FOLIA PARASITOLOGICA 44: 224–232, 1997

Acanthocephalans of the family Centrorhynchidae (Palaeacanthocephala) from Bulgaria

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Key words: Acanthocephala, Centrorhynchidae, birds, morphology, Bulgaria

Abstract. Five species of acanthocephalans of the family Centrorhynchidae are recorded from birds in Bulgaria: *Centrorhynchus amphibius* Das, 1950 from *Buteo buteo* (L.) (new host record), *C. globocaudatus* (Zeder, 1800) Lühe, 1911 from *Falco tinnunculus* L. and *F. vespertinus* L. (new host record), *Sphaerirostris picae* (Rudolphi, 1819) Golvan, 1960 from *Pica pica* (L.) and *Lanius excubitor* L. (new host record), *S. lancea* (Westrumb, 1821) Golvan, 1960 from *Vanellus vanellus* (L.), and *S. turdi* (Yamaguti, 1939) Golvan, 1960 from *Turdus merula* L., *Cinclus cinclus* (L.) (new host record) and *Sturnus vulgaris* L. (new host record). New geographical record for Europe is this of *C. amphibius*, and for Bulgaria – this of *S. turdi*. The species are described and figured on the basis of Bulgarian specimens. *Sphaerirostris picae* is recognized as a valid species and *S. teres* is considered its synonym. A male of *S. picae* with a copulatory cap is reported.

Until now, the following species of acanthocephalans of the family Centrorhynchidae Van Cleave, 1916 have been reported from Bulgaria: *Centrorhynchus aluconis* (Müller, 1780), *C. buteonis* (Schrank, 1788), *C. conspectus* Van Cleave et Pratt, 1940 (see Bachvarov 1988), *C. globocaudatus* (Zeder, 1800) (see Tsacheva 1965, 1967, Petrova 1974, 1984), *C. spinosus* (Keiser, 1893) (see Petrova 1984), *Sphaerirostris teres* (Westrumb, 1821) (see Stoimenov 1962, Zhelyazkova-Paspaleva 1962, Tsacheva 1965, 1967, Petrova 1984, Dimitrova 1991), *S. areolatus* (Rudolphi, 1819) (see Tsacheva 1967), *S. lancea* (Westrumb, 1821) (see Petrova 1974, 1984), *S. scanensis* (Lundström, 1942) (see Tsacheva 1965, Tsacheva-Petrova 1971, Petrova 1974) and *S. pinguis* Van Cleave, 1918 (see Pavlov 1940, 1945, Petrova 1984).

In this report new data are presented for the species composition, distribution and morphology of species of the family Centrorhynchidae in Bulgaria.

MATERIALS AND METHODS

The present study is based on acanthocephalan specimens collected in the period 1984–1994 in various localities in Bulgaria. The data about the hosts, localities and the number of specimens are presented in the section for each species.

Specimens were fixed and preserved in 70% ethanol. They were cleared in glycerine (25–100%) or dimethylphthalate and studied in temporary mounts. The measurements are in millimetres. Figures given in parentheses after the range are those of single measurements outside the normal range.

Voucher specimens are deposited in the Collection of the Parasitic Worms Division, The Natural History Museum, London (NHM).

RESULTS AND DISCUSSION

The following species of the family Centrorhynchidae were found in the course of the present study:

Centrorhynchus amphibius Das, 1950 Figs. 1, 2

Specimens studied: 2 males from *Buteo buteo*, Chirpan, January 1993.
Voucher specimen: NHM 1997.1.7.1.

Description (1 whole male and 1 male metasoma): Trunk elongate, almost cylindrical, 20.0–20.7 long and 1.44–1.65 wide at level of anterior part. Proboscis 1.17 long, consisting of two parts, separated by constriction at level of proboscis receptacle attachment. Anterior part of proboscis almost cylindrical, 0.640 long, 0.325 wide at constriction. Posterior part of proboscis truncate, 0.530 long, 0.575 wide at base. Proboscis armament consists of 32 longitudinal rows, 20 hooks in each row; 11 (12) on anterior part of proboscis, first 8 (9) hooks with strong roots directed posteriorly, roots of first hooks in some rows with apophysis directed anteriorly; transitional hooks 3, with bifurcate roots directed anteriorly; remaining 8 (9) hooks on posterior part of proboscis, spiniform, with small anteriorly directed apophyses. Dimensions of hooks (blade × root): I – 0.0425 × 0.040; II–III – 0.0525–0.053 × 0.050–0.055; IV – 0.050–0.051 × 0.050–0.052; V – 0.0475–0.050 × 0.050; VI – 0.045–0.0475 × 0.050; VII – 0.040–0.0425 × 0.0575–0.0625; VIII – 0.0375–0.040 × 0.0375–0.050; IX–XI – 0.0325–0.0375 × 0.0255–0.0325; XII–XVI – 0.0325 × 0.0250–0.0325; XVII–XX – 0.035–0.040 ×

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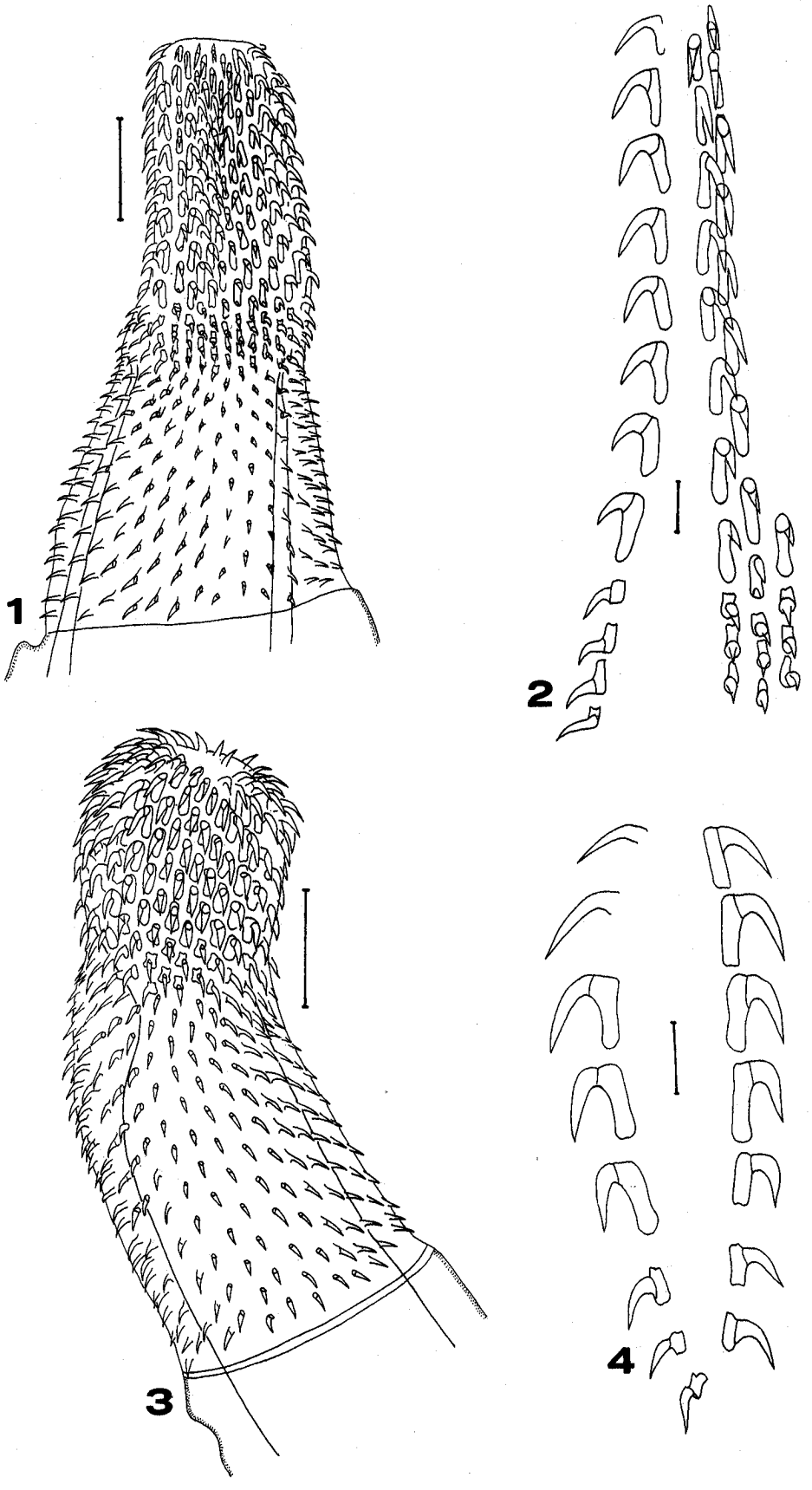


Figs. 1–4. *Centrorhynchus* spp. **Fig. 1–2.** *C. amphibius* Das, 1950, male. **Fig. 1.** Proboscis. **Fig. 2.** Longitudinal rows of hooks, left – lateral view, right – frontal view. **Figs. 3–4.** *C. globocaudatus* (Zeder, 1800), male. **Fig. 3.** Proboscis. **Fig. 4.** Longitudinal rows of hooks, from the ventral (left) and dorsal (right) surface of the proboscis, lateral views. Scale bars = 0.2 mm (Figs. 1, 3) and 0.05 mm (Figs. 2, 4).

0.0255– 0.0325. Neck short, 0.030 long. Proboscis receptacle double-walled, cylindrical, attached at proboscis constriction (at level of 11th–12th hooks), 1.77–1.86 long and 0.27–0.35 wide. Lemnisci 2.4 long and 0.54 wide, longer than proboscis receptacle. Testes oval, situated in tandem and slightly overlapping one another, anterior testis at 1.50–2.88 from proboscis receptacle. Dimensions of testes (length × width): 1.02 to 1.50 × 0.60–0.66. Cement glands 4 in number, situated in pairs, 9.60–10.20 long. Ducts of cement glands 2.1–2.6 long. Genital bursa (invaginated) 1.35–1.65 long.

Remarks: The species was described by Das (1950) on the basis of juvenile specimens from mesenterium of amphibians in India. Schmidt and Kuntz (1969) described adult specimens of the same species found in *Accipiter soloensis*, *A. virgatus affinis* and *Hirundo rustica gutturalis* from Taiwan.

Our specimen has proboscis armament similar to that reported by Schmidt and Kuntz (1969), especially concerning the number of the longitudinal rows of hooks, the number of the hooks and the spines on the anterior and the posterior parts of the proboscis, and the morphology of the roots of the hooks and of the spines. The basic difference between our specimens and those described by Das (1950) and by Schmidt and Kuntz (1969) is in the number of cement glands: 4 in the acanthocephalans studied and 2 reported by Das (1950) and Schmidt and Kuntz (1969). In addition, Bulgarian specimens have greater width of the trunk. Nevertheless, on the basis of the similarity of all the other characters, we determined our specimens as *C. amphibius*.

This is the first record of *C. amphibius* in Europe. *B. buteo* is a new definitive host of this acanthocephalan species.

Centrorhynchus globocaudatus (Zeder, 1800) Lühe, 1911 Figs. 3, 4

Specimens studied: 1 male from *Falco vespertinus*, Krapec, October 1984; 1 male from *F. tinnunculus*, village of Lovets (Stara Zagora Region), March 1990.

Voucher specimen: NHM 1997.1.7.2 (from *F. vespertinus*).

Description (based on the specimen from *F. vespertinus*): Trunk elongate, cylindrical, 17.85 long and 1.35 wide at level of anterior part. Proboscis 1.0 long, divided into two parts by constriction. Anterior part of proboscis cylindrical, 0.40 long and 0.32 wide, 0.26 wide at constriction. Posterior part of proboscis almost cylindrical and slightly arched towards anterior part, 0.61 long and 0.40 wide. Proboscis armament consists of 30 longitudinal rows, 18–19 hooks in each row: 7–8 hooks on anterior part of proboscis, first 5–6 of them longest, with roots directed posteriorly; next 2 (3) hooks shorter, transitional, with shield-shaped roots with anterior and posterior processes; remaining 11–12 hooks on posterior part of proboscis, spiniform, with reduced roots. Dimensions of hooks (blade × root): I – 0.0325–0.0425 × 0.030–0.0325; II – 0.050–0.0525 × 0.0475; III – 0.055–0.0575 × 0.050; IV – 0.050–0.0525 × 0.050; V – 0.0425–0.0450 × 0.045–0.0475; VI – 0.0375–0.040 × 0.0275–0.030; VII – 0.0375 × 0.0225–0.025; VIII – 0.0275–0.0325 × 0.0175; IX–XVIII – 0.025–0.0275 × –. Neck cylindrical, 0.030 long and 0.480 wide. Proboscis receptacle double-walled, cylindrical, attached to constriction of proboscis, 1.25 long and 0.33 wide. Lemnisci 1.65 long. Testes elongate-oval, 1.50 long and 0.60 wide, situated in tandem and slightly overlapping one another, occupying anterior part of trunk. Cement glands 3 in number, tubular, 8.70 long, begin immediately behind posterior testis. Ducts of cement glands 2.70 long. Genital bursa invaginated, 2.40 long.

Remarks: The characters of the specimen from *Falco tinnunculus* correspond well to those of the specimen from *F. vespertinus*. Only in the former the hooks in the latero-ventral row have longer blades than those in the dorso-lateral row and are slightly longer (0.060–0.065) compared with those of the latter.

There are contradictory opinions considering the validity of *C. globocaudatus*, especially in the older literature. De Marval (1905) and Golvan (1956, 1960) considered this species synonym of *C. aluconis* whilst Travassos (1926) identified it with *C. buteonis*. However, most of the authors (Meyer 1932–1933, Petrochenko 1958, Ward 1964, Nelson and Ward 1966) assumed *C. globocaudatus* as a valid species distinguished from *C. aluconis* and *C. buteonis* on the basis of the size of the trunk and the eggs, the shape and the armament of the proboscis and the morphology of the hook and spine roots.

Comparing the morphometric data of our specimens with the descriptions of the above mentioned authors, we found no significant differences. Only the specimen from *F. vespertinus* has larger testes, 1.5 × 0.6, while Ward (1964) reported 0.9 × 0.3 for this character.

This species has been reported from various birds (mainly Strigiformes and Falconiformes) from Europe, Asia and Africa (Petrochenko 1958, Khokhlova 1986). Previously, it has been recorded in Bulgaria from *Buteo buteo*, *Falco naumanni* and *F. tinnunculus* (Tsacheva 1965, 1967, Petrova 1974, 1984). *Falco vespertinus* is a new host record for *C. globocaudatus*.

Sphaerirostris picae (Rudolphi, 1819) Golvan, 1960 Figs. 5–8

Synonyms: *Echinorhynchus picae* Rudolphi, 1819; *Gordiorhynchus* (*Sphaerirostris*) *picae* (Rudolphi, 1819) Dollfus et Golvan, 1957; *Centrorhynchus* (*Sphaerirostris*) *picae* (Rudolphi, 1819) Dollfus, 1958; *Echinorhynchus teres* Westrumb, 1821; *Centrorhynchus teres* Westrumb, 1821) Travassos, 1926; *Centrorhynchus*

(*Sphaerirostris*) *teres* (Westrumb, 1821) *sensu* Golvan, 1956; *Centrorhynchus skrjabini* Petrochenko, 1949; *Centrorhynchus picae* Dollfus, 1953.

Specimens studied: 4 males and 5 females from *Pica pica*, Bourgas, October 1984; 9 males and 5 females from *P. pica*, village of Trankovo (Stara Zagora Region), April 1988; 1 male from *Lanius excubitor*, Krapec, May 1992.

Voucher specimens: NHM 1997.1.7.3–11 (from *P. pica*).

Description (based on specimens from *Pica pica*, village of Trankovo): Trunk fusiform, with maximum width between first and second third of trunk; posterior third of trunk gradually tapering. Transverse vessels of lacunar system form dense reticulum of irregular polygons. Proboscis divided into two parts by constriction at level of proboscis receptacle attachment. Anterior part of proboscis oval to completely spherical, posterior part truncate to cylindrical. Proboscis armament consists of 32–34 (28) longitudinal rows, 11–13 hooks in each row: 7–8 (9) on anterior part of proboscis, first 5 of them longest, with posteriorly directed roots, 6th hook with anteriorly and posteriorly directed or with only anteriorly directed root (occasionally, 6th hook with posteriorly directed root); next 2 (3) hooks with rectangular roots, anteriorly directed; remaining 3–4 hooks on posterior part of proboscis, spiniform, with apophyses directed anteriorly. Neck short, trapezium-shaped to cylindrical (in some specimens, especially in females, partly or completely invaginated in trunk). Proboscis receptacle double-walled, cylindrical. Lemnisci longer than proboscis receptacle.

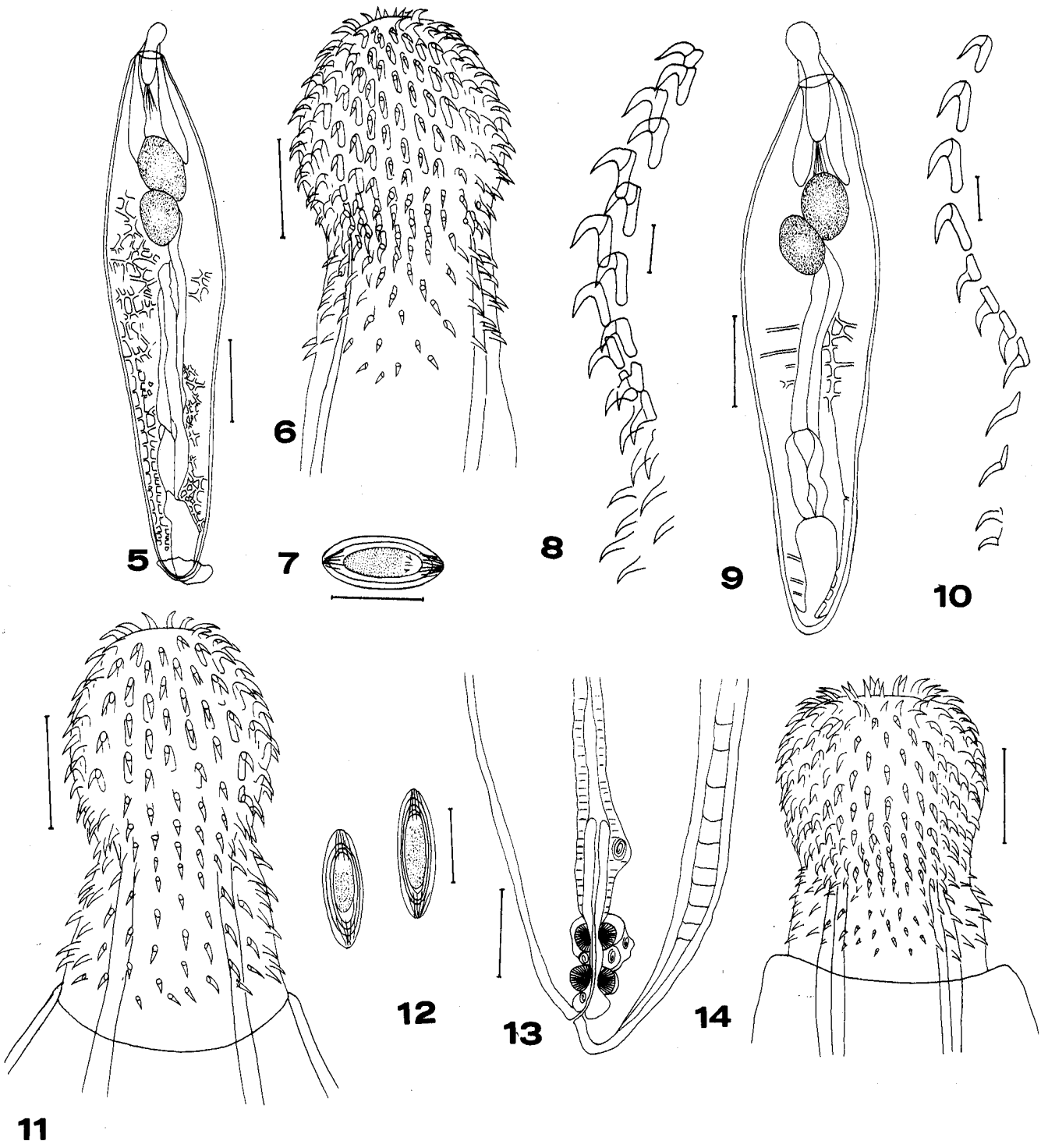
Male (N = 8): Trunk 9.63–12.84 long and 1.95–2.91 wide. Proboscis 0.538–0.737 long: anterior part 0.394 to 0.469 long and 0.356–0.413 wide, posterior part 0.123 to 0.281 long and 0.388–0.438 wide, 0.300–0.325 wide at constriction. Maximum dimensions of the first 5 hooks (blade × root), 0.0425–0.050 × 0.045–0.065, maximum dimensions of next (3–4) hooks (blade × root), 0.0325–0.040 × 0.025–0.0375. Neck 0.082–0.140 long and 0.400–0.469 wide. Proboscis receptacle 1.08 to 1.20 long and 0.22–0.35 wide. Lemnisci 2.10–2.55 long and 0.155 wide, reach to anterior testis. Testes oval, situated in tandem and slightly overlapping one another, in anterior third of trunk, 1.20–1.50 long and 0.75–0.90 wide. Cement glands 4 in number, tubular, 3.09–5.70 long, situated in pairs, one of them begining from middle or slightly before middle of anterior testis. Ducts of cement glands 2, 1.59–1.80 long. Genital bursa (invaginated in all specimens) 0.60–1.80 long. One of specimens with copulatory cap around genital pore (Fig. 5).

Female (N = 4): Trunk 12.90–14.10 long and 2.55–3.27 wide. Proboscis 0.600–0.707 long: anterior part 0.438–0.469 long and 0.394–0.469 wide, posterior part 0.125–0.238 long and 0.438–0.444 wide; 0.313–0.406 wide at constriction. Maximum dimensions of the first 5 hooks (blade × root) 0.0475–0.050 × 0.0475–0.0675; maximum dimensions of next hooks (blade × root) 0.035–0.0425 × 0.025–0.0375. Neck (in one specimen measured) 0.125 long and 0.500 wide. Proboscis receptacle (in one specimen) 1.3 long and 0.31 wide. Trunk filled with oval eggs without polar prolongations. Dimensions of eggs (length × width) 0.055–0.0625 × 0.020–0.025.

Additional data (based on a male specimen from *Lanius excubitor*): Length of trunk 6.24. Proboscis armament consists of 31 longitudinal rows, 12 hooks in each row: 9 hooks on anterior part of proboscis, first 5 of them longer, with strong roots directed posteriorly, next 4 (3) hooks with rectangular roots directed anteriorly; 4 spines on posterior part of proboscis, with anterior apophyses.

Remarks: There are different opinions about the validity of *Sphaerirostris picae* (Rudolphi, 1819) and the allied forms *S. teres* (Westrumb, 1821) and *Centrorhynchus picae* Dollfus, 1953. In the original description of *Echinorhynchus teres*, Westrumb (1821) designated it as a new species and included *Echinorhynchus picae* Rudolphi, 1819 as its synonym, in fact recognizing the two forms as belonging to the same species. De Marval (1905), Meyer (1932–1933) and Petrochenko (1958) considered *S. teres* a valid species and recognized *S. picae* (Rudolphi, 1819) as its synonym. Dollfus and Golvan (1957) and Golvan (1960) assumed the validity of *S. picae* (Rudolphi, 1819) and considered *S. teres* and *S. picae* Dollfus, 1953 as its synonyms. However, Dollfus and Golvan (1961) listed both *Centrorhynchus teres* (Westrumb, 1821) and *Centrorhynchus* (*Sphaerirostris*) *picae* (Rudolphi, 1819) as valid species. Khokhlova (1983) accepted *S. teres* as valid name on the basis of its wide use. According to Cordonnier and Ward (1968), *S. teres* (Westrumb, 1821) and *S. picae* Dollfus, 1953 are distinct species.

Our specimens from *Pica pica* are most similar to those from *P. pica mauritanica* from Morocco described by Dollfus (1953). Insignificant differences have been observed in the sizes of roots of hooks and eggs which in our specimens are slightly greater. The description of Dollfus (1953) contains no data about the size of the hook blades but from the Dollfus' (1953) figure 2, a conclusion can be made that the blade of the 5th hook is approximately 0.041. This measurement is comparable with the dimensions in Bulgarian specimens (0.040–0.0475 in male and 0.0375 –0.0475 in female specimens). There are also differences in the number of the longitudinal rows of hooks reaching in some of our specimens up to 34 (36) whilst, according to Dollfus' (1953) description, they are up to 32.



Figs. 5–14. *Sphaerirostris* spp. **Figs. 5–8.** *S. picae* (Rudolphi, 1819), specimens from *Pica pica*. **Fig. 5.** Male, general view (note the presence of a copulatory cap around the genital pore). **Fig. 6.** Male, proboscis. **Fig. 7.** Egg. **Fig. 8.** Male, longitudinal rows of hooks, lateral view. **Figs. 9–12.** *S. turdi* (Yamaguti, 1939). **Fig. 9.** Male, general view. **Fig. 10.** Male, longitudinal row of hooks, lateral view. **Fig. 11.** Male, proboscis. **Fig. 12.** Egg. **Figs. 13–14.** *S. lancea* (Westrumb, 1821), female. **Fig. 13.** Terminal genital ducts. **Fig. 14.** Proboscis. Scale bars = 2.0 mm (Fig. 5), 1.0 mm (Fig. 9), 0.2 mm (Figs. 6, 11, 13, 14), 0.05 mm (Figs. 7, 8, 10, 12).

Cordonnier and Ward (1968) indicated the following characteristics distinguishing *S. teres* from *Centrorhynchus picae* Dollfus, 1953: (1) the size of the trunk of the male specimens (6.0 for *C. picae* Dollfus and 12.0–18.0 for *S. teres*); (2) the level of the proboscis constriction, i.e., the number of the hooks on the anterior part of the proboscis (7th–8th hook in *C. picae* Dollfus and 9th–10th hook in *S. teres*); (3) the presence of anterior apophyses in the last spines of *C. picae* Dollfus and the absence of apophyses in *S. teres*; (4) the maximum size of the hooks, 0.037 in *S. teres* and 0.054 in *C. picae* Dollfus (but without indication which part of the hook is taken in view, the blade or the root). It should be mentioned, however, that Cordonnier and Ward (1968) did not cite adequately the publication of Dollfus (1953). They used as a distinguishing character the minimum measurement of the trunk length (6 mm) of the males and omitted the maximum length, i.e., 12 mm (Dollfus 1953). Also, as for the sizes of the hooks, Cordonnier and Ward (1968) compared the lengths of the blades in their specimens with the lengths of the roots from Dollfus' (1953) description.

The comparison of our specimens from *P. pica* with the redescription of *S. teres* by Cordonnier and Ward (1968) exhibits many similarities. Some differences concerning the number of the longitudinal rows of hooks, the number of hooks per row and the size of the eggs are in the range of the intraspecific variation. However, in contrast with the redescription mentioned, the Bulgarian specimens have larger hook blades (up to 0.050–0.0525), possess 7–8 hooks on the anterior part of proboscis and all spines have anterior apophyses.

In the present specimen from *Lanius excubitor*, the armament of the proboscis, especially the number of the hooks and spines on the two parts, is similar to that described by Cordonnier and Ward (1968) with the only exception that all the spines have anterior apophyses.

Therefore, only one of the four distinguishing characteristics indicated by Cordonnier and Ward (1968), the level of the proboscis constriction, seems sufficiently grounded. However, having in view the great intraspecific morphological variability, it does not seem sound to use a sole morphological character for distinguishing species.

On this basis, following Dollfus and Golvan (1957) and Golvan (1960), we regard *S. picae* (Rudolphi, 1819) as a valid name and consider *S. teres* (Westrumb, 1821) and *C. picae* Dollfus, 1953 as its synonyms.

One of the male specimens studied was found to be with a cemented genital pore (Fig. 5). Similar observations were also reported by Miller and Dunagan (1985).

S. picae has been reported in many regions of the Palaearctic Region: in Europe, Northern Asia and Northern Africa (Petrochenko 1958, Khokhlova 1986). It was previously reported in Bulgaria as *Centrorhynchus skrjabini* or *Sphaerirostris teres* from various birds: *Aythya ferina*, *Saxicola torquata*, *Turdus merula*, *Pica pica* and *Corvus corone* (Zhelyazkova–Paspaleva 1962, Stoimenov 1962, Tsacheva 1965, 1967, Petrova 1984). Larvae of this species have been found several times from the insectivores *Crocidura leucodon* (see Genov 1984) and the snake *Coluber jugularis* (see Biserkov 1989, 1995).

Sphaerirostris lancea (Westrumb, 1821) Golvan, 1960 Figs. 13–14

Specimens studied: 1 female from *Vanellus vanellus*, village of Byalo Pole (Stara Zagora Region), April 1990.

Voucher specimen: NHM 1997.1.7.12.

Description: Total length 12.93. Trunk elongate, fusiform, 12.10 long, divided by constriction into two almost equal parts; anterior part significantly wider than posterior. Anterior part 5.7 long and 1.86 wide, posterior part 5.6 long and 0.96 wide. Proboscis 0.581 long, consisting of two parts, separated by constriction at level of 8th–9th hooks: anterior part almost spherical, 0.394 long and 0.375 wide; posterior part almost cylindrical, 0.188 long and 0.425 wide at base; 0.320 wide at constriction. Proboscis armament consists of 36 (probably 38) longitudinal rows, 11–12 (?) hooks in each row (apical hooks invaginated): 9 (10) hooks on anterior part of proboscis, first 6 (5) hooks longer, with strong roots directed posteriorly, with maximum dimensions (blade × root): 0.045–0.050 × 0.0425–0.0575; next 3 (4) hooks shorter, with anteriorly directed roots, with maximum dimension (blade × root) 0.0375–0.0425 × 0.025 –0.0275; hooks on posterior part of proboscis 2, spiniform, with maximum dimensions 0.0275–0.0325 × –. Neck partly invaginated, 0.250 long. Proboscis receptacle double-walled, cylindrical, 1.1 long and 0.37 wide. Trunk filled with egg balls. Ripe eggs lacking. Genital pore subterminal, with subvulvar process.

Remarks: There are several descriptions of *S. lancea* published previously but, unfortunately, none of them are complete. Only a few reports (De Marval 1905, Skrjabin 1913, Florescu and Ienistea 1984) are illustrated.

The specimen studied has a greater number of longitudinal rows of hooks (36–38) than reported by Skrjabin (1913) for *S. lancea* (30–32). Concerning this character, it is rather close to *S. lanceoides* (Petrochenko, 1949). According to Belopolskaya (1983), *S. lancea* and *S. lanceoides* are very similar species differing only by the number of the longitudinal rows of hooks and by the shape of the anterior part of the proboscis. Florescu and Ienistea (1984) denied the validity of *S. lanceoides*. Having in view the great variability of the number of

the longitudinal rows of hooks in this acanthocephalan group, it seems that this character has a restricted taxonomic value for distinguishing species. The specimen studied is identified as *S. lancea* because of its similarity with the description of Skrjabin (1913) with respect to other characteristics, especially the number of hooks and spines per row and the morphology of the roots.

This species has been reported in Europe, North Asia, China, Taiwan, Egypt and USA (Khokhlova 1986). Previously, *S. lancea* was recorded in Bulgaria from *Himantopus himantopus*, *Vanellus vanellus* and *Erithacus megarhynchos* (Petrova 1974, 1984).

Sphaerirostris turdi (Yamaguti, 1939) Golvan, 1960
Figs. 9–12

Specimens studied: 5 males and 13 females from *Turdus merula*, Kokalyane, Dyavolsky Most (Sofia Region), June 1983; 4 males and 7 females from *T. merula*, Sveta Agalina (Bourgas Region), April 1984; 9 males and 18 females from *Sturnus vulgaris*, Krapec, April 1984; 1 female from *Cinclus cinclus*, Kokalyane, August 1983.

Voucher specimens: NHM 1997.1.7.13–20 (from *S. vulgaris*); NHM 1997.1.7.21–25 (from *T. merula*).

Description (based on the specimens from *Sturnus vulgaris*): Trunk fusiform, maximum width at anterior third in males and at middle in females. Transverse vessels of lacunar system form dense reticulum of irregular polygons. Proboscis consists of two parts, separated by constriction: anterior part spherical, posterior part truncate. Proboscis armament consists of 22–26 (usually 26) longitudinal rows in males and 26–29 longitudinal rows in females, 10–12 hooks in each row: 6–7 (8) hooks on an terior part of proboscis, anterior 4 (3) of them with strong roots directed posteriorly; remaining 2–3 (4) with rectangular roots directed anteriorly (sometimes root of 5th hook has both anterior and posterior apophyses); 4 (5) hooks on posterior part of proboscis, spiniform, with very thin roots directed anteriorly. Neck very short. Proboscis receptacle double-walled, cylindrical to sacciform, attached at proboscis constriction. Lemnisci sacciform.

Males (N = 9): Trunk 3.96–7.18 long and 1.05–1.71 wide. Proboscis 0.580–0.650 long: anterior part 0.350 to 0.420 long and 0.294–0.344 wide; posterior part 0.220 to 0.280 long and 0.313–0.460 wide, 0.231–0.269 wide at constriction. Maximum dimensions of anterior 4 hooks (blade × root) 0.045–0.0525 × 0.050–0.065; maximum dimensions of next hooks (blade × root) 0.030–0.045 × 0.025–0.035. Neck 0.05–0.10 long and 0.32–0.48 wide. Proboscis receptacle 0.82–1.06 long and 0.19–0.32 wide. Lemnisci 0.82–1.25 long. Testes spherical, situated in tandem, slightly overlapping one another, situated in widest part of trunk. Dimensions of testes (length × width) 0.55–1.05 × 0.35–0.48; first testis at 0.30–0.76 from proboscis receptacle. Cement glands 3 (4) in number, tubular, 1.68–2.4 long. Ducts of cement glands 0.56–1.11 long. Genital bursa (evaginated in two specimens) 0.67–0.80 long, with 12 (10) rays.

Female (N = 18): Trunk 4.80–10.35 long and 1.20–2.34 wide. Proboscis 0.580–0.700 long: anterior part 0.370–0.440 long and 0.313–0.375 wide, posterior part 0.190 to 0.290 long and 0.375–0.488 wide at base, 0.256–0.331 wide at constriction. Maximum dimensions of anterior 4 hooks (blade × root) 0.045–0.055 × 0.050–0.065; maximum dimensions of next hooks (blade × root) 0.0375–0.0425 × 0.025–0.0375. Neck 0.02–0.08 long and 0.406–0.469 wide. Proboscis receptacle 0.86 to 1.08 long and 0.22–0.38 wide. Lemnisci 0.83–1.29 long and 0.15–0.19 wide. Female genital tract 1.32 to 1.61 long; vagina provided with two sphincters. Eggs elongate-oval, without polar prolongations. Dimensions of eggs (length × width) 0.065 to 0.0875 × 0.020–0.0275. Genital pore slightly subterminal.

Remarks: The specimens studied exhibit intermediate characters between those of *Sphaerirostris turdi* and *S. scanensis*. *S. turdi* was described from birds of the families Turdidae and Emberizidae in Japan (Yamaguti 1939). Its proboscis is armed with 26–29 longitudinal rows in males and 26–34 in females (Yamaguti 1939) or 26 longitudinal rows in both sexes (Kugi 1988), 11–13 hooks per row; males have 4 cement glands. *S. scanensis* was described from *Turdus merula* from Sweden (Lundström 1942); according to the original description, it is characterized by 22 longitudinal rows of hooks, 10–11 hooks in each row, and 3 cement glands. As for the remaining characters (the length of the trunk and the proboscis, the number of the true hooks and the spines, the morphology of the hook roots, the sizes of the hooks, the proboscis receptacle, the lemnisci and the eggs), the two species show close similarity. The present observations revealed a great variation in relation to the number of longitudinal rows of hooks (22–26 in the males and up to 29 in females), 10–12 hooks in each row. The correct number of the cement glands was not always clear, in some specimens only 3 cement glands were seen whilst in others 4 distinct glands were counted. On this basis, we consider that *S. turdi* and *S. scanensis* are very similar forms and additional taxonomic analysis of their type specimens is needed to check the validity of the latter.

Acknowledgements. We are grateful to Dr. D.I. Gibson for providing a copy of the original description of *Echinorhynchus teres*, and to Dr. J. Mariaux for the copy of the article by Dollfus (1953). This investigation was supported by the National Scientific Research Foundation of the Republic of Bulgaria, Grant B-306/1993.

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Received 30 July 1996

Accepted 19 February 1997