

[Versión en español](#)



CLASS THECOSTRACA

SUBCLASS CIRRIPEDIA

SUPERORDER ASCOTHORACIDA

Orders Laurida & Dendrogastrida

Gregory A. Kolbasov

White Sea Biological Station, Biological Faculty, Moscow State University,
119991, Moscow, Russia. gkolbasov@gmail.com

1. Brief characterization of the group and main diagnostic characters

The Ascothoracida are ecto-, meso- or endoparasites in echinoderms and cnidarians. Most of them are dioecious, except for the secondarily hermaphroditic species of the Petrarciidae. The larger female is accompanied by smaller males, often living inside her mantle cavity. Ascothoracidans use their piercing mouthparts for feeding on their hosts. The approximately 100 described species are classified in 2 orders, the Laurida and Dendrogastrida (Grygier, 1987; Kolbasov *et al.*, 2008). The life cycle includes up to six free-swimming naupliar instars, an a-cypris larva, a juvenile, and an adult (Fig. 2). The larval stages are free living or brooded.

1.1. Morphology

Primitively the inner body proper is covered by bivalved **carapace**, but valves are often fused in females of advanced forms (Fig. 1, 2). In advanced species (Dendrogastrida), the adult females can grow into elaborate forms, with bizarre extensions from the body (Fig. 2). The carapace contains **gut diverticulum** and **gonads** (Fig. 1-2). The head with 4-6-segmented, Z-shaped prehensile **antennules**, distal segment terminates with a movable claw (Fig. 3). Developed compound eyes are absent in adults, but their rudiments are combined with frontal filaments into sensory organs, better developed in males. **Labrum** sheathes piercing mouthparts and forms conical **oral cone** (Fig. 3). Mouthparts are equipped with spines, teeth and setae and consist of paired **mandibles**, **maxillules** and **maxillae** and unpaired paragnath or **medial languette** (Fig. 3). Primitive forms have 6 **thoracic somites** with biramous, setose **thoracopods**, **abdomen** with 5 somites, first abdominal somite with biramous or uniramous **penis** in both sexes (vestigial in females), last segment terminates with blade-like, unsegmented **furcal rami** (Fig. 1-3). Number of trunk somites and thoracopods are often reduced in advanced forms. Female gonopores are at bases of first thoracopods. The coxae of thoracopods 2-5 in females bear **seminal receptacles**.

1.2. Natural history

The ascothoracidans are parasites of both cnidarians and echinoderms. The members of order Laurida include ecto- meso- and endoparasites of cnidarians (Scleractinia, Zoantharia, Antipatharia and Alcyonacea) and ectoparasites of crinoids (*Waginella*). Whereas species of the order Dendrogastrida are exclusively meso- and endoparasites of echinoderms (Asteroidea, Echinoidea and Ophiuroidea). The members of laurid family Synagogidae represent the most primitive ascothoracidans. They are found in antipatharians, octocorals and crinoids. Species of the most primitive genera *Synagoga* and *Sesillogoga* have a wide distribution in Atlantic, Indian and Pacific Oceans. They are ectoparasites of antipatharians

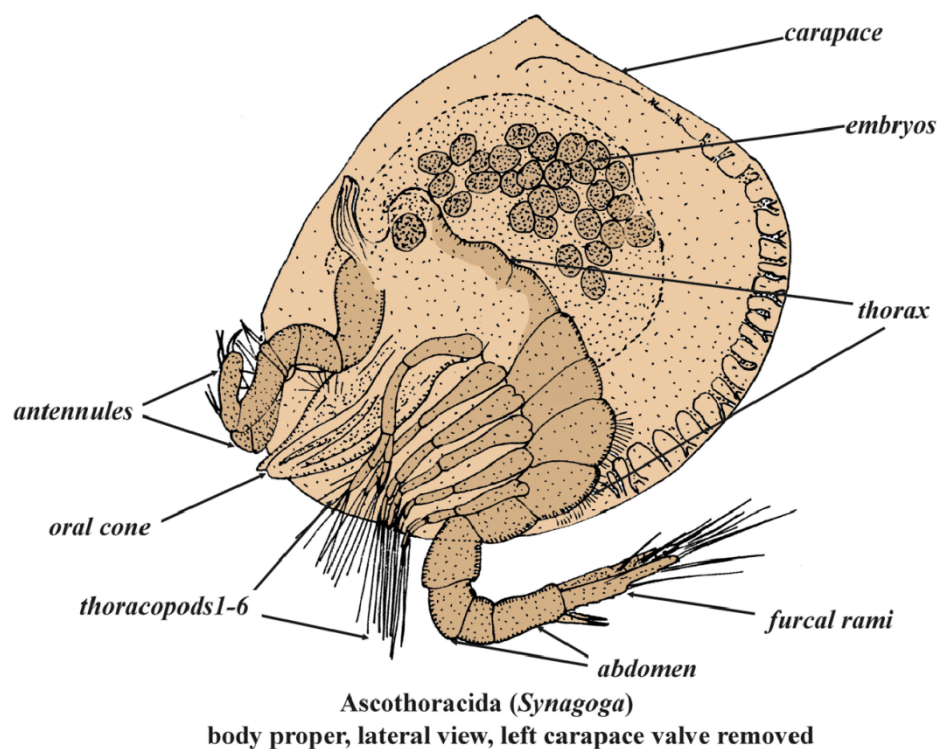
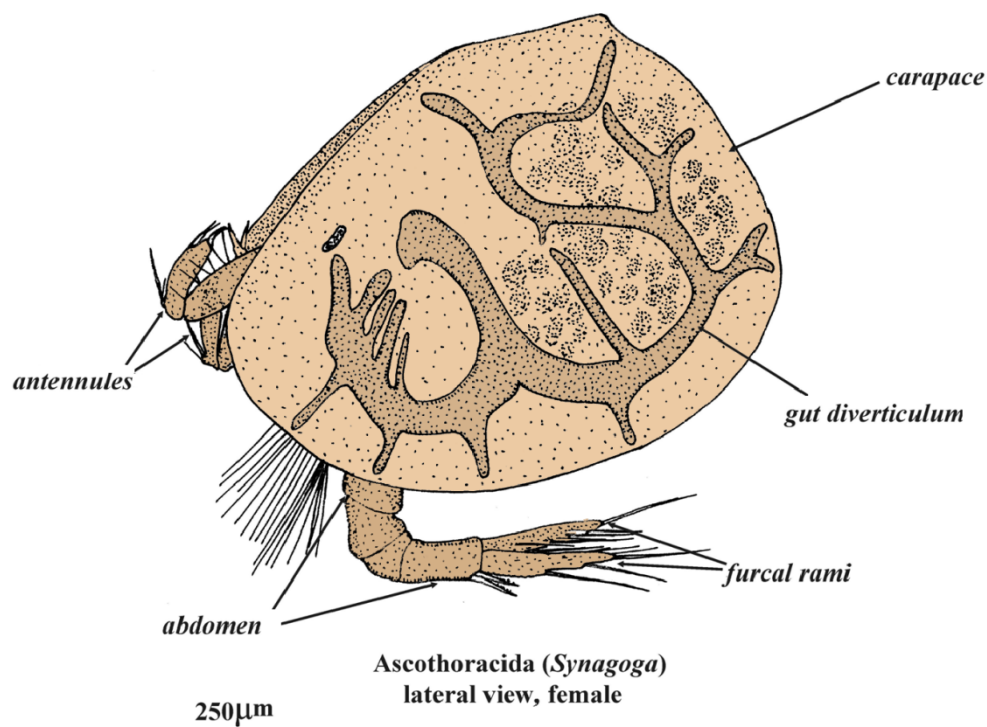


Fig. 1. Ascothoracida: *Synagoga* sp.

and alcyonarians and both sexes can move from one to another host (Grygier, 1983, 1990). Whereas other primitive genus *Waginella* has semipermanent fixation to crinoid host by cement glue (Grygier, 1995). Other synagogid genera (*Gorgonolaureus*, *Isidascus*, *Thalassomembracis* and *Cordomanica*) inhabit octocorals (former gorgonians) and host forms a permanent cyst with polyps surrounding a parasite. The family Lauridae (*Laura*, *Baccalaureus*, *Zoanthoecus* and *Polymarsypus*) includes meso- and endoparasites of zoanths (Grygier, 1987). Another laurid family Petrarciidae (*Petrarca*, *Zibrowia* and *Introcornia*) consists of endoparasites of scleractinian corals. The ascothoracids of other order Dendrogastrida are represented with bursal parasites of ophiuroids (Ascothoracidae: *Ascothorax* and *Parascothorax*), mesoparasites of starfish (Ctenosculidae: *Ctenosculum*, *Endaster*) and endoparasites of irregular urchins (Dendrogastridae: *Ulophysema*) or starfish (Dendrogastridae: *Dendrogaster*, *Bifurgaster*).

Some Ascothoracida retain the thecostracan ground pattern, with six instars of planktotrophic nauplii, but most species either release lecithotrophic nauplii or brood their offspring inside the mantle cavity until

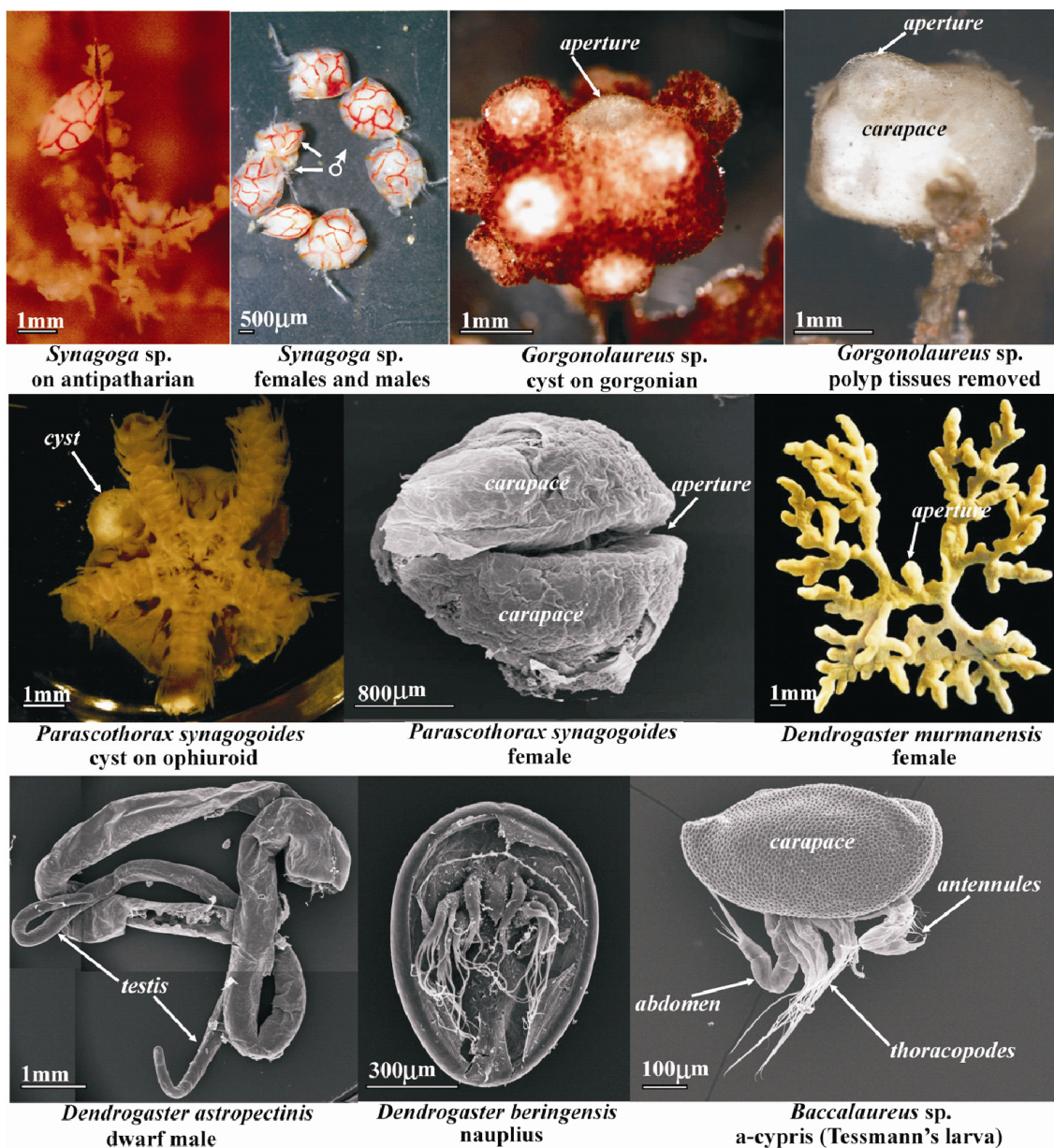


Fig. 2. Ascothoracida.

their release as a-cyprids, also called ascothoracid larvae (Itô & Grygier 1990). The a-cyprid locates and attaches to the host, using its prehensile antennules. The nauplii have an oval bowl-shaped head shield that is broader anteriorly (Fig. 2). The a-cyprid (or ascothoracid larva) has a bivalved carapace that surrounds the body (Fig. 2). The carapace surface can be almost smooth or covered by prominent polygonal cuticular ridges. The laurid a-cyprids normally have six-segmented antennules, as opposed to the four-segmented antennules in dendrogastrid a-cyprids. Most species of the Dendrogastrida brood their larvae inside the female's mantle cavity until the cypridoid stage, which consists of two a-cypris instars (Brattström, 1948; Wagin, 1976; Kolbasov *et al.*, 2008). The first a-cypris instar is normally retained within the mantle cavity, while the second instar has the definitive morphology for host location and attachment and is released into the plankton. Settlement and metamorphosis of the a-cyprid have never been observed, so a full life cycle is not known for any species.

Three of four ascothoracid species known for the Iberia and Macronesia are endemics found from a single location. These are *Synagoga bisetosa* Grygier 1990 found from depth about 2000 m outside the Strait of Gibraltar, host is unknown; *Zoanthoeus scrobisaccus* Grygier 1990 found near Azores (38°23'45"N, 28°31'15"W, 927 m) in zoanthid *Epizoanthus fatuus* and *Petrarca azorica* Grygier 1985 described off Azores (37°26'N, 25°52'W, 835-1000 m) in scleractinian *Enallopsammia rostrata*. A new undescribed species of *Synagoga* sp. (Kolbasov and Newman, in prep.) has been found in both Madeira and Cape Verde Islands on antipatharian *Antipathella wollastoni*. Two other ascothoracid species have been found in adjacent waters. These are *Isidascus bassindalei* Moyse 1983 found in Bay of Biscay (47°31'04"N, 8°43'06"W, 2000 m), on alcyonacean *Acanella arbuscula* and *Ascothorax pilocaudatus* Grygier 1983 found in two locations close to both Iberian Peninsula and Azores (42°55.4'N, 14°07.9'W, 5260 m and 30°06.7'N, 28°27.0'W 324-323m, in brittle star *Ophiosphalma armigerum*.

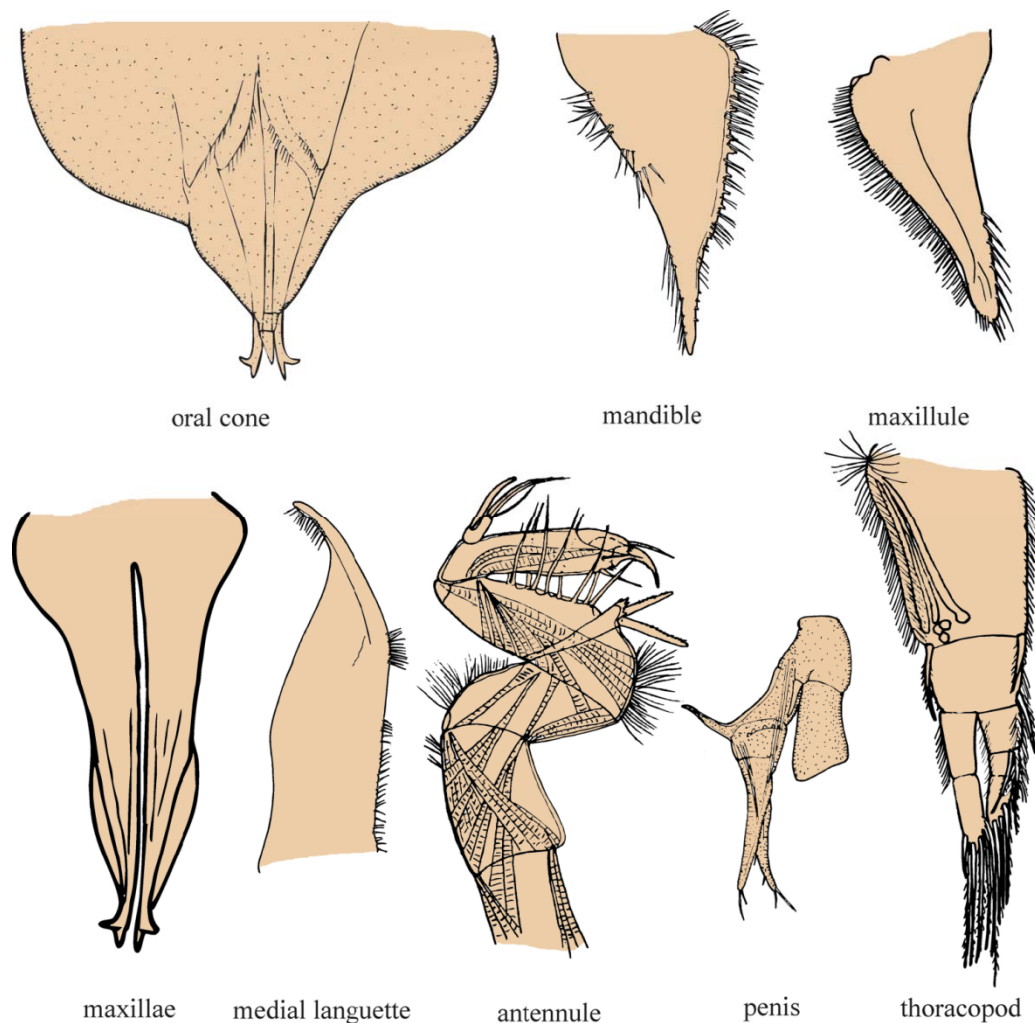


Fig. 3. Ascothoracida.

1.3. Distribution

The Ascothoracida are cosmopolitans and were found almost in all seas, from the tropical regions to high latitudes (Wagin, 1976; Grygier, 1991). Although some species were found from shallow waters, a number of the ascothoracidans described from bathyal and even abyssal depths (*Ascothorax pilocaudatus*, *Petrarca bathyactidis*, *Waginella sandersi*) (Newman, 1974; Grygier, 1983). Four of more than 100 known species of the Ascothoracida inhabit Ibero-Macronesian area and are known from one or two locations. Also two ascothoracidan species from adjacent waters (*Isidascus bassindalei* and *Ascothorax pilocaudatus*) may be found in studied Ibero-Macronesian area.

1.4. General or applied interest

The Ascothoracida are the most primitive thecostracans having a great value in reconstruction of phylogeny and evolution of the class Thecostraca and as well as whole Crustacea. They also represent a good model for evolution of parasite-host interactions and adaptations to parasitism in invertebrates.

1.5. Main diagnostic characters

The main diagnostic characters concern female morphology and include carapace structure, segmentation and morphology of antennules, trunk somites and thoracopods. Synagogidae is characterized with bivalved or dorsally fused carapace in females, 6-segmented antennules with developed processes on sixth segment and developed biramous thoracopods. Lauridae is characterized with univalved, enlarged carapace in females, reduced antennules and 4-6 pairs of uniramous thoracopods in females. Petrarciidae possesses carapace with two thick valves covered by spines, 5-segmented antennules and uniramous thoracopods where first pair is reduced or absent. Ascothoracidae has spherical carapace with partially fused valves in females, 5-segmented antennules and short, leaf-like thoracopods. Ctenosculidae is characterized with ovoid carapace, reduced antennules and leaf-like thoracopods. Dendrogastridae is characterized with reduction of trunk somites and has large, soft and branched carapace (mantle) in females, 4-segmented antennules, short and uniramous thoracopods that may be absent in some forms.

2. Systematics of the group

The systematics of the Ascothoracida has been thoroughly studied by Wagin (1976) and Grygier (1983, 1984, 1987, 1991). Ascothoracida includes two orders the Laurida with families Synagogidae, Lauridae and Petrarciidae and the Dendrogastrida with families Ascothoracidae, Ctenosculidae and Dendrogastridae. Synagogidae includes 26 species assigned into 8 genera (*Cardomanica*, *Flatsia*, *Gorgonolaureus*, *Isidascus*, *Sesillologa*, *Synagoga*, *Thalassomembracis* and *Waginella*). Lauridae encompasses 18 species assigned into 4 genera (*Baccalaureus*, *Laura*, *Polymarsypus* and *Zoanthoecus*). Petrarciidae consists of two subfamilies (Introcorniinae and Petrarciidae) with 11 species and 3 genera (*Introcornia*, *Petrarca* and *Zibrowia*). Ascothoracidae includes 9 species assigned into 2 genera (*Ascothorax* and *Parascothorax*). Ctenosculidae consists of 3 species in 3 genera (*Ctenosculum*, *Endaster* and *Gongylophysema*). Dendrogastridae includes 2 subfamilies (Ulophysematinae and Dendrogastrinae) and encompasses 36 species in 3 genera (*Ulophysema*, *Bifurgaster* and *Dendrogaster*).

The ascothoracidans of Ibero-Macronesian region belong to the order Laurida, Synagogidae (*Synagoga bisetosa* and *Synagoga* sp.), Lauridae (*Zoanthoecus scrobisaccus*), Petrarciidae (*Petrarca azorica*).

3. Diversity of the group

The Ibero-Macronesian ascothoracidans compose only 4% of the World diversity.

4. Current state of the knowledge of the group

The shallow water marine communities of North-East Atlantic are well studied, but ascothoracidans mostly inhabit deep water cnidarians and echinoderms. A single monograph on the Ascothoracida concerning almost all aspects of their biology was published in Russian (Wagin, 1976). Since many data on the morphology, taxonomy, development and distribution of the Ascothoracida were published in a number of separate papers (Grygier, 1983, 1984, 1987, 1991, 1992; Itô & Grygier, 1990; Kolbasov *et al.*, 2008). Subsequently, the new species may come from the deep waters of Ibero-Macaronesian area.

5. Main available sources of information

Unfortunately a single monograph (Wagin, 1976), mentioned earlier, represents the main source of information about the Ascothoracida. Additional information on systematics, morphology, phylogeny, development and distribution can be found in numerous publications of Mark Grygier. The larval development of *Ulophysema öresundense* was studied in detail by Brattström (1948). Thorough studies of the larval development of ascothoracidans, using SEM, were published by Itô & Grygier (1990), Grygier (1992) and Kolbasov *et al.* (2008).

6. References

- BRATTSTRÖM, H. 1948. On the Larval Development of the Ascothoracid *Ulophysema öresundense* Brattström. Vol. 2, Studies on *Ulophysema öresundense*. *Undersökningar över Öresund No. 33. Kungliga Fysiografiska Sällskapets i Lund Förhandlingar, n.s.*, **59**(5). Lund, Sweden: C.W. K. Gleerup.
- GRYGIER, M. J. 1983. Revision of the *Synagoga* (Crustacea: Maxillopoda: Ascothoracida). *Journal of Natural History*, **17**: 213-239.
- GRYGIER, M.J. 1984. Ascothoracida (Crustacea: Maxillopoda) parasitic on *Chrysogorgia* (Gorgonacea) in the Pacific and western Atlantic. *Bulletin of Marine Science*, **34**(1): 141-169.
- GRYGIER, M.J. 1987. Classification of the Ascothoracida (Crustacea). *Proceedings of Biological Society, Washington*, **100**(3): 452-458.
- GRYGIER, M.J. 1990. Five new species of bathyal Atlantic Ascothoracida (Crustacea: Maxillopoda) from the Equator to 50°N latitude. *Bulletin of Marine Science*, **46**(3): 655-676.
- GRYGIER, M.J. 1991. Additions to the ascothoracidan fauna of Australia and South-east Asia (Crustacea, Maxillopoda): Synagogidae (part), Lauridae and Petrarciidae. *Records of Australian Museum*, **43**: 1-46.
- GRYGIER, M.J. 1992. Laboratory rearing of ascothoracidan nauplii (Crustacea: Maxillopoda) from plankton at Okinawa, Japan. *Publications of the Seto Marine Biological Laboratory*, **35**(4/5): 235-251.
- GRYGIER, M.J. 1995. SEM-based morphology and new host and distribution records of *Waginella* (Ascothoracida), in: Schram, F.R. *et al.* (Ed.) (1995). *New frontiers in barnacle evolution. Crustacean Issues*, **10**: 209-228.
- ITÔ, T. & M.J. GRYGIER 1990. Description and complete larval development of a new species of *Baccalaureus* (Crustacea: Ascothoracida) parasitic in a zoanthid from Tanabe Bay, Honshu, Japan. *Zoological Science*, **7**: 485-515.
- KOLBASOV, G.A., M.J. GRYGIER, J.T. HØEG & W. KLEPAL 2008. External morphology of ascothoracid-larvae of the genus *Dendrogaster* (Crustacea, Thecostraca, Ascothoracida), with remarks on the ontogeny of the lattice organs. *Zoologischer Anzeiger*, **247**: 159-183.

- NEWMAN, W.A. 1974. Two new deep-sea Cirripedia (Ascothoracica and Acrothoracica) from Atlantic. *Journal of the Marine Biological Association of the United Kingdom*, **54**: 437-456.
- WAGIN, V.L. 1976. *Ascothoracida*. Kazan, Russia: Kazan University Press, 141 pp. [in Russian].