

New combination for *Malacoceros jirkovi* and a key for *Spio* (Polychaeta: Annelida) from Norwegian waters and adjacent Arctic areas

Новое сочетание для вида *Malacoceros jirkovi* и определительный ключ для рода *Spio* (Polychaeta: Annelida) из норвежских территориальных вод и прилежащих арктических вод

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The species *Malacoceros jirkovi* Sikorski, 1992 is transferred to *Spio* Fabricius, 1785 in the light of new data (listed below). The description of this species is given for the first time in English. About 30 years of the study of polychaetous material from the economic zone of Norway has eventually shown there to be nine species belonging to *Spio* inhabiting this area: *S. filicornis* (Müller, 1776) [including *S. malmgreni* Sikorski, 2001 as a junior synonym], *S. mecznikovianus* Claparede, 1868, *S. decoratus* Bobretzky, 1871, *S. arctica* Söderström, 1920, *S. armata* Thulin, 1957, *S. goniocephala* Thulin, 1957, *S. jirkovi* (Sikorski, 1992), newly described *S. symphyta* Meißner, Bick et Bastrop, 2011 and *S. arndti* Meißner, Bick et Bastrop, 2011. The species *S. theeli* Söderström, 1920 and *S. tzetlini* Sikorski, 2001 which might be obtained in the adjacent areas (the Barents and White Seas) are also mentioned to fulfill the list of Arctic fauna.

В свете полученных в последнее время фактов вид *Malacoceros jirkovi* Sikorski, 1992 переводится в род *Spio* Fabricius, 1785; первый раз описание этого вида приведено на английском языке. Почти тридцатилетнее изучение фауны многощетинковых червей из экономической зоны Норвегии показало в результате наличие здесь девяти видов, принадлежащих роду *Spio*: *S. filicornis* (Müller, 1776) [включая *S. malmgreni* Sikorski, 2001 как младший синоним], *S. mecznikovianus* Claparede, 1868, *S. decoratus* Bobretzky, 1871, *S. arctica* Söderström, 1920, *S. armata* Thulin, 1957, *S. goniocephala* Thulin, 1957, *S. jirkovi* (Sikorski, 1992), недавно описанные *S. symphyta* Meißner, Bick et Bastrop, 2011 и *S. arndti* Meißner, Bick et Bastrop, 2011. Виды *S. theeli* Söderström, 1920 и *S. tzetlini* Sikorski, 2001, которые могут быть встречены в прилежащих водах Баренцева и Белого морей также рассмотрены здесь для пополнения списка арктической фауны.

Key words: Norway, Barents sea, *Spio*, *Malacoceros jirkovi*, identification key

Ключевые слова: Норвегия, Баренцево море, *Spio*, *Malacoceros jirkovi*, определительный ключ

INTRODUCTION

This paper has been prepared to reflect the new composition of the Norwegian fauna of *Spio* Fabricius, 1785 and especially the new status of the species *Malacoceros jirkovi* Sikorski, 1992 which was transferred to *Spio* because of better correspondence to *Spio*-diagnostic characters. It covers the Norwegian economic zone and adjacent ar-

reas together with the whole Barents Sea. The species mentioned here have been met in the samples processed by Akvaplan-niva over a period of 20 years. The paper contains a key which aims to be simple for practical use. In pursuing the practical aims this paper is unconcerned by problems of levels higher than species. Remarks about some species or groups of species are given when it is deemed necessary.

MATERIALS AND METHODS

The material used was mostly collected by a consulting firm Akvaplan-niva and also by the Norwegian Institute for Water Research (NIVA) and the Norwegian Institute of Marine Research (IMR). These surveys were for pure scientific purposes or for the purposes of ecological monitoring around oil and gas sites in the North and Barents seas, around fish-farms or in areas of responsibility of municipalities. Materials collected by the Soviet and Russian institutions in the Arctic and in the Far East were also examined. Materials collected by the Akvaplan-niva and IMR are used to clarify the status of *M. jirkovi*. Types of *M. jirkovi* are deposited in the collections of Zoological Museum of Moscow University (ZMUM) and Zoological Museum of the University of Copenhagen (ZMUC). Materials collected only by the Akvaplan-niva used for the cases of *Spio mecznikowianus* Claparede, 1868, *S. decoratus* Bobretzky, 1871 and *S. symphyta* Meißner et al., 2011. The material collected by the Akvaplan-niva is deposited now in the Museum of Natural History and Archaeology of the Trondheim Norwegian University of Science and Technology (NTNU-VM). Material of species described by Söderström, Thulin and Bick were examined: the type-materials from the Swedish Museum of Natural History (*S. arctica* Söderström, 1920 and *S. theeli* Söderström, 1920), the Zoological Museum of the Lund University (*S. armata* Thulin, 1957 and *S. goniocephala* Thulin, 1957) and the Zoological Collection of the Rostock University (*S. arndti* Meißner, Bick et Bastrop, 2011). The museum collections (Russian, Danish, German and Swedish) which were examined in former 28 years together with the zoological material collected by the author personally were extremely helpful to come to the final conclusions.

RESULTS AND DISCUSSION

Genus *Spio* Fabricius, 1785

Diagnosis: Body metameric. Peristomium not fused to first setiger. Branchiae from

first or second setiger; usually flattened and normally fused basally to notopodial post-setal lobes. Branchiae normally present along length of body (absence or presence of branchiae on first setiger used by many authors as generic character to separate *Spio* and *Microspio* Mesnil, 1896 but as the first branchiae in *Spio* vary from large to inconspicuous, this character alone is not fit to confer generic separation). No notopodial hooks. Neuropodial capillaries are replaced by hooded hooks by a certain setiger in some species, but often the setiger number at which hooks replace capillaries can vary within a species. Usually there is an obvious separate narrow lower fascicle of setae in neuropodia as well as the existence of an upper fascicle in notopodia. Capillaries in the lower neuropodial fascicle are replaced posteriorly by sabre setae. Other types of specialized setae are absent. Metameric dorsal nuchal organ containing two or four longitudinal strokes per segment present anteriorly (sometimes hardly visible or completely invisible even after staining in Methyl Blue or Methyl Green). Pygidium with two pairs of anal cirri (cirri in dorsal pair may be nearly completely reduced in some species – e.g. *S. mecznikowianus*). Number of anal cirri does not vary with size. Dorsal pair of anal cirri can be remarkably reduced in several species and sometimes only the ventral pair appears to remain. Often dark pigment is present on anterior segments. Pigmentation is rather resistant to alcohol and the pattern of pigmentation is often a key feature for species.

Discussion. The validity and taxonomic borders of the genus *Microspio* are not considered here. The author supposes that there is a confusion surrounding this genus due to the existence of two different approaches in taxonomic literature based on different characters: presence or absence of branchiae on the setiger 1 (e.g. Fauchald, 1977) or shape of the dorsal metameric sense (ciliated) organ (e.g. Söderström, 1920; Bick et al., 2010).

The following 9 species belonging to *Spio* occur in Norwegian waters:

1. *S. filicornis* (Müller, 1776) [including *S. malmgreni* Sikorski, 2001 as a junior synonym]
2. *S. mecznikovianus* Claparede, 1868
3. *S. decoratus* Bobretzky, 1871
4. *S. arctica* Söderström, 1920
5. *S. armata* Thulin, 1957
6. *S. goniocephala* Thulin, 1957
7. *S. jirkovi* (Sikorski, 1992)
8. *S. symphyta* Meißner, Bick et Bastrop, 2011
9. *S. arndti* Meißner, Bick et Bastrop, 2011
Two species, *S. theeli* Söderström, 1920 and *S. tzetlini* Sikorski, 2001, inhabit the adjoining Barents Sea.

Spjo jirkovi (Sikorski, 1992),
new combination
(Figs 1–3)

Malacoceros jirkovi Sikorski, 1992: 105–108;
2001: 299–300.

Material. *Holotype* (ZMUM PI-809) and *paratype* (ZMUC POL-946) 61°00'N, 1°36'W, 140 m, sand, 18 July 1957; *paratype* (ZMUM PI-811) 61°42'N, 4°50'W, 235 m, silty sand, 17 July 1957 and *paratype* (ZMUM PI-812) 63°21'N, 6°19'E, 210 m, sand, 18 July 1957.

Additional material collected by Institut of marine research (Bergen, Norway – not deposited yet in proper museum collections) and the material collected by Akvaplan-niva (Tromsø, Norway) is: deposited in NTNU-VM: 39 samples (NTNU-VM-59193–59210; 61313–61330; 61382, 61383 and 67189) with 205 specimens.

Redescription. Prostomium with stout antero-lateral horns often nearly perpendicular to the sagittal axis or forward-oriented (Fig. 1a). Less commonly prostomium is merely triangular without lateral horns (Fig. 2a). Posterior acute part of prostomium (caruncle) is often (but not always) inflated forming a so-called occipital crest. Two pairs of small eyespots present, often invisible. Prostomium looks like pillow lying on the peristomium not forming any lateral wings. Palps are moderately long usually reaching the 10th setiger. Neuropodia of 1st setiger are approximate-

ly on the level of notopodia of 2nd setiger. Setae in the bundles of notopodial bristles have quite a small divergence angle and are directed at a considerable angle (~45–60°) to the horizontal (Figs 1e–g). Neuropodial hooks start to replace capillaries from between setiger 26th to 32nd. Hooks are tridentate in side view (Figs 1e, c). Unpaired main fang surmounted by unpaired apical tooth, often very small. Number of hooded hooks per neuropodium is from two – five (in individuals of about 0.6 mm width) to six – eight (for individuals of 1–1.2 mm width). Sabre setae in low bundles of neuropodia can be visible from setiger 5th–6th with two to three per neuropodium. Sabre setae with fine hair-like tips (Fig. 1d). Neither nuchal organ nor metameric dorsal ciliated organ (sensu Meißner et al. 2011) are detectable. Branchiae acute. Branchiae on 1st setiger are a little longer than notopodial postsetal lobes (Fig. 1e) and about as twice as long as notopodial postsetal lobes on the following segments. Up to setiger 10th branchiae and notopodial postsetal lobes appear not to be at all fused. From approximately setiger 10th they are fused at the base (Fig. 1g). Branchiae are absent from the posterior third of body. Notopodial postsetal lobes are thread-like on the posterior two thirds of body and are thinner than branchiae in the middle third. Neuropodial postsetal lobes of 1st setiger are narrow and acute; they are not acute on the following segments, have rounded margins, and are nearly invisible in the posterior half of the body. Pygidium with four thin anal cirri placed in the ventral two thirds of pygidium (Fig. 2b). Number of anal cirri is stable and does not increase with size.

Colour. Fixed specimens not pigmented.

Distribution (Fig. 3). Known from the area between the Shetland and Faroe Islands and along the Norwegian coast from the North Sea up to Finmarken (SW Barents Sea), on depths 33–338 m. Sand and silty sand.



Fig. 1. *Spio jirkovi*, paratype ZMUC POL-946: **a**, anterior end; **b**, hooded hook, setiger 36; **c**, enlarged head of hooded hook; **d**, sabre setum, setiger 36; **e**, paropodium of setiger 1; **f**, paropodium of setiger 32; **g**, paropodium of setiger 83. Dorsal (a) and anterior (e–g) view. Scale bars: 0.5 mm (a), 0.05 (b), 0.01 mm (c, d), 0.1 (e–g).

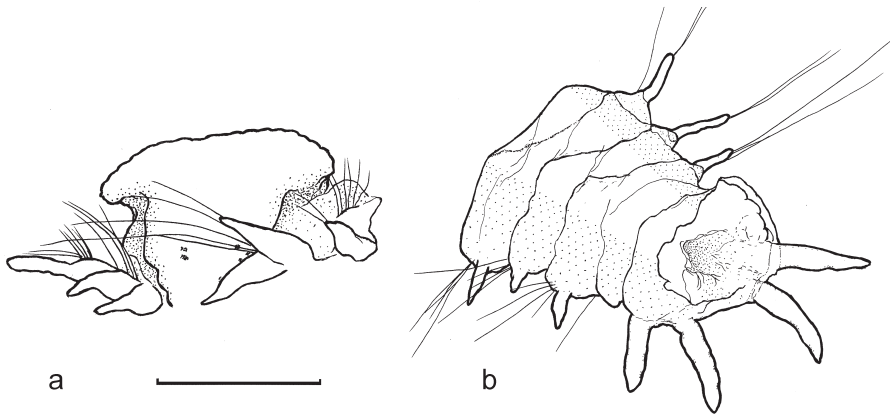


Fig. 2. *Spio jirkovi*: a, anterior end without antero-lateral horns, dorsal view (Vigdis, St. 5, 61,399°N 02,07°E, 282 m, 31 May 1999); b, pygidium, dorsal view (Huldra, St. 2, 60,85°N 2,65°E, 121 m, 23 May 2004). Scale bar: 1 mm.

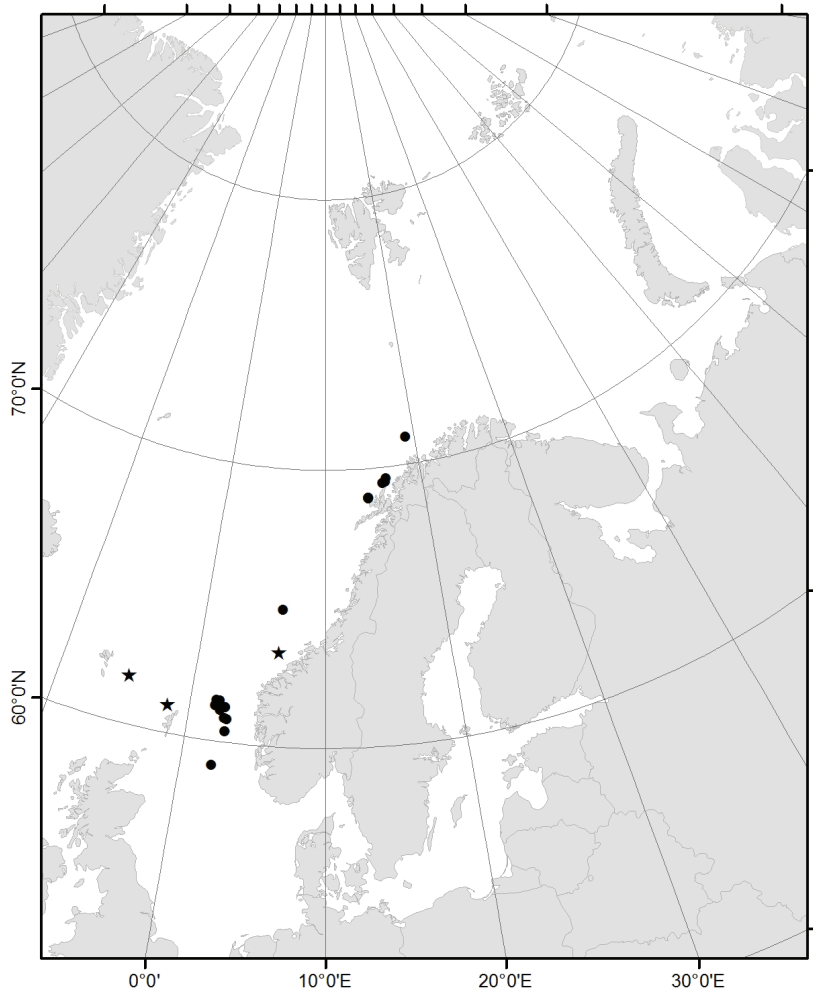


Fig. 3. Distribution of *S. jirkovi* (asterisks show type-locality).

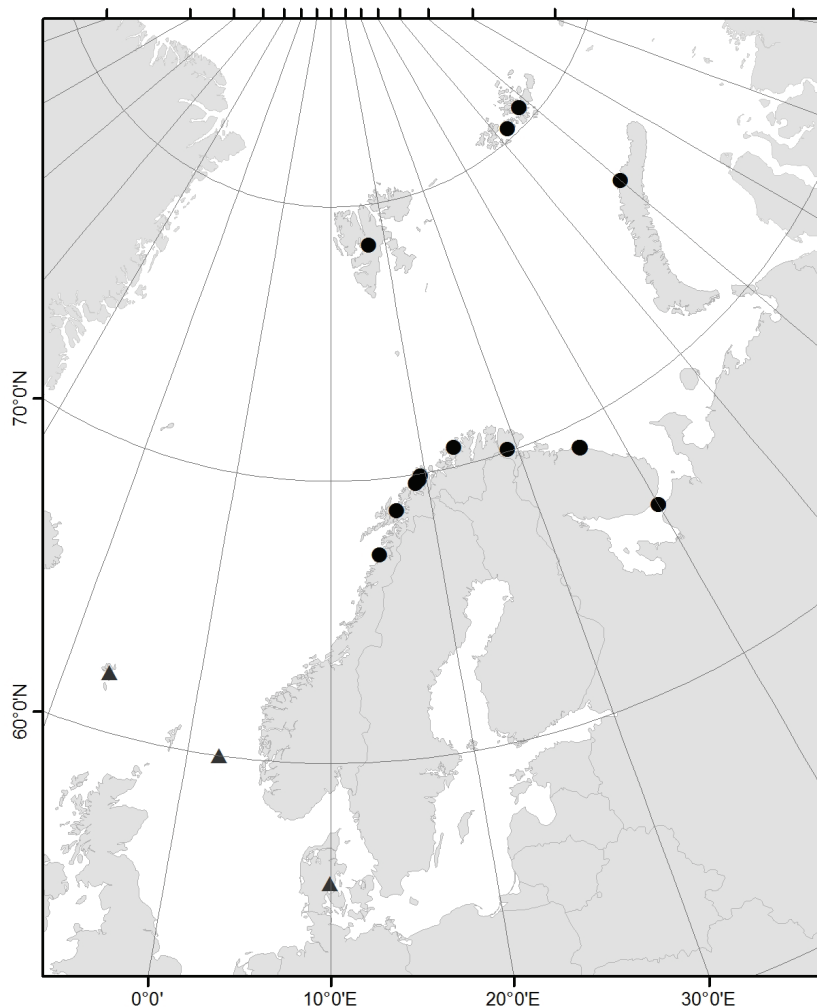


Fig. 4. Distribution of *S. filicornis* and *S. arndti* (triangles refer to presumed *S. arndti*).

DISCUSSION

- Fixed number of anal cirri – four, whereas the number of anal cirri in *Malacoceros* is size-variable;
- the often absence of antero-lateral horns (small rounded antero-lateral projections were also mentioned for *S. goniocephala* Thulin, 1957);
- the teeth on the hooks are arranged in a tandem pattern (absence of paired teeth).

Morphologically this species is extremely close to *Malacoceros indicus* which may also belong to the genus *Spio*, due to the same reasons listed above (see Williams, 2007).

Several points are still not completely certain in the taxonomy of *Spio* in the Arctic and waiting to be clarified:

- The group *Spio* grex *filicornis* unites valid species names belonging to morphologically close species (*S. filicornis*, *S. malmgreni*, *S. arndti*) and can be easily recognized morphologically due to characteristic pattern of pigmentation. Genetic investigations have shown the heterogeneity of this group (oral presentation of K. Meißner, A. Bick and R. Bastrop on 10-th International Polychaeta conference in Lecce in 2010; Bastrop in Meißner et al., 2011). The heterogeneity could be detected even on the map of obtained samples (Fig 4). The

northern group of dots on this map belongs to morphotype which seemed preferable to name *S. malmgreni* before the exploration in the type-locality had been done (Meißner et al., 2011) and today the name *S. filicornis* has been resurrected for this morphotype. So we may assume the northern specimens belong to *S. filicornis*, whereas the southern dots may be treated as belonging to *S. arndti*. Unfortunately this statement can not be sufficiently supported today by morphological evidence. Morphological characters given by K. Meißner and A. Bick (Meißner et al., 2011) to split reliably these two species (number of pairs of ventral wide dots visible after transferring from Methyl Green back to water and the extension of the metameric dorsal ciliated organ) unfortunately do not show satisfactory results when working with Norwegian material (collected around Tromsø). For example the number of pairs of ventral wide dots visible after transferring from Methyl Green back to water or 70% ethanol is normally about four per setiger in *S. arndti*, up to six in *S. filicornis* from the type-locality (Meißner et al., 2011) and up to ten in the specimens collected around Tromsø; metameric dorsal ciliated organ is up to setiger 11th or 12th in *S. filicornis*, up to 16th – 20th in *S. arndti* (Meißner et al., 2011) and often up to the setiger 13th at least in specimens collected around Tromsø. It may be that Meißner and Bick did not deal with enough material to provide us with more reliable diagnostic characters. The chance also exists that we have in Norway another species which could be recognized only using genetic methods. This possibility was indicated in the oral presentation of Meißner, Bick and Bastrop at the 10th International Polychaeta conference in Lecce in 2010. Studying material from Siberia and from the Far East we obtained specimens close morphologically but having differences like, for example, sometimes neuropodial hooks from twelfth setiger or more dense pigmentation. So, this morphological group might be very genetically heterogeneous. The number of species

inside this morphologically clearly bordered group should be clarified and possibilities of reliable identification based on morphological features have to be closely examined.

2. *Spio arctica* Söderström, 1920 could be a junior synonym of *S. limicola* Verrill, 1879. Such possibility was detected several times (e.g. Maciolek, 1990; Sikorski, 2001). The types of *S. arctica* were examined whereas the types of *S. limicola* were not. *S. arctica* is also morphologically easy recognizable by pattern of pigmentation. There are also at least several morphologically very close species exist demonstrating similar to that pattern of pigmentation. *S. picta* (Zachs, 1933) is already described from the Far East. For this reason the name *S. arctica* is used here as the paper is devoted to the area close to the type-locality of this species. So, it is desirable that this situation in this morphological group be further thoroughly examined ideally involving genetic methods as well.

3. In the case of *S. decoratus* the material from Norway has to be compared with material from the species type-locality (Sevastopol, Black Sea). Without that the proper use of this name is in doubt. Type specimens of this species were destroyed during the Second World War together with the building of Svastopol biological station where they were deposited.

4. Material named as *S. mecznikowianus* from Norwegian waters needs to be compared to material named *S. mecznikowianus* from the type area (Mediterranean).

There is another valid name: *S. atlanticus* Langerhans, 1881. This species was described from Madeira. It has been treated many times as a junior synonym of *S. mecznikowianus* however may be a better name to use instead of *S. mecznikowianus* for the Norwegian material. So, uncertainty in proper use of a name for Norwegian material remains.

Key for species identification of *Spio* from the Arctic and the North Sea (except for *S. multioculata* (Rioja, 1918) recorded just once as larvae by Hannerz (1956) and *S. martinensis*

Mesnil, 1896 recorded only along the southern coast of the North Sea, as it was never observed in Akvaplan's samples). Based on material which was personally examined by the author:

1. Branchiae present on 1st setiger 2
 - Branchiae absent from 1st setiger 10
2. With antero-ventral horns
 -(partly) *Spio jirkovi*
 - Without antero-ventral horns 3
3. Prostomium looks fused with peristomium in middle part forming collar-like structure around anterior part of prostomium. Very characteristic pigmentation pattern – lateral border between peristomium and 1st setiger; stays often pigmented even if a worm looks completely unpigmented – can be easily detected; hooks tridentate (with tiny apical tooth – more easily visible with oil immersion). Metameric dorsal ciliated organ absent on setiger *Spio symphyta*
 Note: Bifid hooded hooks were incorrectly stated for the species in the remarks to the key in Sikorski (2001).
 - Prostomium does not look fused to peristomium 4
4. Hooded hooks tridentate 5
 - Hooded hooks bidentate 7
5. Branchiae on 1st setiger are not fused basally to notopodial postsetal lobes. Branchiae and postsetal lobes on 1st setiger are sharply pointed (partly) *Spio jirkovi*
 - Branchiae basally fused to notopodial postsetal lobes on 1st setiger. Branchiae and postsetal lobes on 1st setiger are rounded 6
6. Very characteristic (stable in fixative) pattern of pigmentation on ventral surface of anterior setigers: transverse stripes of dark pigment on borders between segments interrupted in the mid-line by an unpigmented longitudinal stripe. Two large dark lateral spots in the anterior part of prostomium very characteristic if present (clear in adults as a rule; might be not so well pronounced in smaller individuals). Appearance of hooded hooks varies from 8th to 19th setiger (smallest individuals only have hooks starting anteriorly from 12th setiger) *Spio arctica*
 Note: The taxon is very close morphologically to *Spio limicola* Verrill, 1880.
 - Pigmentation of ventral surface is also characteristic for species: middle areas of borders between segments are pigmented. Hooded hooks appear always on 11th setiger. Epaulette-like nuchal organ on dorsal side of two

- anterior-most setigers is clearly pronounced due to backwardly surrounding pigmentation *Spio decoratus*
7. Dorsally peristomium is heavily pigmented contrasting with unpigmented or just slightly dorsally pigmented prostomium (pigmentation pattern is very characteristic). Hooks always from 11th setiger. Prostomium is slightly incised in the middle anteriorly
 - *Spio grex filicornis* [including *S. arndti* Meißner Meißner, Bick et Bastrop, 2011 and *S. filicornis* (Müller, 1776) together with *S. malmgreni* Sikorski, 2001 as a junior synonym]
 - Other pattern of pigmentation 8
 8. Branchiae on 1st setiger remarkably taller than notopodial postsetal lobe. Prostomium elongated, tapered anteriorly. Neuropodial hooded hooks appear further back of 11th setiger (from 12th setiger in smallest individuals only) *Spio goniocephala*
 - Branchiae and notopodial postsetal lobes are of a similar height on 1st setiger 9
 9. Prostomium pointed anteriorly .. *Spio theeli*
 Note: Morphologically very close to *S. goniocephala* by the shape of prostomium and by the structure of nuchal and metameric dorsal ciliated organ.
 - Prostomium rounded anteriorly. Easy to identify by nearly always pigmented ventrolateral border (lower than pigmented area in *Spio symphyta*) between peristomium and 1st setiger *Spio armata*
 10. Tridentate hooded hooks appear always on 9th setiger. Branchiae long; reaching 11th setiger. They abruptly decrease in length on 12th setiger. The pattern of ventral pigmentation is quite often similar to that of *S. decoratus* *Spio mecznikowianus*
 - Hooded hooks bidentate, appearing after setiger 10. Branchiae do not disappear abruptly. Prostomium short, triangular *Spio tsetlini*
 Note: Tiny, delicate, rare animals. Described from Kola peninsula. Holotype and 3 Paratypes deposited in Zoological Institute in St Petersburg (ZIN Nos 1/50428; 2/50429-4/50431).

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