACLES AND TRACHEAL TRUNKS

The tracheal system in Harvestmen of all three suborders opens outwards by a pair of spiracles (spiracula) situated just behind coxae of leg pair IV in the limits of sternit II. Moreover, in the representatives of family *Phalangiidæ* there appear simply built additional spiracles on the leg tibiae.

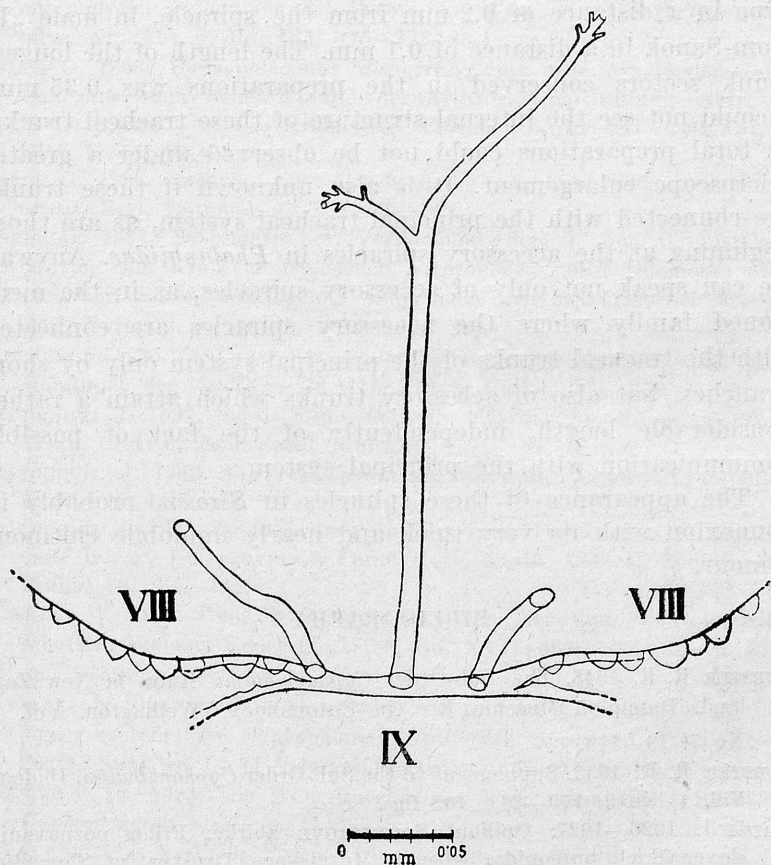


Fig. 21. *Siro carpaticus* sp. n. ♂ (type) — accessory spiracles and tracheal trunks seen from the inside of the body. VIII — eighth tergite, IX — ninth tergite.

In *Siro carpaticus* sp. n. — basing on the examination of three males — I ascertained the presence of three (!) addi-



tional spiracles on the end of the abdomen, namely between tergites VIII and IX (fig. 21). These spiracles are smaller and simpler than the accessory spiracles on the leg tibiae of *Phalangidae*. They are simply little openings, 8—12 microns in diameter (the accessory spiracles in *Phalangidae* according to KÄSTNER (1935) have a diameter of 20—40 microns). The tracheal trunks begin directly at these openings. The first branches on the principal trunk were found by me in the male type in a distance of 0,2 mm from the spiracle, in male „I“ from Sanok in a distance of 0,1 mm. The length of the longest trunk sectors conserved in the preparations was 0,35 mm. I could not see the internal structure of these tracheal trunks, as total preparations could not be observed under a greater microscope enlargement. It is also unknown if these trunks are connected with the principal tracheal system, as are those beginning at the accessory spiracles in *Phalangidae*. Anyway we can speak not only of accessory spiracles, as in the mentioned family where the accessory spiracles are connected with the tracheal trunks of the principal system only by short branches, but also of accessory trunks which attain a rather considerable length, independently of the fact of possible communication with the principal system.

The appearance of these spiracles in *Siro* is probably in connexion with its very thick and nearly immobile chitinous armour.

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#### STRESZCZENIE

Autor opisuje *Siro carpaticus* sp. n. — nowy gatunek kosarza z podrzędu *Cyphophthalmi*, wykryty w Bieszczadach i na ich pogórzu. Ponadto na podstawie nowego gatunku i *Siro duricorius* (JOSEPH) opisuje nieznane dotąd lub niedostatecznie znane szczegóły budowy rodzaju *Siro*, a mianowicie: gruczoł tarsalny, przetchlinki i tchawki akcesoryczne, pokładefko, przede wszystkim zaś męski organ kopulacyjny (prącie), odznaczający się skomplikowaną budową. Organ ten ma duże znaczenie systematyczne.

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#### РЕЗЮМЕ

Автор описывает *Siro carpaticus* sp. n. из подрода *Cyphophthalmi*, который найден был в Бещадах и в их предгорьях. Далее, опираясь на новый вид и на *Siro duricorius* (JOSEPH), автор описывает некоторые, до настоящего времени неизвестные или недостаточно изученные детали строения рода *Siro*, а именно: тарзальную железу, акцессорные дыхальца, овипозитор, в особенности же генитальный аппарат самца (пенис). Орган этот отличается сложным строением и имеет большое систематическое значение.

Redaktor zeszytu: Doc. dr K. Kowalski.

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