

~~1111~~
With the author's compliments

P. L. Kramp.

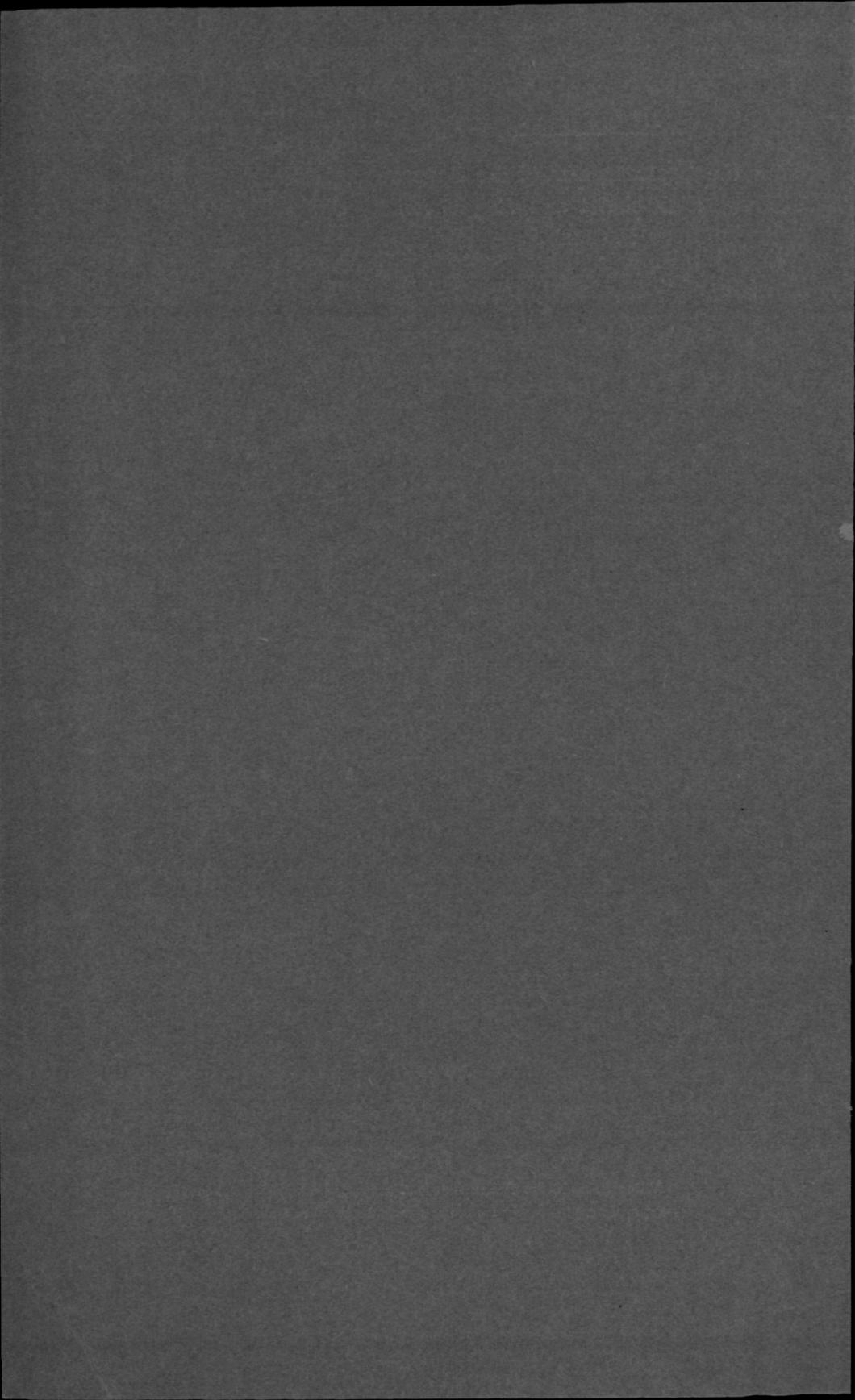
On the Leptomedusæ of the Genera
Eirene Eschscholtz and *Helgicirrho*
Hartlaub.



145387

Instituut voor Zeeonderzoeking
Instituut voor Zeeonderzoeking
Prinses Elisabethlaan 69
6401 Breda - Belgium - Tel. 059/30 37 13

Vidensk. Medd. fra Dansk naturh. Foren., Bd. 99, 1936.
Separate copies ready from the press March 30th, 1936.



On the Leptomedusæ
of the Genera *Eirene* Eschscholtz and *Helgicirrha*
Hartlaub.

By
P. L. Kramp.

Dr. C. Künne, Helgoland, has recently issued a very interesting paper: "Über die Leptomedusen *Helgicirrha schulzii* Hartlaub und *Eirene viridula* (Péron und Lesueur)" in Zoologischer Anzeiger Bd. 106, 1934. Künne calls attention to the short note by Hartlaub in his paper "Über Thaumantias pilosella..." (Hartlaub 1909 a p. 86), where the genus *Helgicirrha* is established as different from *Eirene* Eschscholtz, and he regrets, with full right, that subsequent authors have continually confounded the two genera, having either neglected or misunderstood Hartlaub's statement. Künne rightly points out that the term "cirrhi marginales" in Eschscholtz's diagnosis of *Eirene* really means what we now call tentacles, whereas true cirri are not present in *Eirene*. Several authors have been aware that Haeckel had intermingled several different species under the names of *Irene pellucida* and *Irene viridula*, but most of them persisted in using the name of *Irene* (*Eirene*) in the sense of Haeckel for species provided with true cirri (Brooks, Maas, Torrey, Mayer, Vanhöffen, Neppi, Stiasny, Bigelow, and others, and quite recently Ranson, 1933 and 1934). Especially Mayer (1910) strongly emphasized the difference between *Eirene* (with cirri) and *Phortis* (without cirri), and in this respect he is followed by Ranson, who even (1933 p. 628) directly argues against Hartlaub's view that *Eirene* is destitute of cirri. In several papers (Kramp 1924, 1927, 1930, 1933) I have likewise set out from Mayer's definition of the genus *Eirene*.

A re-examination of the material previously identified by me as *Eirene viridula*, and a review of the old literature (Péron & Lesueur,

Eschscholtz, Will, Forbes etc.) immediately showed that Künne is right, as far as the species from the North Sea are concerned, but also that in connection herewith a series of questions concerning related species and genera are raised.

Revision of material previously identified by Kramp as *Eirene viridula*.

1930 (Hydromedusae... south-western part of the North Sea, etc.) p. 30: Specimens from the coast of Belgium and the Strait of Dover; all correctly identified as *Eirene viridula*.

1927 (Hydromedusæ of the Danish Waters) p. 139, material from the west coast of Jutland. The majority of the specimens belong to *Helgicirrho schulzei*, but the following are *Eirene viridula*: "Dana" stat. 2844 (1 specimen), 2851 (2 spec.), 2863 (1 spec.); for details, see the paper quoted. Moreover there is, in our collection, one specimen of *Eirene* from the Horns Rev Light-vessel, Oct. 30th 1911.

1924 (Medusæ. Rep. Dan. Oceanogr. Exped. to the Mediterranean, etc.) p. 20. The specimens from stat. 94 in the Strait of Gibraltar and from stat. 136 at the coast of Tunis belong to *Helgicirrho schulzei*. The specimens from stat. 69, near the south-west point of Portugal, fully agree with the well known drawing by Mayer (1910 p. 312); as mentioned below I consider this medusa identical with *Tima cari* Haeckel 1864, which should be called *Helgicirrho cari*.

The material at my disposal fully confirms the descriptions given by Künne, as far as *Helgicirrho schulzei* and *Eirene viridula* are concerned.

Ranson (1933 and 1934a—c) has established a special family, *Eutimidæ* (= subfam. *Eutimidæ* + *Eirenidæ* Haeckel 1879 and Mayer 1910) for the Eucopidæ provided with a gelatinous stomachal peduncle, being in this respect in disagreement with Bigelow (1919 p. 301) and Kramp (1932 p. 317). Ranson (1934a p. 70) gives the following diagnosis of the family *Eutimidæ*: "Leptomedusæ à lithocystes clos, avec pédoncule stomacal; 4 ou 6 canaux radiaires". He is right that this group cannot be further subdivided into two families or subfamilies according to the number of lithocysts being 8 or another number, which can only be a character of generic value; (and even when taken as a generic character it is not the very number of 8 that is of importance, but whether the number of lithocysts is "constant" (8, 12, 16) in all stages of development of the free medusa, or "undertermined")

and increasing during the growth of the medusa; comp. Kramp 1932 p. 336 on the classification of the *Mitrocomidæ*). On the other hand, I will maintain, against Ranson, that there is not such a principal difference between the well-developed stomachal peduncle in the "*Eutimidæ*" and the low, gelatinous protuberance upon the subumbrella found in various species of *Eucopidæ* s. str. (e.g. in *Phialopsis*, see below), that it justifies a division into two families.

According to Ranson the "*Eutimidæ*" comprise the following 6 genera: *Eutonina*, *Eutimalphes*, *Eutima*, *Phortis*, *Eirene*, *Tima*. The three first have 8 lithocysts; *Tima* has unbroken gonads covering the radial canals on the subumbrella as well as on the stomachal peduncle. In the present paper I shall only deal with the medusæ with undetermined numbers of lithocysts and with the gonads restricted to the subumbrella parts of the radial canals, corresponding to Ranson's two genera *Eirene* Eschscholtz and *Phortis* McCrady, which are only separated by the presumed presence of cirri in *Eirene* and their absence in *Phortis*; in this respect Ranson is in accordance with Mayer¹). It appears from Künne's paper that the diagnoses of these two genera must be altered.

Künne's diagnoses (derived from Hartlaub's notes) of *Eirene* (without cirri) and *Helgicirrho* (with cirri) are not exactly congruous with Mayer's and Ranson's diagnoses of *Phortis* and *Eirene* respectively. In his diagnoses Künne includes the possession of excretory papillæ (which may prove to be justifiable, see below), and also the degree of development of the oral lips, which can hardly be of more than specific importance. At any rate, as shall be demonstrated below, Künne is not right (p. 28) that cirri and long oral lips "nicht bei ein und demselben Tier vereinigt sind".

In the following pages I shall deal with the various species belonging to the group and see, how they should be classified into genera. I must, however, postpone a thorough revision of the species until I have

¹) Let me remark that it is superfluous, with Ranson, to state in the generic diagnoses that the lithocysts are closed, as this is given in the diagnosis of the family; likewise I cannot agree with Ranson in his using as a generic character for *Eutima* and *Tima* the possession of "verruës ou cirres marginaux"; marginal warts and cirri are two different structures, and from a morphological as well as from a systematical point of view the presence or absence of one of them is independent of the presence or absence of the other.

finished with the extensive collections of medusæ from various expeditions, which I have been trusted to work up; in some of these collections several species of *Eirene* and *Helgicirrha* are represented, and it would be incorrect to anticipate the forthcoming reports on the expeditions by picking out detailed accounts on special forms for publication on the present occasion.

Two genera, which have been referred to *Eirene*, must be removed from the group:

Irenium was established by Haeckel for *I. quadrigatum* n. sp. (Haeckel 1879 p. 199; Taf. XI, figs. 12, 13) from a single specimen from Morocco, by Mayer (1910 p. 313) referred to *Eirene*. The species has never been found again. It has only four, very large tentacles, and the gonads continue from the subumbrella far downwards on the broad stomachal peduncle. To place this medusa in the same genus as *Helgicirrha schulzei* is excluded, neither can it be referred to any other known genus.

Phialopsis Torrey 1909 was referred to *Eirene* by Ranson (1934c) who carries out a detailed comparison between *Phialopsis diegensis* Torrey and various medusæ (with cirri) which have been presumed to belong to *Eirene viridula*, and the comparison is illustrated by figures of the stomachal peduncle and the bell margin. As *Phialopsis* has cirri, it can, at any rate, not belong to *Eirene* as now defined (Hartlaub, Künne); but we must consider the possibility of its being synonymous with *Helgicirrha*. If so, *Phialopsis* Torrey, February 17th, 1909, would have the priority over *Helgicirrha* Hartlaub, March 2nd, 1909. A comparison between the diagnoses of the two genera seems to indicate that they differ from each other in relative characters only, and especially in the degree of development of the stomachal peduncle, which is "feebly developed" in *Phialopsis*; the "numerous rudimentary tentacles" in *Phialopsis* are not permanently rudimentary in the same sense as the marginal warts in e. g. *Eutima* and *Tima* and are, therefore, not essentially different from the smaller tentacles in *Helgicirrha*; the absence of excretory papillæ on the tentacle bulbs in *Phialopsis* may prove to be a severe objection against a connection of the two genera, but at present we are not quite sure of the systematic importance of this structure. There is, however, one point which settles the question: in all medusæ belonging to *Helgicirrha* or related genera the cirri, when present, are what we call "lateral cirri",

placed laterally on either side of the tentacle bulbs or the rudimentary marginal warts; but *Phialopsis diegensis* (as figured by all the authors who have seen it, and as observed by myself in a specimen from the Atlantic) has "marginal cirri" situated on the bell margin in the spaces between the tentacle bulbs. I therefore do not hesitate to state that the genera *Phialopsis* and *Helgicirrho* are not closely related. On the other hand, the presence of a "feebly developed gastric peduncle" in *Phialopsis diegensis* shows how little importance, as a family character, can be attached to the mere presence of this structure (comp. Kramp 1927 p. 140 and 1932 p. 317).

Phialucium comata Bigelow 1909 (from Acapulco Harbor, Mexico and Gouadeloupe Island, West Indies), which has cirri but no trace of a stomachal peduncle, was referred to *Phialopsis* by Maas (1909 p. 23), Mayer (1910 p. 276), and Vanhöffen (1911 p. 226). I would rather refer it to *Mitrocomium* Haeckel; the tentacles are "flanked with from one to three pairs of lateral cirri", and the number of lithocysts, though apparently somewhat varying in different individuals, is "always small, and not subject to increase with the later growth of the medusa" (Bigelow 1909 p. 159). I have stated (Kramp 1932 p. 320) that the lithocysts of *Mitrocomium* are closed.

The medusæ here dealt with are *Eucopidæ* with a stomachal peduncle; with gonads restricted to the subumbrella; with a large and undetermined number of lithocysts.

A. Species in which cirri are not observed.

For the species of this group the following generic names have been used: *Oceania*, by Péron & Lesueur 1809 for *viridula* n. sp. — *Dianæa*, by Lamarck 1816 and subsequent authors until Lesson 1843 for *viridula* P. & L. — *Eirene* n. g., by Eschscholtz 1829 for *viridula* P. & L. — *Geryonia*, by Will 1844 for *pellucida* n. sp. — *Geryonopsis*, by Forbes 1848 for *delicatula* n. sp., synonym of *Eirene viridula*, and for *pellucida* Will. — *Phortis*, by McCrady 1857 for *gibbosa* n. sp., and by later authors for all species without cirri. — *Eutima*, by L. Agassiz 1862 for *pyramidalis* n. sp. and by A. Agassiz 1865 and Haeckel 1879 for the same species. — *Tima*, by Gegenbaur 1856 and Claus 1881 for *pellucida* Will., by Neppi 1909 for *willi* n. sp. (= *pellucida*), and by Mayer 1910, who referred *pellucida*

to *Tima lucullana*. — *Irenopsis* n. g., by Goette 1886 for *hexanemalis* n. sp.

Dianæa was founded by Lamarck 1816 for a great number of medusæ belonging to very different groups and with *Lymnorea triedra* Péron & Lesueur as the genotype, so it cannot be used for the medusæ here concerned. Of the other names quoted above *Oceania*, *Geryonia*, *Eutima*, and *Tima* can be left out of consideration, as they are now used for other medusæ. *Geryonopsis* is a synonym of *Eirene*. *Phortis* is defined by McCrady with so many details that the diagnosis is really a description of the species *Ph. gibbosa*; by later authors, from Brooks 1883, *Phortis* is characterized by its absence of cirri in contradistinction to *Eirene* which was supposed to have cirri; accordingly *Phortis* is likewise a synonym of *Eirene*.

Irenopsis was founded by Goette 1886 for a six-rayed medusa, *I. hexanemalis*; by Vanhöffen (1912a p. 17) it was considered a variety of *Phortis pellucida* Will. I agree with Ranson (1934a p. 75) that it is an independent species, but also that *Irenopsis* cannot be retained as a separate genus; it is a synonym of *Eirene* sensu Hartlaub.

Among all the generic names mentioned above, *Eirene* thus proves to be the oldest practicable name for the medusæ here concerned, and *E. viridula* (Péron & Lesueur) Eschscholtz is the genotype. By a survey of the species we must, however, consider the possibility that the genus must be divided into two or more genera; let me say at once that in my opinion it should not be divided!

Besides the species with cirri, mentioned below, the following species have incorrectly been referred to *Eirene*:

By Eschscholtz (1829 p. 94): *Oceania endrachtensis* Péron & Lesueur (= *Geryonia proboscidalis* (Forskål)), *Oceania gibbosa* Péron & Lesueur (which is a *Tima*), *Medusa digitale* Fabricius (= *Aglantha digitale*).

By Bedot (Histoire des Hydroides): *Oceania gibbosa* P. & L., *Dianæa lucullana* Delle Chiaje, *Medusa crinita* Dalyell, *Thaumantias cymbaloidea* Forbes, *Geryonopsis forbesii* van Beneden.

Eirene viridula (Péron & Lesueur) Eschscholtz. Genotype.

Oceania viridula Péron & Lesueur 1809 p. 346. — British Channel.

Eirene viridula Eschscholtz 1829 p. 94.

Geryonopsis delicatula Forbes 1848 p. 39, Pl. IX fig. 1 a—e. — Dorset and Devon.

Eirene viridula L. Agassiz 1862 p. 362.

Irene pellucida Garstang 1894 p. 215. — Plymouth.

Irene viridula Hartlaub 1894 p. 195. — Helgoland.

Irene pellucida Browne 1898 p. 190. — Plymouth.

Irene pellucida Browne 1905 c p. 761. — Firth of Clyde.

Irene pellucida Hartlaub 1909a p. 86, note. — Helgoland.

Phortis gibbosa Ranson 1926 p. 298. — Tatihou, the Channel.

Eirene viridula Kramp 1930 p. 30. — S.W. North Sea.

Eirene pellucida Plymouth Marine Fauna 1931 p. 83. — Plymouth.

Eirene viridula Künne 1934 p. 30, fig. 2a—c. — S.E. North Sea.

In parte:

Eirene viridula Kramp 1927 p. 139. — West coast of Jutland.

Eirene viridula Kramp 1933 p. 590 (non fig. 60, 61).

?:

Geryonia pellucida Frey & Leuckart p. 138. — Helgoland.

i.p. *Eirene viridula* Haeckel 1879 p. 202. — Helgoland.

Irene pellucida(?) Crawford 1891 p. 296. — St. Andrews, Scotland.

Irena viridula Johansen & Levinsen 1904 p. 275. — Danish Belt Sea.

Non:

Irene viridula Bles 1892 p. 342. — Plymouth. (= *Laodicea undulata*)¹.

Irene viridula Maas 1893 p. 63 (= *Phialopsis diegensis*). N. Atlantic.

Irene viridula Broch 1905 p. 7 (= *Cosmetira pilosella* and ?). — Norway.

Eirene viridula Bigelow 1909 p. 163, Pl. 36 figs. 1—4 (= *Phialopsis diegensis*).
S.W. of Galapagos Islands.

Eirene viridula Mayer 1910 fig. 312 (= *Helgicirrho cari*). — Naples.

Irene viridula Vanhöffen 1912b p. 370 (= *Phialopsis diegensis*). — E. trop.
Atlantic.

Eirene viridula Kramp 1924 p. 20 (= *Helgicirrho cari* + *schulzei*). — Medi-
terranean and Cadiz Bay.

Eirene viridula Ranson 1925 p. 381 (= *Helgicirrho cari*). — Portugal and
Tunis.

Eirene viridula Ranson 1934 c p. 271 ff.

Distribution: Eastern and southern parts of the North Sea, British Channel, west coast of Scotland, and perhaps also east coast of Scotland.

I have nothing to add to Künne's description (1934).

Eirene pellucida (Will).

Geryonia pellucida Will 1844 p. 70, Taf. II figs. 8—12. — Trieste.

Geryonopsis pellucida Forbes 1848 p. 40.

i.p. *Tima gibbosa* L. Agassiz 1862 p. 362.

¹) According to note in Journ. Mar. Biol. Ass., Plymouth, vol. II p. V.

- Tima pellucida* Gegenbaur 1856 p. 253.
Irene (Tima) pellucida Claus 1881 p. 102, Taf. III figs. 21—30. — Adria.
Eirene pellucida Graeffe 1884 p. 358. — Trieste.
Irene pellucida Chun 1896 p. 5. — Zanzibar.
Phialidium tenue Browne 1905a p. 730, Pl. 54 fig. 4, Pl. 57 fig. 16. — Maldives.
Irene pellucida Hartlaub 1908 p. 383. — French Somali.
Irene pellucida Hartlaub 1909b p. 451, Taf. 19 figs. 5, 8—10. — Djibouti.
Tima willi Neppi 1909 p. 368 ff. figs. — Trieste.
Irene pellucida Neppi 1910 p. 157 ff. figs. 1, 1a. — Trieste.
Irene pellucida Stiasny 1910 p. 586.
i.p. *Tima lucullana* Mayer 1910 p. 314.
Eirene pellucida Mayer 1910 p. 496.
Irene pellucida Vanhöffen 1911 p. 230, textfig. 20. — W. Africa.
Phortis pellucida Neppi & Stiasny 1913 p. 49. — Trieste.
Phortis pellucida Bigelow 1919 p. 302.
Phortis pellucida Ranson 1933 figs. 1—2. — Djibouti.
- Non:
Irene pellucida Goette 1886 p. 833. — Zanzibar.
Irene pellucida Lo Bianco 1909 p. 543. — Naples.
Phortis pellucida Ranson 1934b p. 182. — Tatihou in the English Channel.

Distribution: Adriatic Sea and tropical seas east and west of Africa.

This species has been thoroughly studied by several authors, particularly by Claus (who followed the development from the young to the fully grown medusa), Hartlaub, Neppi, and Ranson. It is evidently closely related to *E. viridula*; the gelatinous substance is much thicker, the gonads are shorter, and it has a smaller number of tentacles. In both species there are, even in adult specimens, a certain number of fully developed tentacles and a similar or somewhat greater number of smaller or quite rudimentary tentacles; both have a short stomach with four swellings at the points of issue of the radial canals, and long, pointed, crenulated lips, and both have well developed excretory papillæ on the base of the tentacle bulbs. This resemblance in several details is interesting, because it shows that no great systematic importance can be applied to the shape of the stomachal peduncle which is slender in *viridula*, but has a very broad base in *pellucida*. It is very likely that future investigations will show that these two species actually are identical¹⁾; if so, the name of *viridula* will take the priority over *pellucida*.

¹⁾ Mr. E. T. Browne, who has seen several specimens of *Eirene* at Plymouth, informs me in a letter that some of them are very similar to *E. pellucida* as figured by Claus.

Eirene gibbosa (McCrary), non Eschscholtz.

Phortis gibbosa McCrary 1857 p. 193. — Charleston Harbor.

Eirene gibbosa L. Agassiz 1862 p. 362.

Eirene gibbosa A. Agassiz 1865 p. 112.

Irene gibbosa Haeckel 1879 p. 203.

Phortis gibbosa Brooks 1883 p. 470. — Beaufort, N. Carolina.

Phortis gibbosa Mayer 1910 p. 307.

Distribution: Southern part of the New England coast.

This medusa has only been observed by McCrary and by Brooks, and it has never been figured. It seems to be very similar to *pellucida*.

This species is the genotype of *Phortis* McCrary which, as mentioned above, is a synonym of *Eirene*.

Brooks has seen the hydroid and studied the development of the medusa.

Eirene pyramidalis (L. Agassiz).

Eutima pyramidalis L. Agassiz 1862 p. 363. — Florida.

Eutima pyramidalis A. Agassiz 1865 p. 118.

Eutima pyramidalis Haeckel 1879 p. 191.

Phortis pyramidalis Mayer 1900b p. 59, Pl. 10 figs. 21, 21a. — Bahamas and Tortugas, Florida.

Phortis pyramidalis Mayer 1904 p. 17, Pl. III fig. 25.

Eirene pyramidalis Bigelow 1909 p. 160.

Phortis pyramidalis Mayer 1910 p. 308, Pl. 39 figs. 3—6.

Phortis pyramidalis Vanhöffen 1913 p. 424. — Tortugas.

Phortis pyramidalis Bigelow 1919 p. 302.

Distribution: Bahamas and Florida.

Bigelow (1919), who has studied this medusa himself, compares it with the descriptions of *gibbosa* and finds the two species much alike; Bigelow points out that excretory pores, which had been overlooked by previous authors, are "present and easily distinguished" in *pyramidalis*.

Eirene lactea (Mayer).

Phortis lactea Mayer 1900b p. 58, Pl. 40 fig. 133. — Tortugas, Florida.

Eirene lactea Bigelow 1909 p. 160.

Phortis lactea Mayer 1910 p. 308, Pl. 40 fig. 2, Pl. 41 fig. 6.

Phortis lactea Bigelow 1919 p. 303.

Distribution: Tortugas, Florida.

According to Bigelow (1919) this species "may be a young *pyramidalis*". This does not seem to me very probable, not merely because

the gonads are well-developed, but mainly because the peduncle is very large, whereas in young individuals of other species it is generally feebly developed.

Eirene hexanemalis (Goette).

Irenopsis hexanemalis Goette 1886 p. 832. — Zanzibar.

Irenopsis hexanemalis Chun 1896 p. 5. — Zanzibar.

Irenopsis hexanemalis Browne 1905 b p. 142, Pl. I fig. 4, Pl. III figs. 5—8. — Ceylon.

Irenopsis hexanemalis Maas 1905 p. 36, Taf. VI figs. 38—40. — Malayan Archipelago.

Irenopsis hexanemalis Mayer 1910 p. 310, textfigs. 171, 171a.

Irenopsis hexanemalis Vanhöffen 1911 p. 229, textfig. 19. — Nicobar Isl.

Phortis pellucida f. *hexanemalis* Vanhöffen 1912a p. 17. — Hongkong.

Phortis pellucida f. *pentanemalis* Vanhöffen 1912a p. 18. — Hongkong.

Irenopsis hexanemalis Stiasny 1928 p. 211. — Java Sea and Singapore.

Irenopsis hexanemalis Menon 1932 p. 19. — Madras.

Phortis hexanemalis Ranson 1934a p. 75—76.

Distribution: Tropical parts of Indian Ocean and Malayan Archipelago.

The number of radial canals is normally 6, but abnormal specimens frequently occur. *Phialidium tenue* Browne (1905a) from the Maldiv Islands was supposed to be a 4-rayed specimen of *hexanemalis* by Browne himself (1905b) and also by Mayer (1910) and Ranson (1934a); in his next paper (1934b p. 182) Ranson, however, places *Ph. tenue* as a synonym of *Phortis pellucida*, and I think he is right in this respect. I also agree with Ranson that *hexanemalis* is a distinct species and not a variety or an aberrant form of *pellucida* as Vanhöffen will maintain (1912a).

Eirene kambara Agassiz & Mayer.

Eirene kambara Agassiz & Mayer 1899 p. 169, Pl. 8 fig. 29. — Fiji Islands.

Eirene kambara Bigelow 1909 p. 161.

Phortis kambara Mayer 1910 p. 309.

Phortis kambara Bigelow 1919 p. 303.

Of this medusa only one individual has been observed, from the Fiji Islands. Bigelow may be right that it is a young specimen of *E. ceylonensis* Browne.

Eirene elliceana (Agassiz & Mayer).

Phortis elliceana Agassiz & Mayer 1902 p. 146, Pl. 2 figs. 5—7. — Ellis Islands, trop. Pacif.

Phortis elliceana Mayer 1910 p. 309, textfig. 170.

Phortis elliceana Bigelow 1919 p. 305, Pl. 41 figs. 3—7. — Philippines.

Distribution: Tropical Pacific.

This species seems well defined by its cylindrical, though at the same time rather stout peduncle and by the comparatively large number of small tentacle rudiments in proportion to number of fully developed tentacles. Moreover it is interesting by hydroid blastostyles budding from the gonads, as observed by Bigelow (1919).

Eirene ceylonensis Browne.

Irene ceylonensis Browne 1905b p. 140, Pl. III figs. 9—11. — Ceylon.

Irene ceylonensis Annandale 1907a p. 79, Pl. II fig. 5; 1907b p. 36, 38; 1907c p. 139, 142. — Ganges delta.

Eirene ceylonensis Bigelow 1909 p. 160, 161, 164.

Phortis ceylonensis Mayer 1910 p. 309.

Phortis ceylonensis Bigelow 1919 p. 304. — Philippines.

Phortis ceylonensis Stiasny 1928 p. 209. — Java Sea.

Distribution: East India and Malay Archipelago.

This is one of the species with a slender peduncle; the tentacles are very numerous, 100 or more; there are no permanently rudimentary bulbs, but in younger individuals about every second tentacle is smaller than the others or only visible as tiny rudiments. Annandale found this medusa in brackish-water ponds in the Ganges delta and gave a new description of it, and also of its hydroid (unfortunately I have only had access to the last of his three papers, which mainly deals with the polyp). Browne was "doubtful about the presence of excretory pores"; having seen numerous specimens from the Ganges estuary myself, I can state that excretory pores are really present, though difficult to see except in sections. In the number and arrangement of the tentacles and lithocysts this species resembles *E. pyramidalis*, but the shape of the stomachal peduncle is entirely different in the two species. I can state with certainty that this species lacks cirri.

Eirene palkensis Browne.

Irene palkensis Browne 1905b p. 141, Pl. III figs. 12—16. — Ceylon.

Eirene palkensis Bigelow 1909 p. 160—161, 164.

Phortis palkensis Mayer 1910 p. 309.

Irene palkensis Vanhöffen 1911 p. 230. — Nicobars.

Phortis palkensis Vanhöffen 1912a p. 18. — Amoy; Hongkong; Colombo.

Phortis palkensis Vanhöffen 1912b p. 371. — Port Natal.

Phortis palkensis Bigelow 1919 p. 302.

Distribution: Tropical Indian Ocean and China Sea.

Bigelow (1909) suggests that this species may be identical with "*Eirene*" *danduensis*, which has cirri; the absence of cirri in *palkensis* perhaps being "explained by the fact that the bell margins of all the specimens were much damaged". Vanhöffen, who has seen several specimens of *palkensis* from different localities, however, maintains that it has no cirri; in two specimens from the Mergui Archipelago, examined by me, cirri are likewise absent, and also in numerous specimens from the Key Islands.

This is also one of the species with a slender stomachal peduncle. Between each successive pair of fully developed tentacles there are, as a rule, three tiny rudiments of tentacle bulbs, the middle one being just a little larger than the two others; in the largest of the specimens, which I have seen, I find the same arrangement, but the median bulb in almost all the spaces has developed into a true tentacle of the same shape as the fully developed ones, though much smaller. My specimens also agree with Browne's in the very conspicuous excretory papillæ. *E. palkensis* is evidently a well defined species.

Eirene mollis Torrey.

Irene mollis Torrey 1909 p. 26, fig. 11. — San Diego, California.

i.p. *Eirene viridula* Mayer 1910 p. 311.

Eirene mollis Foerster 1923 p. 262.

This species has only been seen by Torrey, who found several specimens near the coast of California. It is well distinguished by its very short, conical peduncle and by the very large number (150—180) of closely set tentacles, all alike, and even more numerous lithocysts. Excretory pores are not mentioned in the description. Mayer has placed it among the synonyms of *Eirene viridula*, whereas Foerster, with full right, maintains it as a separate species.

Eirene sp. (Menon).

Phortis sp. Menon 1932 p. 18. — Madras.

Menon found shoals of this medusa near the coast off Madras; it "differs from *Phortis ceylonensis* (Browne) in its smaller size, in having fewer tentacles and in the nature of its gonads".

Common to all these 12 species of *Eirene* are the following features:

The mouth lips are well-developed, though of varying length, and more or less folded or crenulated.

The gonads reach from near the base of the stomachal peduncle almost to the circular canal and are, therefore, of varying length according to the basal width of the peduncle; they are divided in the median line (so far known).

The tentacle bulbs are conical or globular, varying according to state of contraction.

Excretory pores are observed in most species; they are sometimes placed upon well-developed, adaxial excretory papillæ, but sometimes (e. g. in *ceylonensis*) there are no distinct papillæ, and if so the pores are difficult to see. They are not mentioned at all in the descriptions of *gibbosa*, *kambara*, *lactea*, and *mollis*; in *Eirene* sp. (Menon) papillæ are stated to be absent, which, however, does not exclude the possibility that pores are present, and they may also have been overlooked in the other species just mentioned. As, however, we are not sure that excretory pores are present in all species, it will be best to leave out this structure in the diagnosis of the genus.

The lithocysts are always small; in some species they contain only one concretion, in others 1—3 or 4. The number of lithocysts is at least equal to the number of fully developed tentacles.

The principal characters by which the species are distinguished are the shape of the stomachal peduncle and the number and development of the tentacles, and we must consider the possibility of subdividing the genus according to one of these features.

There is a considerable difference between the slender, cylindrical or slightly conical peduncle with a narrow base in *viridula*, *elliceana*, *ceylonensis*, *palkensis*, and sp. Menon and the mighty, broadly conical structure in *pellucida*, *gibbosa*, *pyramidalis* and *lactea*; in well-sized

specimens of *hexanemalis* it is likewise rather stout, but in young specimens of this as well as in other species the peduncle is very short and flattened or even quite obsolete (as e. g. in very young specimens of *ceylonensis*, as I have seen myself), and in *mollis* it remains in a state resembling the juvenile stage in other species. A subdivision of the genus according to the shape of the peduncle, therefore, does not seem advisable, unless this feature stands in correlation with other important features.

In adult specimens of six of the species described the tentacles are all of nearly the same size; in the six other species there are, in all stages of development, between every successive pair of fully developed tentacles a number (1—4) of much smaller tentacles or quite rudimentary bulbs. These are not, however, true permanently rudimentary bulbs (like the marginal warts in e. g. *Eutima* and *Tima*), but every one of them has the possibility of developing into tentacles (see e. g. remarks on *palkensis*), and in young individuals of the other species similar rudiments are frequently observed. The mode of development of the tentacles, therefore, does not afford a distinguishing character for a subdivision of the genus. Moreover, there is no correlation between the shape of the stomachal peduncle and the mode of development of the tentacles, and the same holds good as far as the other specific characters are concerned. The final result must be, that the 12 species mentioned above all belong to one genus, of which we may now give the following diagnosis:

Eirene Eschscholtz: Eucopidæ with a stomachal peduncle; with gonads restricted to the subumbrella parts of the radial canals; with a large and undetermined number of lithocysts; without cirri.

B. Species in which cirri have been observed.

For the species of this group the following generic names have been used:

Tima, by Haeckel 1864 for *T. cari* n. sp. from the Mediterranean; by Schulze 1874 for the medusa from Heligoland, which Hartlaub 1909a made the type of *Helgicirrho schulzei*, and later on by Böhm 1878; by Claus 1881 for all species with cirri (and stomachal peduncle) in contradistinction to *Irene* without cirri. By Neppi 1910a for *Tima plana*, which is identical with *Helgicirrho schulzei*.

Eirene (*Irene*), first by Haeckel 1879, and after him by many other authors for several species.

Helgicirra n. gen. by Hartlaub 1909a for *H. schulzei* n. sp.

As demonstrated above, *Irenium* Haeckel 1879 and *Phialopsis* Torrey 1909 do not belong to this group of Eucopidæ. *Helgicirra* thus proves to be the oldest practicable generic name for the group of species in question. Hartlaub first (1909a) wrote *Helgicirra*, then (1909b) altering the spelling into *Helgicirra*; according to the rules of nomenclature the first spelling must be retained.

Besides the species of *Helgicirra* mentioned below, the following medusæ with cirri have been referred to the genus *Eirene* (sensu Haeckel, Mayer etc.):

By L. Agassiz (1862 p. 362), A. Agassiz (1865 p. 112), and Haeckel (1879 p. 203): *Eirene coerulea*, which is a *Eutima*.

By Maas 1893, Bigelow 1909, Vanhöffen 1912b, and Ranson 1934c: *Phialopsis diegensis* Torrey (see above, p. 245).

By Broch (1905 p. 7): *Irene viridula*, partly = *Cosmetira pilosella*.

By Mayer 1910: p. 312 *Eirene variabilis* (= *Eutima variabilis* McCrady) is referred to *Eirene*, because it may have 12 lithocysts; this is unwarranted, as the number, whether it is 8 or 12, does not increase with the age of the individual; it is most probably a *Eutima*. — p. 313: *Eirene quadrigatum* (= *Irenium quadrigatum* Haeckel, see above, p. 242).

Helgicirra cari (Haeckel).

Tima cari Haeckel 1864 p. 332. — Nice.

Irene pellucida Haeckel 1879 Taf. XII figs. 1—2. — Nice and Corfu.

Tima cari Metschnikoff 1886 p. 262.

Irene pellucida Lo Bianco 1909 p. 543. — Naples.

Eirene viridula Mayer 1910 textfig. 172 (p. 312). — Naples.

i.p. *Eirene viridula* Kramp 1924 p. 20. — Cadiz Bay.

Eirene viridula Ranson 1925 p. 381. — Off Portugal; Tunis.

Eirene viridula Ranson 1934c p. 279. — Same localities.

Distribution: Mediterranean and adjacent parts of Atlantic Ocean.

A re-examination of my own specimens from the Mediterranean and the Cadiz Bay has convinced me that they belong to the same species which was figured by Mayer and Haeckel, and according to Haeckel his figure is drawn after a living specimen from Nice,

which means that it represents the medusa described by him in 1864 as *Tima cari*. This species is distinguished from the North-European *H. schulzei* by its long, pointed, crenulated mouth lips.

Helgicirrho schulzei Hartlaub. Genotype.

- Tima pellucida* Schulze 1874 p. 138, Taf. II figs. 6a—b. — Heligoland.
Tima pellucida Böhm 1878 p. 76, 87, 100. — Heligoland.
Helgicirrho schulzei Hartlaub 1909a p. 86, note. — Heligoland.
Helgicirrho schulzei Hartlaub 1909b p. 453.
Irene pellucida Neppi 1909 p. 368ff. Figs. — Trieste.
Tima plana Neppi 1910 p. 157ff. Figs. 2, 2a, 2b. — Trieste.
Helgicirrho plana Neppi 1910 (ibid.) p. 166.
Tima plana Stiasny 1910 p. 586.
Eirene (Irene) plana Neppi 1912. — Dalmatian coast.
Helgicirrho schulzei I. Apstein 1913 p. 611.
Eirene plana Neppi & Stiasny 1913 p. 51. — Trieste.
Helgicirrho schulzei Neppi & Stiasny 1913 (ibid.) p. 52.
i.p. *Eirene viridula* Kramp 1924 p. 20. — Strait of Gibraltar; Tunis.
i.p. *Eirene viridula* Kramp 1927 p. 139. — West coast of Jutland.
i.p. *Eirene viridula* Kramp 1933 p. 590.
i.p. *Eirene viridula* Ranson 1934c p. 271ff.
Helgicirrho schulzei Künne 1934 p. 28, fig. 1a—c. — S.E. North-Sea.
- ?:
- i.p. *Eirene viridula* Haeckel 1879 (p. 202). — Heligoland.
Irene pellucida? Crawford 1891 p. 296. — St. Andrews, Scotland.
Irena viridula Johansen & Levinsen 1904 p. 275. — Danish Belt Sea.

It appears from this list of synonyms that the species in question has not been described as an independent species until 1909, when Hartlaub gave it the name of *Helgicirrho schulzei* n.sp., which accordingly becomes the correct name of the species. Hartlaub spelled the name *schulzei*; as it is named in honour of Schulze, the correct spelling, however, seems to be *schulzei*.

Haeckel may have seen this species at Heligoland and included it among the forms which he referred to "*Irene viridula*". The short description by Crawford (1891) of "*Irene pellucida*" from St. Andrews on the east coast of Scotland may as well apply to *E. viridula* as to *H. schulzei*. The medusa mentioned by Johansen & Levinsen (1904) from the Danish Belt Sea is an altogether uncertain species. According to letter from F. S. Russell, *Helgicirrho schulzei* occurs at Plymouth.

Distribution: North-western Europe and Mediterranean.

This species bears a considerable resemblance to *H. cari*, but is easily distinguished from it by the mouth lips being almost rudimentary. I have nothing to add to Künne's description.

Helgicirrha danduensis (Bigelow).

Eirene danduensis Bigelow 1904 p. 254, Pl. 1 fig. 5, Pl. 2 fig. 6. — Maldives.

Eirene danduensis Bigelow 1909 p. 160—161, 164.

Eirene danduensis Mayer 1910 p. 313.

Only one specimen has been observed, at the Maldive Islands. It has 32 tentacles flanked by a pair of cirri and about 70 rudimentary bulbs without cirri. It is mainly characterized by the very elongated stomach. In 1909 Bigelow was inclined to identify this species with *Eirene palkensis* Browne; as mentioned above we may now be sure that cirri are absent in *E. palkensis*, so that the two species, though much alike in general aspect, belong to two different genera. *Helgicirrha malayensis* (Stiasny), which is widely distributed in the tropical parts of the Indian Ocean, is probably identical with *H. danduensis* (see below).

Helgicirrha medusifera (Bigelow).

Eirene medusifera Bigelow 1909 p. 161, Pl. 37 figs. 1—8. — Pacific coast of Mexico.

Eirene medusifera Mayer 1910 p. 313.

Eirene medusifera Foerster 1923 p. 262.

Several specimens were found at Acapulco Harbor, Mexico. The species is much smaller (until 8 mm wide) than any other member of the genus. "All specimens, even the largest, have tentacles in process of formation", but in large specimens the small or rudimentary tentacles are fewer in number than the fully developed ones. A feature of considerable interest is that "all the tentacles, whether fully formed or rudimentary, are flanked at their bases by a pair (sometimes two pairs) of lateral cirri". Moreover medusa buds are developed from the region of the gonads.

Helgicirrha malayensis (Stiasny).

Eirene malayensis Stiasny 1928 p. 210, fig. 1. — Samarang, Java Sea.

Eirene malayensis Menon 1932 p. 20, Pl. III fig. 23. — Madras.

This tropical Indian medusa is probably identical with *H. danduenensis* (Bigelow) from the Maldive Islands. In comparing *Eirene palkensis* with *danduenensis*, Bigelow rightly points out (1909 p. 161) that the length of the manubrium "is subject to great variation owing to contraction", so that the elongated stomach in the only observed specimen of *danduenensis* may not be of specific importance. In *H. danduenensis* the gonads are fairly short, occupying "the distal two thirds of the radial canals", whereas in *malayensis* they are usually very long: "They extend from near the bell margin to some distance down the peduncle" (Menon); according to Stiasny, however, the length of the gonads is variable: "Gonaden... im ganzen Verlaufe der Radiär-canäle oder mehr in den peripheren Teilen derselben entwickelt". In this latter case the resemblance to *H. danduenensis* seems to be almost complete. I have examined two specimens from the Nicobares and one from Muscat (Gulf of Oman, outside the Persian Gulf), and also four of Stiasny's original specimens from Samarang, but further investigations are required to settle the question of the supposed identity of the two species¹).

In the descriptions given by Stiasny and by Menon there are some misunderstandings as to the excretory papillæ, which will be discussed below (p. 257).

Helgicirrha madrasensis (Menon).

Eirene madrasensis Menon 1932 p. 20, Pl. III fig. 24. — Madras.

Only a part of the bell margin is figured, no figure of the entire medusa is given. The species is mainly characterized by its very large number of tentacles (about 100) which are all of about the same size; only in younger specimens "there are a few marginal bulbs without tentacles". The author compares this new species with *Eirene ceylonensis* Browne, stating that the only separating character is the possession of cirri in *madrasensis*. Cirri are present also on the young tentacle bulbs.

¹) The specimen from Muscat belongs to the British Museum, where I saw it several years ago; recently Mr. A. K. Totton has kindly sent me the specimen for re-examination. The specimens from Samarang were kindly sent by Dr. Stiasny.

The number of species described until now, which may be referred to the genus *Helgicirra*, thus amounts to five or six. The following morphological remarks should be compared with the remarks on *Eirene* (p. 251).

In most species the mouth lips are well developed and more or less folded or crenulated; in *H. cari* they are long and pointed, in *medusifera* they are very short, in *schulzei* almost rudimentary.

The stomachal peduncle seems to be only slightly varying in shape and size, about as long as, or a little shorter than the radius of the umbrella; it is always slender, with a narrow base, never broadly conical as in some species of *Eirene*.

The structure of the gonads is similar to that of *Eirene*, but the gonads do not always commence near the base of the peduncle; especially in *medusifera* they are fairly short and placed in the distal parts of the radial canals.

The tentacles and their bulbs as in *Eirene*. In adult specimens of *madrasensis* the tentacles are all alike, in all the other species there are, even in large specimens, one or more small bulbs between the fully developed tentacles; in *medusifera*, however, the small bulbs are few in number in fully grown individuals.

Excretory pores, mounted upon small adaxial papillæ, are observed in *H. cari* and *schulzei*; in the descriptions of *danduensis* and *medusifera* they are not mentioned, and according to Menon's description "they seem to be absent" in *madrasensis*. As to *malayensis*, Stiasny writes in his original description: "Jeder Tentakelbulbus mit abaxialer Excretionspapille", and his figure likewise indicates an abaxial position of the pores, which would indeed be peculiar. In the specimens examined by me, among which are some of Stiasny's original specimens from Samarang, excretory pores are distinctly seen in the usual adaxial position, above the velum, mounted upon feebly developed papillæ. On the abaxial side, on the other hand, each tentacle bulb has a well developed, broadly rounded hook or "spur" grasping around the umbrella margin, exactly as figured by Menon (Pl. III fig. 23). Apparently Menon has also (like Stiasny) mistaken these abaxial processes for excretory papillæ, since he writes about "prominent excretion papillæ" (p. 20); the real, adaxial excretory papillæ are not prominent in this species. Menon's having looked after excretory papillæ on the abaxial side of the tentacle bulbs makes it comprehensible that he was unable to find them in *H. madrasensis* and in his "*Phortis* sp."

The number of lithocysts is equal to or somewhat larger than the number of fully developed tentacles; they usually contain more than one concretion (until 5).

The arrangement of the cirri is interesting. In the two European species, *cari* and *schulzei*, the fully developed tentacles are destitute of cirri, whereas cirri (one or a pair) are present at the base of all the smaller tentacles and rudimentary bulbs; the cirri may even be developed while the developing bulb is hardly visible as yet. In *danduensis* and *malayensis* (which may be identical) the fully developed tentacles have cirri, whereas none are seen on the young bulbs. In *medusifera* and *madrasensis* cirri are found at all tentacle bulbs in all stages of development. In an undescribed species from Panama (resembling *malayensis*) cirri are present on the bulbs of the fully developed tentacles and on the larger of the rudimentary bulbs, but not on the quite young bulbs. In young specimens of *schulzei*, Künne has observed cirri also at the large tentacles. In the arrangement of the cirri, thus, almost all possibilities are represented in the species already described, so that this feature gives no occasion for a subdivision of genus, and in all other respects the differences between the various species are only differences of degree. We can state, accordingly, that the species mentioned above all belong to one genus, for which we may give the following diagnosis:

Helgicirrho Hartlaub: Eucopidæ with a stomachal peduncle; with gonads restricted to the subumbrella parts of the radial canals; with a large and undetermined number of lithocysts; with lateral, spiral cirri at the base of some or all of the tentacle bulbs.

I wish to thank Mr. E. T. Browne, who has been kind enough to read my manuscript and criticize it, before it was sent to print. I also thank Mr. F. S. Russell, Plymouth, for valuable information.

List of Literature.

1865. Agassiz, A. North American Acalephæ. — Cambridge.
 1899. Agassiz, A. & Mayer, A. G. Acalephs from the Fiji Islands. — Bull. Mus. Comp. Zool. Harvard Coll. Vol. 32, no. 9. — Cambridge.

1902. Agassiz, A. & Mayer, A. G. Medusæ. — Rep. sci. res. exped. trop. Pacific. — Mem. Mus. Comp. Zool. Harvard Coll. Vol. 26, no. 3. — Cambridge.
1862. Agassiz, L. Contrib. Nat. Hist. U. S. America. 2' Monogr. Vol. IV. — Boston.
- 1907a. Annandale, N. Notes on the freshwater fauna of India, No. XI. — Journ. Proc. Asiatic Soc. Bengal. N. S. Vol. 3, no. 2. — Calcutta.
- 1907b. — The fauna of brackish ponds at Port Canning, Lower Bengal. I. — Rec. Indian Mus. Vol. 1. — Calcutta.
- 1907c. — do. IV. — Ibid.
1913. Apstein, I. Beiträge zur Kenntnis der Leptomedusen. — Zool. Jahrb., Anat. u. Ontog. Bd. 36. — Jena.
1904. Bigelow, H. B. Medusæ from the Maldive Islands. — Bull. Mus. Comp. Zool. Harvard Coll. Vol. 39. — Cambridge.
1909. — The Medusæ. — Rep. Sci. Res. Exped. Eastern Trop. Pacific... by the "Albatross". — Mem. Mus. Comp. Zool. Harvard Coll. Vol. 37. — Cambridge.
1919. — Hydromedusæ, Siphonophores, and Ctenophores of the "Albatross" Philippine Expedition. — U. S. Nat. Mus., Bull. 100, Vol. I, part 5. — Washington.
1892. Bles, E. J. Notes on the plankton observed at Plymouth... — Journ. Mar. Biol. Assoc. N. S. Vol. 2. — Plymouth.
1878. Böhm, R. Helgolander Leptomedusen. — Jenaische Zeitschr. f. Naturwiss. Bd. XII (N. F. Bd. V). — Jena.
1905. Broch, Hj. Zur Medusenfauna von Norwegen. — Bergens Museums Aarbog 1905. — Bergen.
1883. Brooks, W. K. Notes on the Medusæ of Beaufort, N. C. — Johns Hopkins Univ. Stud. Biol. Lab. Vol. 2, no. 4. — Baltimore.
1898. Browne, E. T. On the pelagic fauna of Plymouth for September 1897. — Journ. Mar. Biol. Ass. N. S. Vol. 5. — Plymouth.
- 1905a. — Hydromedusæ... — Fauna and Geography, Maldive and Laccadive Archipelagoes. Vol. II, part 3. — Cambridge.
- 1905b. — Report on the Medusæ. — Ceylon Pearl Oyster Fisheries. Suppl. Rep. no. 27. — London.
- 1905c. — A Report on the Medusæ found in the Firth of Clyde. — Proc. R. Soc. Edinburgh. Vol. 25. — Edinburgh.
1896. Chun, C. Beiträge zur Kenntniss Ost-Afrikanischer Medusen und Siphonophoren. — Mittheil. Naturhist. Mus. XIII. — Hamburg.
1881. Claus, C. Beiträge zur Kenntniss der Geryonopsiden- und Eucopiden-Entwicklung. — Arbeit. Zoolog. Inst. Wien. T. IV. — Wien.
1891. Crawford, J. H. Further note on the Medusæ of St. Andrews Bay. — Ann. Mag. nat. Hist. Ser. 6, vol. 8. — London.
1829. Eschscholtz, Fr. System der Acalephen. — Berlin.
1923. Foerster, R. E. The Hydromedusæ of the West Coast of North America. — Contrib. Canad. Biol. N. S. Vol. I. — Toronto.
1848. Forbes, E. A Monograph of the British Naked-eyed Medusæ. — London.

1847. Frey, H. & Leuckart, R. Beiträge zur Kenntniss wirbelloser Thiere. — Braunschweig.
1894. Garstang, W. Faunistic notes at Plymouth during 1893—1894. — Journ. Mar. Biol. Ass. N. S. Vol. 3. — Plymouth.
1856. Gegenbaur, C. Versuch eines Systemes der Medusen. — Zeitschr. wiss. Zool. Bd. VIII. — Leipzig.
1886. Goette, A. Verzeichniss der Medusen welche von Dr. Sander... gesammelt wurden. — Sitzber. Akad. d. Wissensch. Bd. 39. — Berlin.
1864. Haeckel, E. Beschreibung neuer craspedoter Medusen aus dem Golfe von Nizza. — Jenaische Zeitschr. f. Med. u. Naturwiss. Bd. I. — Leipzig.
1879. — Das System der Medusen. — Jena.
1894. Hartlaub, Cl. Die Coelenteraten Helgolands. — Wiss. Meeresunters., Abt. Helgoland. N. F. Bd. I. — Kiel u. Leipzig.
1908. — Méduses recueillies en 1904 par M. Ch. Gravier dans le golfe de Tadjourah (Somalie française). — Bull. Mus. nat. d'hist. nat. T. 14. — Paris.
- 1909a. — Über Thaumantias pilosella Forbes und die neue Lafoëiden-Gattung Cosmetira. — Zool. Anzeiger Bd. 34. — Leipzig.
- 1909b. — Über einige von Ch. Gravier in Djibouti gesammelte Medusen. — Zool. Jahrb. Abt. Syst. Bd. 27. — Jena.
1904. Johansen, A. C. & Levinsen, Chr. in: De danske Farvandes Plankton. — Kgl. Danske Vidensk. Selsk. Skrifter. 6. R. nat.-math. Afd. XII, 3. — Kjøbenhavn.
1924. Kramp, P. L. Medusæ. — Rep. Danish Oceanogr. Exped. 1908—10 to the Mediterranean etc. Vol. II, H. 1. — Kjøbenhavn.
1927. — The Hydromedusæ of the Danish Waters. — Kgl. Danske Vidensk. Selsk. Skrifter. 8. R. nat.-math. Afd. XII, 1. — Kjøbenhavn.
1930. — Hydromedusæ collected in the south-western part of the North Sea... in 1903—1914. — Mém. Mus. R. d'hist. nat. de Belgique. Mém. 45. — Bruxelles.
1932. — A Revision of the Medusæ belonging to the Family Mitrocomidæ. — Vidensk. Meddel. Dansk naturhist. Foren. Bd. 92. — Kjøbenhavn.
1933. — Craspedote Medusen III, Leptomedusen. — Nordisches Plankton XII. — Kiel u. Leipzig.
1934. Künne, C. Über die Leptomedusen Helgicirra schulzii Hartlaub und Eirene viridula (Péron und Lesueur). — Zool. Anzeiger Bd. 106. — Leipzig.
1909. Lo Bianco, S. Notizie biologiche... degli animali del golfo di Napoli. — Mittheil. Zool. Stat. Neapel. Bd. 19. — Berlin.
1893. Maas, O. Die craspedoten Medusen. — Ergebn. d. Plankton-Exped. Bd. II, K. c. — Kiel u. Leipzig.
1905. — Die craspedoten Medusen der Siboga-Expedition. — Siboga-Expeditie. Monogr. X. — Leiden.
1909. — Japanische Medusen. — Abhandl. math.-phys. Kl. d. K. Bayer. Akad. d. Wissensch. Supplbd. I, Abh. 8. — München.

- 1900a. Mayer, A. G. Descriptions of new and little-known Medusæ from the western Atlantic. — Bull. Mus. Comp. Zool. Harvard Coll. Vol. 37. — Cambridge.
- 1900b. — Some Medusæ from the Tortugas, Florida. — Ibid.
1904. — Medusæ of the Bahamas. — Mem. Nat. Sci. Mus. Brooklyn Inst. Arts. Sci. Vol. I, No. 1. — Brooklyn.
1910. — *Medusæ of the World*. — Washington.
1857. McCrady, J. Gymnophthalmata of Charleston Harbor. — Proceed. Elliot Soc. Nat. Hist. Vol. 1. — Charleston.
1932. Menon, M. G. K. The Hydromedusæ of Madras. — Bull. Madras Governm. Mus. N. S. nat. hist. sect. Vol. III, no. 2. — Madras.
1886. Metschnikoff, E. Medusologische Mittheilungen. — Arb. Zool. Inst. Wien. T. 6. — Wien.
1909. Neppi, V. Über Anomalien bei Medusen der Gattung Irene und Tima. — Arch. f. Entwickl.-mech. d. Organismen. Bd. 28. — Leipzig.
1910. — Über die im Golfe von Triest vorkommenden Medusen der Gattungen Irene und Tima. — Arb. Zool. Inst. Wien. T. XVIII. — Wien.
1912. — Adriatische Hydromedusen. — Sitzber. k. Akad. Wissensch. math. nat. Kl. Bd. 121. — Wien.
1913. Neppi, V. & Stiasny, G. Die Hydromedusen des Golfes von Triest. — Arb. Zool. Inst. Wien. T. 20. — Wien.
1809. Péron & Lesueur. Tableau des caractères génériques et spécifiques de toutes les espèces de Méduses connues jusqu'à ce jour. — Ann. Mus. d'hist. nat. T. 14. — Paris.
1931. Plymouth Marine Fauna. 2nd edition. — Journ. Mar. Biol. Ass. Plymouth.
1925. Ranson, G. Quelques observations sur le Plankton et liste des Méduses recueillies par la Tanche pendant sa croisière de 1924. — Bull. Mus. nat. d'hist. nat. Paris. Année 1925.
1926. — Sur quelques Méduses des côtes de la Manche. — Ibid. Année 1926.
1933. — Sur une Méduse de l'océan Indien, *Phortis pellucida* (Will). — Bull. de l'Inst. Océanogr. Monaco. No. 628.
- 1934a. — Révision de la collection des Méduses du Muséum National d'Histoire Naturelle. IV. — Bull. Mus. nat. d'hist. nat. Paris. 2. Sér. T. VI. no. 1.
- 1934b. — Révision... V. — Ibid. T. VI. no. 2.
- 1934c. — Révision... VI. — Ibid. T. VI. no. 3.
1874. Schulze, F. E. Coelenteraten. — Zool. Ergebn. d. Nordseefahrt... 1872. — II. Jahresber. d. Komm. wiss. Unters. d. deutsch. Meere in Kiel. — Berlin.
1910. Stiasny, G. Beobachtungen über die marine Fauna des Triester Golfes im Jahre 1909. — Zool. Anzeiger Bd. 35. — Leipzig.
1928. — Hydromedusen aus der Java-See. — Zool. Mededeel. 's Rijks Museum v. nat. hist. Leiden. Deel. XI, 4. — Leiden.
1909. Torrey, H. B. The Leptomedusæ of the San Diego Region. — Univ. Calif. Publ. Zool. Vol. 6. — Berkeley.

1911. Vanhöffen, E. Die Anthomedusen und Leptomedusen... — Wiss. Ergebn. D. Tiefsee-Exped. ("Valdivia") Bd. 19. — Jena.
- 1912a. — Die craspedoten Medusen des "Vettor Pisani" — Zoologica Heft 67. — Stuttgart.
- 1912b. — Die craspedoten Medusen der Deutschen Südpolar-Expedition. — Deutsche Südpol.-Exped. 1901—03. Bd. XIII. Zool. V. — Berlin.
1913. — Über westindische Medusen. — Zool. Jahrb. Suppl. 11, Heft 3. Jena. —
1844. Will, J. G. F. Horae Tergestinae. — Leipzig.

(Separate copies ready from the press March 30th, 1936.)

