

The Scyphomedusae of the Mediterranean coast of Israel, including two Lessepsian migrants new to the Mediterranean

B. S. Galil, E. Spanier & W. W. Ferguson

Galil, B.S., E. Spanier & W.W. Ferguson: The Scyphomedusae of the Mediterranean coast of Israel, including two Lessepsian migrants new to the Mediterranean.

Zool. Med. Leiden 64 (7), 15.xi.1990: 95-105, figs. 1-10.— ISSN 0024-0672.

Key words: Scyphomedusae; Mediterranean; Lessepsian migrants.

Seven species of Scyphomedusae are reported from the Mediterranean coast of Israel. Two of these, *Rhopilema nomadica* spec. nov. and *Phyllorhiza punctata* von Lendenfeld, 1884, are Lessepsian migrants new to the Mediterranean.

B.S. Galil, Center for Nature Conservation Research, George S. Wise Faculty of Life Sciences, Tel Aviv University, Tel Aviv 69978, Israel.

E. Spanier, Center for Maritime Studies and Department of Maritime Civilizations, University of Haifa, Haifa 31999, Israel.

W.W. Ferguson, Department of Zoology, George S. Wise Faculty of Life Sciences, Tel Aviv University, Tel Aviv 69978, Israel.

Introduction

The last decade saw the mass appearance of a previously unknown species of Scyphomedusae off the Mediterranean coast of Israel. The abundance of this medusa and the severity of its sting prompted efforts to identify and study the local scyphomedusan fauna. The Scyphomedusae of the Mediterranean are well known and have been the subject of some of the earliest marine research, but studies of the Levant basin fauna are scarce. The first record of Scyphomedusae from the Israeli coast is by Bodenheimer (1935: 473), who wrote: "During the winter large jellyfish of the species *Rhizostoma pulmo* and *Aurelia aurita* are washed on to the beach, where they may be found, after storms." Later works were concerned mainly with the injuries they can inflict (Lewinsohn, 1977; Spanier, 1987). Fishelson (1983: 107) mentioned *Pelagia noctiluca* (Forskål, 1775) and *Cotylorhiza tuberculata* (Macri, 1778), and Spanier (1989: 55) reported the first record of *Cassiopea andromeda* (Forskål, 1775), a Lessepsian migrant from the Red Sea. Studies of the adjacent waters have added but little; Dowidar (1983: 14) mentions that *Pelagia noctiluca* and *Aurelia aurita* (Linnaeus, 1758) are washed on to the beach, where they may be found, off the Egyptian coast. From Lebanese waters there are records of *Rhizostoma pulmo* (Macri, 1778), *Cotylorhiza tuberculata* and *Cassiopea andromeda* (Lakkis, 1971: 141; Lakkis, 1974: 117; Lakkis & Kouyoumjian, 1974: 107; Lakkis & Zeidane, 1985: 179-80; Goy et al., 1988: 299).

The accumulated observations presented here record the presence of seven species of Scyphomedusae off the Mediterranean coast of Israel. A key and colour illustrations are provided to facilitate their identification. Of the three Lessepsian migrant medusae, one, *Rhopilema nomadica*, is a new species; another, *Phyllorhiza punctata* von Lendenfeld, 1884, was known previously only from Australia, the Philippines and Japan.

Notes on the species

SEMAEOSTOMEAE

Pelagiidae Gegenbaur, 1856

Pelagia Peron & Lesueur, 1809

Pelagia noctiluca (Forskål, 1775)

(fig. 1)

Pelagia noctiluca; Dowidar, 1983: 14; Fishelson, 1983: 107; Goy et al., 1988: 299.

Material.— Israel, Beit Yanai, 12.xii.1970; 20.iii.1972, many specimens; xii.1976, many specimens; 20-27.i.1984, many specimens.

Distribution.— Cosmopolitan, in tropical and subtropical seas; rare along the Mediterranean coast of Israel.

Ulmaridae Haeckel, 1880

Aureliinae L. Agassiz, 1862

Aurelia Peron & Lesueur, 1809

Aurelia aurita (Linnaeus, 1758)

(fig. 2)

Aurelia aurita; Bodenheimer, 1935: 473, pl. 70 fig. 2; Fishelson, 1983: 107, pl.; Dowidar, 1983: 14; Goy et al., 1988: 299.

Aurelia auria; Lewinsohn, 1977: 185 (mis-spelling).

Material.— Israel, Beit Yanai, 19.xii.1972, 1 specimen; xii.1983, 1 specimen; 28.i.1984, few specimens.

Distribution.— Cosmopolitan. Rare along the Mediterranean coast of Israel.

RHIZOSTOMEAE

Cassiopeidae L. Agassiz, 1862

Cassiopea Peron & Lesueur, 1809

Cassiopea andromeda (Forskål, 1775)

(fig. 3)

Cassiopea andromeda; Maas, 1903: 42, 44, 46; Stiasny, 1938: 5, 13, 18; Goy et al., 1988: 299; Spanier, 1989: 55. *Cassiopeia andromeda*; Schäfer, 1955: 241, figs. 2-5 (mis-spelling).

Material.— Israel, Neve Yam, 7.vii.1988, near shore; Suez Canal, Great Bitter Lake, 17.x.1924, Cambridge Expedition (BM.1941.3.20.494, 499); Toussoum, 29.xi.1924, Cambridge Expedition (BM.1941.3.20.500).

Distribution.— Suez Canal, Red Sea, Indo-Pacific Ocean, eastern Mediterranean including the coast of Israel.

Figs 1-7. Survey of the Scyphomedusae of the Mediterranean coast of Israel: fig. 1. *Pelagia noctiluca* (Forskål); fig. 2. *Aurelia aurita* (Linnaeus); fig. 3. *Cassiopea andromeda* (Forskål); fig. 4. *Cotylorhiza tuberculata* (Macri); fig. 5. *Phyllorhiza punctata* von Lendenfeld; fig. 6. *Rhizostoma pulmo* (Macri); fig. 7. *Rhopilema nomadica* spec. nov. Drawings by W.W. Ferguson (not to scale).



Comments.— *Cassiopea andromeda* is the first known Lessepsian Scyphomedusa. In 1886 Keller (1888:389) already saw large numbers of this medusa that had wandered from the Red Sea into the Suez Canal, inhabiting the canal itself and the adjoining lagoons near Toussoum, south of Lake Timsah. A year later the species was recorded from Lake Timsah by Krukenberg (1888: 55). Browne's (1926: 114) specimens, preserved in The Natural History Museum (former British Museum (Natural History)), were collected in Toussoum and the Great Bitter Lake. Fox (1929: 849) reported the species to be abundant in Kabret and in Lake Timsah lagoons. Another specimen from the Great Bitter Lake, collected by Gruvel in 1932, was mentioned by Stiasny (1938: 13).

The first record of *C. andromeda* in the Mediterranean was obtained from Cyprus, by Maas (1903: 42) who wrote: "wie ich bei Exemplaren von Cypren (*C. andromeda*) selbst im Leben beobachten konnte." and "Ich habe an den Riffen der Kuste von Cypren *Cassiopea andromeda* selbst gesammelt". The half century that passed between Maas' report and the next record of *C. andromeda* from the Mediterranean might excuse Schäfer's (1955: 243) statement that the species "bisher aus dem Mittelmeer unbekannt war". Schäfer reported the occurrence of very young specimens (2-30 mm) on Neokameni, a small volcanic island near Thira, in the southern Aegean Sea, where the medusae flourished in rocky pools with water temperatures reaching up to 36° C due to volcanic activity. Schäfer concluded his interesting account by stating: "Sicherlich aber sind sie im Mittelmeer seltene und doch neue Gäste, denn noch keine 100 Jahre besteht zwischen Indischen Ozean und Mittelmeer durch den Suezkanal eine dauernde und breite Verbindung, die sie für ihre Ausbreitung im Mittelmeer haben benutzen können".

Recently *C. andromeda* was reported from Lebanon (Goy et al., 1988: 299) and Israel (Spanier, 1989: 55).

Cepheidae L. Agassiz, 1862
Cotylorhiza L. Agassiz, 1862
Cotylorhiza tuberculata (Macri, 1778)
 (fig. 4)

Cotylorhiza tuberculata; Fishelson, 1983: 107; Lakkis & Zeidane, 1985: 179; Goy et al., 1988: 299.

Material.— Israel, Beit Yanai, 15.vii.1967, 1 specimen (TAU NS20672); 22.ix.1967, 1 specimen; 14.i.1969, 1 specimen; 2.vii.1976, many specimens; 10.i.1979, few specimens. Off Tel Aviv, 25.vii.1974, many specimens.

Distribution.— Mediterranean; uncommon along the coast of Israel, but in July 1974 a large shoal, extending several kms, was sighted.

Mastigiadidae Stiasny, 1924
Phyllorhiza L. Agassiz, 1862
Phyllorhiza punctata von Lendenfeld, 1884
 (fig. 5)

Phyllorhiza punctata von Lendenfeld, 1884: 296, 307, pl. 4 fig. 1, pl.5, figs. 1-4.

Material.— Israel, Beit Yanai, 1965, 1 specimen(TAU). Australia, N.S. Wales, Port Jackson, 16.i.1923, 3 specimens, det. G. Stiasny (RMNH 6991); 17.i.1923, 7 specimens (RMNH 6988, 6989).

Distribution.— Australia, Philippines, Japan; the above material from Israel constitutes the first and only record from the Mediterranean.

Rhizostomatidae Eschscholtz, 1829

Rhizostoma Cuvier, 1800

Rhizostoma pulmo (Macri, 1778)

(fig. 6)

Rhizostoma pulmo; Bodenheimer, 1935: 473, pl. 70 fig. 1; Lewinsohn, 1977: 184, fig. 2; Fishelson, 1983: 106; Lakkis, 1971: 141; Lakkis, 1974: 117; Lakkis & Kouyoumjian, 1974: 107; Lakkis & Zeidane, 1985:180; Goy et al., 1988: 299; Spanier, 1989: 55.

Material.— Israel, Beit Yanai, iv.1965, many specimens; v.1971, many specimens.

Distribution.— Mediterranean, Atlantic Ocean. Very common, although irregular along the coast of Israel; rare in winter.

Rhopilema Haeckel, 1880

Rhopilema nomadica spec. nov.

(figs. 7-10)

Rhopilema hispidum; Stiasny, 1938: 31; 1939: 20, figs. 5-8.

Material.— Holotype: Red Sea, Kamaran, iii.1939, J.H. Ziesel, 1 specimen, bell diameter 340 mm (RMNH 7038). Paratypes: Red Sea, Kamaran, 1937, J.H. Ziesel, 8 specimens, (RMNH 7036); iii.1939, J.H. Ziesel, 2 juvenile specimens (RMNH 7037); 1 specimen (damaged) (RMNH 7043); 6 specimens (RMNH 7039). Israel, Dor, 30.ix.1976, Ch. Lewinsohn, 1 specimen (TAU 20665). 1 km West of Ashdod, 12.x.1989, Oren & Elat, 1 specimen (RMNH 17923); id., 17.viii.1989, abundant, largest diameter 350 mm; 12.ix.1989, abundant, largest diameter 350 mm; 18.ix.1989, abundant (TAU 26156); 4.x.1989, many; 12.x.1989, many, largest diameter 250 mm. Israel, Haifa, port, 26.vii.1989, 8 specimens, together with juvenile *Alepes djedaba* (TAU 26153). Off Haifa Bay, 12.vii.1989, depth 20 m, diameter 120-240 mm; 23.vii.1989, 13 m, diameter 200 mm; 27.vii.1989, abundant; 28.vii.1989, abundant; 14.viii.1989, abundant; 31.viii.1989, many specimens, largest diameter 250mm; 7.ix.1989, abundant; 13.ix.1989, abundant. 2.i.1990, abundant, diameter 200-350 mm (TAU 26154). 18 kms West of Haifa, 2.viii.1989, abundant. 8 kms West of Haifa, 3.ix.1989, abundant. 5 kms West of Haifa, 10-14.ix.1989, abundant, 2-3 specimens per m², diameter 200-250 mm; 17-22.ix.1989, abundant, 2-3 specimens per m², diameter 200-250 mm; 2 kms West of Haifa, 25-26.ix.1989, 3 specimens per m², diameter 200-300 mm; 29.x.- 1.xi.1989, 1 specimen per 5 m², diameter 200 mm. Atlit, 30.i.1990, abundant, largest diameter 600 mm (TAU 26155). Hahotrim, 5.vii.1988, 1 specimen, together with a juvenile *Alepes djedaba*; Gaash, 15.viii.1989, abundant, largest diameter 350 mm. Beit Yanai, 14.vii.1979, 1 specimen; 26.vii.1983, 8 specimens per km.; vi.1986, many specimens; 1.i.1989, 1 specimen; 1.iii.1989, 1 specimen; 6-8.ix.1989, many specimens.

Description.— Umbrella nearly hemispherical, thickest centrally, thinning gradually towards margin. Exumbrella minutely granulate, granules fewer and blunter near margin. Margin of umbrella divided into sixty-four rounded velar lappets.

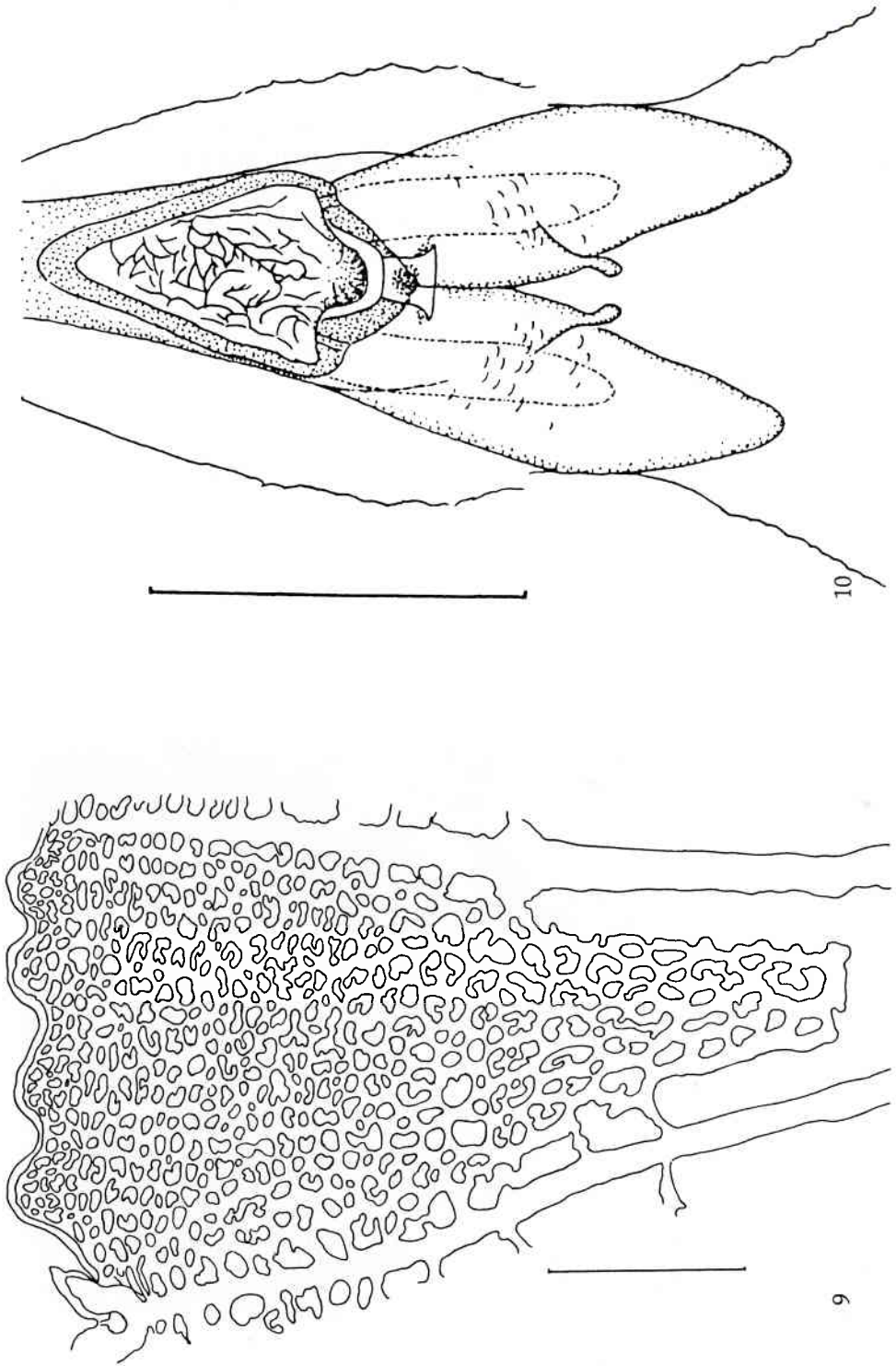
Ocular lappets small, lanceolate, one third as wide as vellar lappets. Subumbrellar circular muscles well developed, uniform. Arm disc prismatic, about one third of bell diameter, oral pillars quadrate. Distal corners of oral pillars prominently tuberculate. Subgenital ostium at each interradius kidney-shaped, as wide as oral pillar. A pear-shaped, tuberculate papilla interradially on subumbrella, opposite ostial opening. Eight pairs of large, deeply bowed scapulets arise from adradial sides of arm disc; underside concave, smooth; upper side bearing frilled mouths and numerous filaments. Distal part of scapulets bearing long filaments, sometimes twice as long as scapulets. Each scapulet is divided, midlength, into two, with five appendages on each side.

Eight adradial mouth arms stout, smooth, fused to midlength. Lower part of mouth arm divided into two triangular flaps, each flap distally tripartite and terminating in claw-like digitate processes. Ventrally, mouth arms bear numerous frilled mouths and long filaments. Lowermost end bearing a vermicular appendage terminating in a thin filament. Stomach cavity nearly octagonal. Gastrovascular system consisting of four perradial, four interradiial and eight adradial canals interconnecting in a complex network of anastomosing vessels extending almost to bell margin. Four principal canals extend from lower part of stomach to radii entering each scapulet and mouth arm, then branching to numerous minute canals leading to mouths.

Colour in life icy blue.



Fig. 8. An injury caused by *Rhopilema nomadica* spec. nov.; Haifa, ix.1989. Photo by E. Spanier.



Figs. 9, 10, *Rhiopilema nomadica* spec. nov.; 9, section of gastro-vascular system (scale-line = 5 cm); 10, rhopalium (scale-line = 1 mm).

Distribution.— Red Sea, south-eastern Mediterranean. The species appeared off the Israeli Mediterranean coast in the mid-seventies. It has become fairly common in the past decade, appearing in ever larger numbers each year.

Comments.— Lewinsohn (1977: 184) remarked on the appearance of an unidentified blue medusa whose stings can result in severe, burning-like injuries requiring medical treatment (fig. 8). Stiasny's reports of *R. hispidum* (Vanhöffen, 1888) from the Red Sea (Stiasny, 1938: 31; 1939: 20) prompted comparison with that species. The blunt tuberculation of the exumbrella and the mouth arms ending in vermicular filaments of *R. nomadica* as compared with the sharply conical warts and "swollen-club" appendages of *R. hispidum* help to distinguish clearly between the two medusae. Stiasny's description (1939: 20-23) of *R. hispidum*, however, suggested characters of *R. nomadica*: "Totalansicht der Mundarme mit sehr zahlreichen Peitschenfilamenten ohne runde Endkolben" (p. 22, caption fig. 7) and "An Stelle des Endkolbens findet sich ein einziges langes, oder sehr viele lange Peitschenfilamente" (p. 22). On examination, all of Stiasny's specimens from the Red sea, preserved in the Nationaal Natuurhistorisch Museum (formerly Rijksmuseum van Natuurlijke Historie), Leiden, proved to be identical with our Mediterranean material, and one of these specimens (RMNH 7058) was chosen as the holotype of *Rhopilema nomadica*.

It is of interest that the juveniles of *Alepes djedaba* (Forskål, 1775), a Lessepsian migrant carangid fish, are commonly found in association with *R. nomadica*, taking shelter under its umbrella and among the filamentous mouth arms. Panikkar & Prasad (1952: 295) reported finding young *Caranx kalla* (Cuvier & Valenciennes, 1833) sheltering with *Rhopilema hispidum*: "The medusae were always found to be followed by a group of young fish, which when disturbed take shelter underneath the bell". In another report Bapat & Prasad (1952: 111) wrote: "427 specimens of *Caranx kalla* varying from 8.25-55 mm in length were moving in small schools around the large medusae belonging to the species *Rhopilema hispidum* Maas".

Key to the Scyphomedusae of the Mediterranean coast of Israel (figs. 1-7)

1. Tentacles arise from umbrellar margin; single central mouth opening..... 2
- No marginal tentacles; numerous mouths on mouth arms, no central mouth opening..... 3
2. Eight tentacles, as long as mouth arms, arise from umbrellar margin; sixteen marginal lappets..... *Pelagia noctiluca*
- Numerous short marginal tentacles; eight marginal lappets *Aurelia aurita*
3. Network of anastomosing canals connecting with gastric cavity through and between radial canals; no scapulets; subgenital ostia without papillae..... 4
- Network of anastomosing canals connecting with gastric cavity solely through radial canals; bearing eight pairs of scapulets on mouth arms; subgenital ostia with papillae..... 6
4. Mouth arms bifurcate, exumbrellar dome surrounded by gutter-like ring *Cotylorhiza tuberculata*

- Mouth arms complexly branched, exumbrella shaped otherwise 5
- 5. Exumbrella dome-shaped, granular; mouth arms with large openings in lateral membranes..... *Phyllorhiza punctata*
- Exumbrella smooth, saucer-shaped; mouth arms entire..... *Cassiopea andromeda*
- 6. Small scapulets; mouth arms bearing a single club-like terminal appendage, not filamentous; canal network forming few, large meshes *Rhizostoma pulmo*
- Large scapulets; mouth arms bearing numerous long filaments; canal network forming fine meshes..... *Rhopilema nomadica* spec. nov.

Acknowledgements

Our sincere thanks are due to Dr R. J. Larson for his interest and advice, to H. Bernhard, B. Eilat, G. Brokman, Y. Hanin, Y. Mor, U. Oren, I. Pengas and Y. Tur-Kaspa for their assistance in collecting, and to P. Clark, Natural History Museum (British Museum (Natural History) (BM)), J.C. den Hartog, Nationaal Natuurhistorisch Museum (Rijksmuseum van Natuurlijke Historie (RMNH)) for making their collections available for study. This study was partially supported by MEDPOL grant no. ISR/24-I. TAU stands for the collection of the Tel Aviv University.

References

- Bapat, S. V. & R. R. Prasad, 1952. On some developmental stages of *Caranx kalla* Cuv. & Val.— J. Bombay nat. Hist. Soc., 51: 111-115, 1 pl., 4 figs.
- Bodenheimer, F.S., 1935. Animal life in Palestine, an introduction to the problems of animal ecology and zoogeography: 1-506.— L. Mayer, Jerusalem.
- Browne, E.T., 1926. Report on the medusae. Zoological results of the Cambridge Expedition to the Suez Canal, 1924.— Trans. zool. Soc. Lond., 22: 105-115.
- Dowidar, N.M., 1983. Medusae of the Egyptian Mediterranean waters.— Workshop on Jellyfish Blooms in the Mediterranean. Athens, 1983: 9-16.
- Fishelson, L., 1983. Aquatic life. In: A. Alon (ed.) Plants and animals of the land of Israel — an illustrated encyclopedia: 1-324.— Israel Ministry of Defence. Tel Aviv. (In Hebrew).
- Fox, H.M., 1929. Summary of results. Zoological results of the Cambridge Expedition to the Suez Canal, 1924.— Trans. zool. Soc. Lond., 22: 843-863.
- Goy, J., Lakkis, S. & R. Zeidane, 1988. Les Meduses de la Méditerranée Orientale.— Rapp. P.-v. Réunion. Comm. int. Explor. scient. Mer Mediterr., 31(2): 299.
- Keller, C., 1888. Die Wanderung der marinen Thierwelt im Suezcanal.— Zool. Anz. 11: 359-364, 389-395.
- Krukenberg, C.F.W., 1888. Die Durchfluthung des Isthmus von Suez in chorologischer, hydrographischer und historischer Beziehung. Wissenschaftliche Ergebnisse meiner Reise vom Etang de Berre über Marseille und Triest nach Suakim und Massaua.— Vergl.-Physiol. stud., 2(5) 5: 1-156.
- Lakkis, S., 1971. Contribution a l'étude du zooplancton des eaux libanaises.— Mar. Biol. Berlin, 11(2): 138-148.
- Lakkis, S., 1974. Distributions saisonnières du zooplancton dans les eaux libanaises.— Rapp. P.-v. Réunion. Comm. int. Explor. scient. Mer Mediterr., 22(9): 117-118.
- Lakkis, S. & H. Kouyoumjian, 1974. Observations sur la composition et l'abondance du zooplancton aux embouchures d'effluents urbains des eaux de Beyrouth.— Rapp. P.-v. Réunion. Comm. int. Explor. scient. Mer Mediterr., 22(9): 107-108.
- Lakkis, S. & R. Zeidane, 1985. Les Hydromeduses des eaux neritiques libanaises.— Rapp. P.-v. Réunion. Comm. int. Explor. scient. Mer Mediterr., 22(9): 179-180.
- Lendenfeld, R. von, 1884. The Scyphomedusae of the Southern Hemisphere.— Proc. Linn. Soc. N. S. W.: 155-69, 242-49, 259-306.

- Lewinsohn, Ch., 1977. Injuries caused by marine animals.— *The Family Physician* 7(1-2): 182-202, figs. 1-17, pls 1-4. (In Hebrew with English, French and Russian summaries).
- Maas, O., 1903. Die Scyphomedusen der Siboga Expedition.— *Siboga Exped.* 1901, 11 (9): 1-91, 12 pls.
- Panikkar, N. K. & R. R. Prasad, 1952. On an interesting association of ophiurids, fish and crab with the jellyfish *Rhopilema hispidum*.— *J. Bombay nat. Hist. Soc.*, 51: 295-296, 1 pl.
- Schäfer, W., 1955. Eine Qualle aus dem Indischen Ozean in der Agais.— *Natur Volk* 85: 241-245.
- Spanier, E., 1987. Dangerous marine animals in the coastal waters of Israel. In: R. Nezer & Y. Epstein (eds.) *The way out — the skill to survive*: 235-274.— Israel Ministry of Defence. Tel Aviv.
- Spanier, E., 1989. Swarming of jellyfishes along the Mediterranean coast of Israel.— *Isr. J. Zool.*, 36(1): 55-56.
- Stiasny, G., 1938. Die Scyphomedusen des Roten Meeres.— *Verh. K. ned. Akad. Wet. sect 2*, 37(2): 1-35, pls 1-2.
- Stiasny, G., 1939. Über einige Scyphomedusen von Kamaran (Rotes Meer).— *Zool. Anz.*, 128: 17-23, figs. 1-8.

Received: 6.xii.1989

Accepted: 28.iii.1990

Edited: J.C. den Hartog