

A CONTRIBUTION TO THE KNOWLEDGE OF THE PHYLUM SIPUNCULA IN THE MALTESE ISLANDS (CENTRAL MEDITERRANEAN)

Constantine MIFSUD¹ and José I. SAIZ SALINAS²

ABSTRACT

Specimens of the phylum Sipuncula collected through a span of eleven years from around the Maltese Islands have revealed the existence of fifteen species and subspecies. The majority of these animals are new records for the Maltese Islands.

INTRODUCTION

Sipunculans can be found in various habitats including mud, muddy sand, rocks, algae, weeds, empty mollusc shells, polychaete tubes, foraminiferan tests, barnacles and sunken wood. Earlier, sipunculans were considered close relatives of holothurians. Recently, there is general agreement that these animals are protostomes and closely related to annelids (Wollesen & Wanninger 2008). Sipunculans are known to play an important role in the bioturbation of sediments and as a food source for higher trophic levels.

Sipunculans occur in cold, temperate and tropical marine benthic habitats. They have been found in all depths from the intertidal zone to great abyssal depths in 6,800m. The phylum consists of two classes, four orders, six families, 17 genera, and 150 species worldwide.

In the Mediterranean Sea a total of 36 species are presently known (Açik, 2011; Ferrero-Vicente *et al.* 2012). Saiz Salinas (1993) listed the species living in the western Mediterranean, while Murina *et al.* (1999) published a list including 20 of these species from the eastern Mediterranean. Pancucci-Papadopoulou (undated) has cited 25 species for the Italian waters. Recently Açik (2010; 2011) also published a list of eighteen species from the southern coast of Turkey and found a new record for the Mediterranean. Ferrero-Vicente *et al.*, (2012) had also found a new record for the Mediterranean, namely *Phascolion caupo* Hendrix, 1975 from the southeastern coast of Spain.

Locally, species of the phylum are usually neglected, or at times rarely mentioned in published lists or general works treating the local marine fauna. A few odd occurrences are recorded in students' dissertations and unpublished works, mostly as "Sipunculid species". This was due mostly to the difficulty in the taxonomy, especially at species level. Micallef & Evans (1968) mentioned two species in their fauna list for the Maltese Islands, *Sipunculus nudus* (Linnaeus, 1766) and *Phascolosoma granulatum* (Leuckart, 1828). The latter species was not found in our study. *Phascolosoma granulatum*, *Aspidosiphon (Akrikos) mexicanus* (Murina, 1967) and *Aspidosiphon muelleri* Diesing, 1851 were also reported for Malta by Schembri and Jaccarini (1978), Borg *et al.* (1998) and Pancucci-Papadopoulou *et al.* (1999). However, no specific studies on the local sipunculan species have ever been published.

MATERIALS AND METHODS

During the last eleven years the first author had collected several specimen samples of these animals from material obtained through several sources. These included, dredging, trawlers and fisheries bycatch, scuba divers, snorkelling, and weed washings. The animals were temporarily preserved in alcohol (75%). Another small collection obtained during the Rv/Urania Marcos cruise (April 2007) (collected by H. Zibrowius) was also examined. This research cruise was centred round the Maltese Islands (Costantini *et al.* 2009; Taviani *et al.* 2009). In all, 15 species and subspecies are recorded herein from the Maltese Islands.

¹ 5, Triq ir-Rghajja, Rabat RBT 2486, Malta. E-Mail: kejdon@go.net.mt

² Dep. Zoology, Fac. Sciences & Technology, Univ. Basque Country, E-48080 Bilbao, P.O. Box 644, Spain.

RESULTS

- The species studied belong to two classes, three orders, five families and eight genera.
- The numbers in brackets behind each station are relevant to the station's approximate position on Map in Figure 1.
- A short comment is added on particular characteristics for each species.

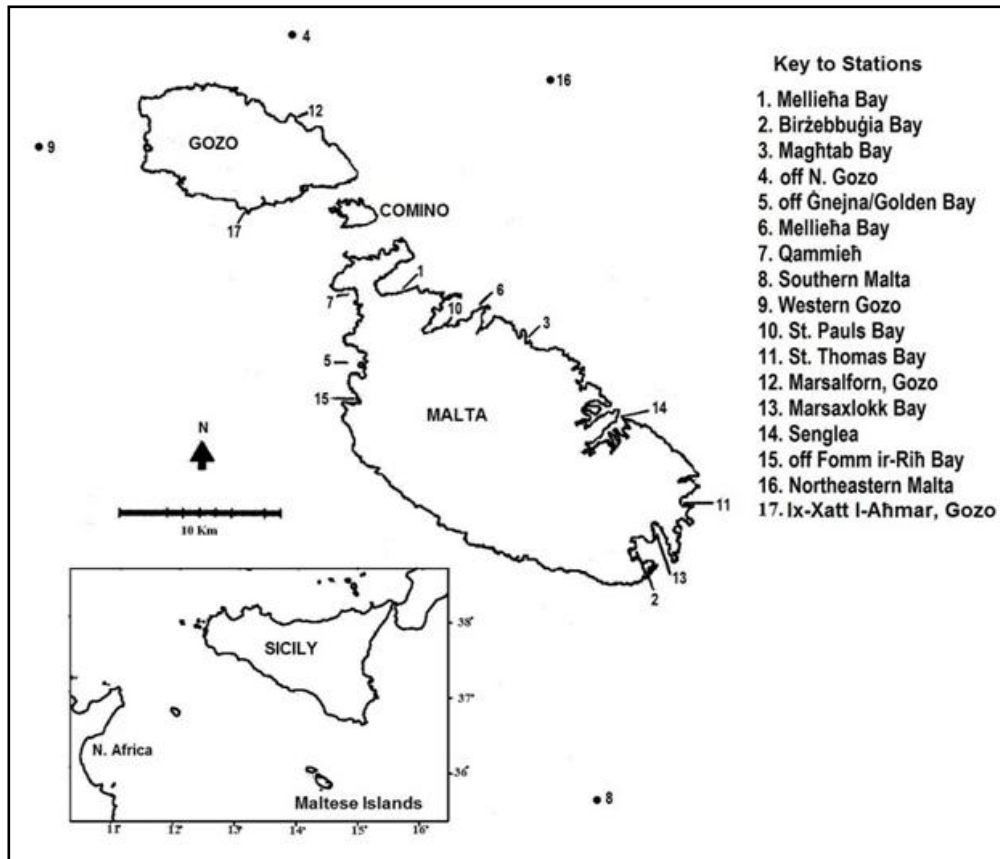


Figure 1. The Maltese Islands in the central Mediterranean Sea, with an enlarged view of the Islands, indicating approximate position of stations studied.

CLASS SIPUNCULIDEA ORDER SIPUNCULIFORMES

FAMILY SIPUNCULIDAE

Sipunculus (Sipunculus) nudus Linnaeus, 1766 [Fig. 2 A]

- Mellieħa Bay (1): beached after NE Storm, 5-xi-2001, leg. E. Cauchi. 1 specimen.
- Birzebbugħa Bay (2): beached after NE storm (force 8), 3-ii-2006. 2 specimens.
- Birzebbugħa Bay (2): beached after NE storm, iii-2007. 1 specimen.
- Magħtab Bay (3): in weed washings from shallow water, 1 juvenile specimen.

This is the largest species found all over the Mediterranean. It is well characterized by a trunk divided into squares. The species can reach 25cm in length. It is used locally as fish bait and is known as “Hanex tar-Ramel”.

FAMILY GOLFIGIIDAE

Golfingia (Golfingia) elongata (Keferstejn, 1862).

- Off Northern Gozo Island (4): found inside sunken wood from fisherman's by-catch, in 300m. 2 specimens.

The species is easily separated by the hook arrangement in rings at the foremost end of the introvert.

Golfingia (Golfingia) vulgaris (De Blainville, 1827) [Fig. 2F]

- Off Ġnejna Bay and Golden Bay (5): in 40-60m, in muddy sand and dead decaying leaves of *Posidonia*, 3 specimens.

The species shows scattered hooks at the distal end of the introvert.

Nephasoma (Nephasoma) confusum (Sluiter, 1902).

- Off Ġnejna Bay (5): found in mud in 160m, 2 specimens.
- Off Northern Gozo Island (4): attached to fossil coral block, 250m, from fisherman's bycatch, 13-vii-2009. leg. E. Cauchi, 3 specimens.

This is an uncommon species. It is well characterized by the scattered, thick, bent hooks on the introvert.

FAMILY PHASCOLINIDAE

Phascolion (Phascolion) caupo Hendrix, 1975

- Mellieħa Bay (6): in gastropod shell from muddy sand, 20 m, 1 specimen.
- Qammieħ, iċ-Ċumnija (7): dredged in 40-60m, in gastropod shell, vii-2003, 1 specimen.
- Fomm ir-Riħ Bay: in gastropod shells, 30m, x-2008, 1 specimen.

The species is quite similar to *Phascolion strombus* but characterized by broad-based, recurved hooks at the apical end of the introvert. This is the second record of this species for the whole Mediterranean Sea. The first record was published recently by Ferrero-Vicente *et al.* (2012) from the southeastern coast of Spain. The species frequently inhabits gastropod shells.

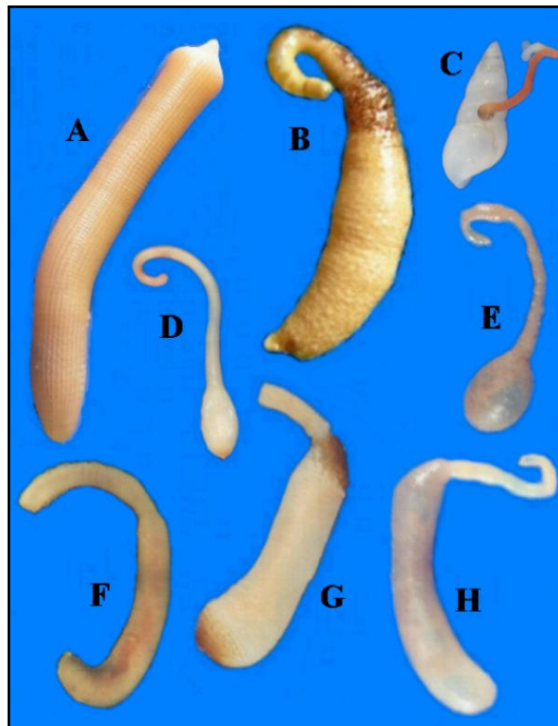


Figure 2. External morphology of a few sipunculid species; A, *Sipunculus nudus*, B, *Phascolosoma stephensoni*, C, *Aspidosiphon muelleri* (in gastropod shell), D, *Onchnesoma steenstrupii*, E, *Apionsoma murinae*, F, *Golfingia vulgaris*, G, *Aspidosiphon misakiensis*, H, *Aspidosiphon mexicanus*. (Not to scale).

Phascolion (Phascolion) strombus (Montagu, 1804)

- Off Ġnejna Bay (5): in sand from 40-60m, vii-2000, 1 specimen.
- Off Golden Bay (5): in mud and algae fragments, 140m, 1 specimen.

- Southern Malta station (8): MEDITS research cruise, St. M130 Trawl. Start: 35°57.66'N-14°14.24'E, End: 35°59.76'N-14°12.11'E, 195-201m, x-2004, leg. M. Dimech, 1 specimen.

The species exhibits sharp, claw-like hooks and horseshoe-shaped holdfast papillae over the trunk.

***Phascolion (Isomya) tuberculosum* Théel, 1875**

- Off Ġnejna Bay (5): in muddy sand in 80m, inside a gastropod shell, 1 specimen.

This seems to be an uncommon species locally. It is characterized by its stout recurved hooks and holdfast papillae, without a dark hardened border over the trunk.

***Onchnesoma steenstrupii* Koren & Danielssen, 1876 [Fig. 2D]**

- Qammieħ (7): dredged in 60-80m, in mud & dead weeds, vi-2009, 2 specimens.
- Off Ġnejna Bay (5): dredged in mud, 120m, viii-2008, 21 specimens + 2 fragments.
- Off Ġnejna Bay (5): dredged in mud from 140m, 26-vi-2005, 7 specimens.
- Southeastern Malta station (8): MEDITS 2005 research cruise, St. M28, Trawl, Start: 35°36.66'N-14°31.25'E, 421m, End: 35°39.03'N-14°33.41'E, 302m, ix-2005, leg. M. Dimech, 1 specimen.
- Western Gozo station (9): MARCOS cruise: St. 49: Epibenthic Trawl: Start: 35°52.730'N-014°56.570'E, 84m, End: 35°52.520'N-014°54.640'E, 82m, 22-iv-07, 1 specimen.

A small common species with a pyriform trunk found in mud and sand from several local stations.

**CLASS PHASCOLOSOMATIDEA
ORDER PHASCOLOSOMATIFORMES
FAMILY PHASCOLOSOMATIDAE**

***Phascolosoma (Phascolosoma) stephensoni* (Stephen, 1942) [Fig. 2B]**

- Ġnejna Bay (5): in weed washing 0.5 m, near boat slipway, 1 specimen.
- Off Ġnejna Bay (5): in mud, 80m, vii-2000, 1 specimen.
- St. Paul's Bay, "Tal-Ġħażzenin" (10): from weed washings on offshore rocks, 1 m, 11-x-2001, 14 specimens + 1 fragment.
- St. Thomas Bay (11): in weed washing from 1m, viii-1995, 1 specimen.
- Gozo Island, Marsalforn, Qbajjar Bay (12): in weed washing from 2-3m, 8-x-2005, 1 specimen.
- Marsaxlokk Bay (13): in dead oysters with mud, attached to hull of salvaged old patrol boat wreck, i-2008, 2 specimens.
- Off Ġnejna Bay (5): in by-catch material from fishermen's nets, 80m, iii-2009, 1 specimen.
- Senglea (14): in mass of Bryozoa attached to mooring ropes from shore, iii-2006, 1 specimen.

Locally, this is one of the most common species. It is found in algae and in mud mostly in shallow depths. The species was in the past probably misidentified as *Phascolosoma granulatum* (Leuckart), a species not found in our study but present in localities around the Mediterranean Sea. It is separated by the presence of a large crescent area on the concave part of the introvert hooks.

***Apionsoma (Apionsoma) misakianum* (Ikeda, 1904).**

- Off Fomm ir-Riħ Bay (15): in mud and gravel, 140m. 10-ix-2005, 1 fragment.
- Off Ġnejna Bay (5): 80-100m, muddy sand, 17-vii-2010, 1 specimen.
- Off Ġnejna Bay (5): dredged in muddy sand and weed, 60-80m, vii-2006, 1 specimen.
- Western Gozo station (9): MARCOS cruise: St.M58: Agassiz Trawl: Start: 36°02.91'N- 14°09.41'E, 184m, End: 36°01.022'N-14°10.343'E, 162m, 14/04/2007, 4 specimens.
- Western Gozo station (9): MARCOS cruise: St.M49: Epibenthic Trawl: Start: 35°52.730' N-14°56.570'E, 84m, End: 35°52.520'N-14°54.640'E, 82m, 22-Jul-07, 8 specimens + 1 fragment (introvert).

This seems to be a frequent species in various stations around our shores. Specimens were found in muddy sands in depths of 60-140 m. The species exhibits small papillae on the posterior end of the trunk.

***Apionsoma (Apionsoma) murinae* (Cutler, 1969) [Fig. 2E]**

- Southern Malta station (8): MEDITS 2005 research cruise, St. M28- Trawl, Start: 35°36'66'N-14°31'25'E, 421m, End 35°39'03'N-14°33'41'E, 302m, ix-2005, leg. M.Dimech, 1 specimen.

- Southern Malta station (8): MARCOS cruise: St.M45: Epibenthic Trawl, start: 35°30.741'N-14°06.077'E, 620m, End: 35°31.276'N-14°05.680'E, 470m, 23-Jul-07, 2 specimens.
- Western Gozo station (9): MARCOS cruise: St.M49: Epibenthic Trawl, Start: 35°52.730'N-14°56.570'E, 84m, End: 35°52.520'N-14°54.640'E, 82m. 22-Jul-07, 1 specimen.

This species is easily separated by its large mammiform papillae at the trunk end.

ORDER ASPIDOSIPHONIFORMES

FAMILY ASPIDOSIPHONIDAE

Aspidosiphon (Akrikos) mexicanus (Murina, 1967) [Fig. 2H]

- Northeastern Malta station (16): MEDITS research cruise, St. M38, grab, 36°26.320'N- 015°05.030'E, 84m, 21-vii-2007. leg. M. Dimech, 1 fragment (introvert).
- Northeastern Malta station (16): MEDITS research cruise, St. M36- Trawl- Start: 36°09.49'N-15°15.63'E, 139m, - End: 36°10.59'N-15°16.98'E, 146m, 2005, leg. M. Dimech, 2 specimens.
- Western Gozo station (9): MARCOS Cruise, St.M55: Epibenthic Trawl, Start: 35°59.740'N-014°42.680'E, 124m, End: 36°01.110'N-014°43.420'E, 126m, 14-Jul-2007, 1 specimen.
- Off Fomm ir-Riĥ Bay (15): in gastropod shells, 30m, x-2008, 1 juvenile.

This species is more frequently present in circalittoral muds. It possesses scattered hooks and poorly developed shields. The species was recorded earlier for these Islands by Pancucci-Papadopoulou *et al.* (1999) and Murina *et al.* (1999).

Aspidosiphon (Aspidosiphon) misakiensis Ikeda, 1904 [Fig. 2 G]

- Gozo Island, ix-Xatt l-Aħmar (17): in gastropod shells, 60-80m, ii-2009, 2 specimens.
- Off Ġnejna Bay (5): in muddy sand, 60-80m, v-2000, 3 specimens.
- Off Fomm ir-Riĥ Bay (15): in gastropod shells, 50m, x-2008, 1 specimen.
- Off Ġnejna Bay (5): 80-100m, muddy sand, 17-vii-2010, 1 specimen.
- Off Golden Bay (5): 40-50m, in sand and weeds, iii-2006, 1 specimen.

This species is usually found in muddy sands in 40-120m. It is characterized by the anal shield, in possessing closely packed, irregular-shaped areas with only a few, or no furrows.

Aspidosiphon (Aspidosiphon) muelleri muelleri Diesing, 1851 [Fig. 2C]

- Off Ġnejna Bay (5): in muddy sand, 60m, v-2000, 1 specimen.
- Off Golden Bay (5): 40-50m, in sand and weeds, iii-2006, 6 specimens.
- Off Ġnejna Bay (5): in muddy sand, 40-60m, vi-2007, 1 specimen.
- Off northern Gozo station (4): in a *Trophon echinatus* shell in 250 m, 1 specimen.

An infrequent species characterized by an anal shield with a dorsal zone of longitudinal furrows and a middle zone of large polygons. The species was recorded earlier by Schembri and Jaccarini (1978) and Borg *et al.* (1998).

Aspidosiphon (Aspidosiphon) muelleri kovalevskii Murina, 1964.

- Off Golden Bay (5): 40-50m, in sand and weeds, iii-2006, 1 specimen.

This seems to be another rare species locally. It is separated from the nominal subspecies by the sharp, large spines at the ventral end of the anal shield.

DISCUSSION AND CONCLUSIONS

In the past these sipunculan animals were neglected in published literature treating the local marine fauna. This short work presents at least a data compilation to instil further research on these important animals. The number of species and sub-species, fifteen, for these Islands, at the centre of the Mediterranean, although significant, may not indicate the complete situation. This is due to the low number of stations examined (17) and therefore, further work will surely add to the present number of species. Most of the local species have a wide distribution or are even cosmopolitan. The author's collection will be deposited at the Museum of Natural History, Mdina, Malta).

ACKNOWLEDGEMENTS

The authors would like to thank M. Taviani (CNR-ISMAR, Bologna, Italy) and H. Zibrowius (Station Marine d'Endoume) for the specimens collected during the MARCOS Research cruise. M. Dimech (FAO EastMed Project Technical Officer, FIRF) for specimens examined from the cited research cruises. E. Cauchi (Mellieħa) for material obtained from fisheries by-catch and several other colleagues who contributed to the collection of these animals. P. Sammut and an unknown reviewer are also thanked for their comments and corrections to the manuscript.

REFERENCES

- Açık, S.** 2010. Sipunculan Fauna in the Fethiye-Göcek Specially Protected Area (Turkey, Eastern Mediterranean). *Mediterranean Marine Science*, 11(1): 105-116.
- Açık, S.** 2011. Sipuncula from the southern coast of Turkey (eastern Mediterranean), with a new report for the Mediterranean Sea. *Cahiers de Biologie Marine*, 52: 313-329.
- Borg, J. A., Howege, H. M., Lanfranco, E., Micallef, S. A., Mifsud, C. & Schembri, P. J.** 1998. The Macrobenthic species of the infralittoral to circalittoral transition zone off the Northeastern coast of Malta (Central Mediterranean). *Xjenza*, 3(1): 16-24.
- Costantini, F., Taviani, M., Remia, A., Pintus, E., Schembri, P. J. & Abbiati, M.** 2009. Deep-water *Corallium rubrum* (L., 1758) from the Mediterranean Sea: Preliminary genetic characterization. *Marine Ecology*, 1–9. Blackwell Verlag GmbH.
- Ferrero-Vicente, L. M., Loya-Fernández, A., Marco-Méndez, C., Martínez-García, E. Saiz Salinas, J. I. & Sanchez-Lizaso, J. L.** 2012. First record of the sipunculan worm *Phascolion (Phascolion) caupo* Hendrix, 1975 in the Mediterranean Sea. *Mediterranean Marine Science*, 13 (1): 89-92.
- Kristof, A., Wollesen, T. & Wanninger, A.** 2008. Segmental Mode of Neural Patterning in Sipuncula. *Current Biology*, 18: 1129–1132.
- Micallef, H. & Evans, F.** 1968. *The Marine Fauna of Malta*. Malta University Press, vi+26pp. Malta.
- Murina, G. V. V., Pancucci-Papadopoulou, M. A. & Zenetos, A.** 1999. The phylum Sipuncula in the eastern Mediterranean: composition, ecology, zoogeography. *Journal of the Marine Biological Association of the United Kingdom*, 79: 821-830.
- Pancucci-Papadopoulou, M. A.** (undated). *Societa' Italiana di Biologia Marina*. <http://www.sibm.it/CHECKLIST/principalechecklistfauna.htm>.
- Pancucci-Papadopoulou, M. A., Murina, G. V. V. & Zenetos, A.** 1999. *Monographs of marine science-2. The Phylum Sipuncula in the Mediterranean Sea*. National Centre for Marine Research, pp. 109. Athens.
- Saiz Salinas J. I.** 1993. *Sipuncula*. [In] *Fauna Iberica*, vol. 4, Ramos, M. A. *et al.* (eds.). Museo Nacional de Ciencias Naturales. CSIC. Madrid. Pp.200.
- Schembri, P.J. & Jaccarini, V.** (1978) Some aspects of the ecology of the echiuran worm *Bonellia viridis* and associated infauna. *Marine Biology*, 47: 55-61.
- Taviani, M., Dimech, M., Mifsud, C., Freiwald, A., Harasewych, M. G. & Oliverio, M.** 2009. Coralliophilinidae (Gastropoda: Muricidae) associated with deep-water coral banks in the Mediterranean. *The Nautilus*, 123(3): 106-112.
-