The life cycle of *Tiaropsidium roseum* (Tiaropsidae fam. nov., Leptomedusae, Cnidaria)*

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ABSTRACT: The life cycle of *Tiaropsidium roseum* is described. The hydroid has different features from those of other hydroids of the family Mitrocomidae to which *Tiaropsidium* was formerly referred. The medusae have compound sense organs, constituted by statocysts and endodermal ocelli, and two types of tentacles. This complex of characters requires the proposal of a new family, the Tiaropsidae, comprising the genera *Tiaropsis*, *Tiaropsidium* and *Octogonade*.

1. INTRODUCTION

The genus *Tiaropsidium* comprises six species, namely: *Tiaropsidium atlanticum* Russell, *T japonicum* Kramp, *T kelseyi* Torrey, *T mediterraneum* (Metschnikoff), *T polyradiatum* Kramp, *T roseum* (Maas) (see Kramp 1961, 1968, Bouillon 1985, for diagnoses). The life cycle of *T mediterraneum* has alone been studied: Hadzi (1915) described the hydroid of this species as *Camélia vilae velebiti*, even if he recognized the identity of the medusa as *Tiaropsidium (Tiaropsis) mediterraneum*. Huvé (1952) regarded *Camélia vilae velebiti* as conspecific with *Tiaropsidium mediterraneum*. Subsequently Hadzi (1958) discussed Huvé’s (1952) synonimization of *Camélia vilae velebiti* with *Tiaropsidium mediterraneum*, but without giving sufficient support for the retention of *Camélia versus Tiaropsidium* against the rule of priority. The description of the life cycle of another species of *Tiaropsidium, (T. roseum)* corroborates the previous impression of homogeneity of the genus in both hydroid and medusa stages, and allows discussion of its family affinity.


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2. MATERIAL AND METHODS

The hydroid of *T. roseum* was collected in August 1986, growing on algae living on the bottom of the lagoon of Laing Island, a coralline island off the north coast of Papua New Guinea (Bouillon et al. 1986). The colony was kept in culture. The water was changed daily, the temperature was about 28°C, and the colony was fed daily with *Artemia* nauplii. Gonothecae developed three weeks after collection. The medusae released in culture lived only a few days. Young medusae are generally abundant in the lagoon where the hydroid was collected (Bouillon 1984, Bouillon et al. 1986).
3. RESULTS

3.1. Description of the hydroid

Colony stolonal. Hydrotheca tubular, about 0.3 mm high, with straight walls, with short, wavy or straight peduncle, not annulated (Fig. 1). Diaphragm present, very thin. Operculum of 6-7 flaps, sharply demarcated from hydrothecal margin; flaps with broad base and rounded apex. Hydranth completely retractable into hydrotheca, about 1 mm long when completely extended (Fig. 2); hypostome rounded, tentacles about 14 in a circlet, amphicoronate (alternately elevated and depressed); elevated tentacles longer than depressed ones, no intertentacular web. Large nematocysts (merothrichous isorhizae) (Fig. 2) at tentacle base, microbasic mastigophores on tentacles and scattered over hydranth column. Gonotheca borne on hydrorhiza, about 0.5 mm high, strongly compressed, base narrow, apex wide, with a single medusa bud (Fig. 2).

3.2. Description of medusa

Newly released medusa (Fig. 3) about 1.5 mm wide, 1.2 mm high, with four long tentacles, four interradial tentacular, 16 adradial shorter tentacular, eight compound sense organs each with an ocellus and an open statocyst containing six to nine statoliths (Fig. 4), and four radial canals; manubrium wide, quadratic, with four lips, one third of subumbrellar chamber. Scattered nematocysts (microbasic mastigophores) on exumbrella. Nematocysts much more abundant in tentacular than tentacles.

Young medusae of the same size are abundant in the plankton from January to July, mainly at night (Bouillon et al. 1986).

Nematocyst of adult medusa, microbasic mastigophores and basitrichous isorhizae (Fig. 5).

3.3. Remarks

The hydroid of Tiaropsidium roseum differs from that of T.mediterraneum in several respects. The number of opercular flaps is lower in T.roseum, and the flaps of T.mediterraneum are pointed, whereas those of T.roseum are rounded. Tiaropsidium mediterraneum has a short, annulated stem, which is reduced in T.roseum. The hydranth of T.mediterraneum has been described by Hadzi (1915, 1958), but no figure of a living, extended specimen was provided. Comparison of Hadzi’s drawings with the present material indicates, nevertheless, that the hydranths of the two species are quite similar. In the hydroid stage of Leptomedusae dimorphism of the tentacles (the elevated ones being longer than the depressed ones) even if figured many times by several authors, has seldom been discussed, but it seems to be a common feature to many species. In preserved material all contracted
Figure 2. *Tiaropsidium roseum*. Extended hydranth and gonotheca. Nematocysts of hydroid: merotrichous isorhizae (large, discharged and undischarged), microbasic mastigophore (undischarged).
tentacles tend to be of similar length, but living specimens have many different features from dead ones. As demonstrated by Cornelius (1987) the morphology of the living hydranth often provides useful information for the discrimination of species and should be taken into account in taxonomic descriptions.

The big merothrichous isorhiza at the bases of the tentacles of the hydranth are identical in structure with those of species of *Hydranthea* and *Campalecium*.
Figure 4a. *Tiaropsis roseum*; compound sense organs of medusae, with black ocellus (Oc.) and a statocyst (St.); b. *Tiaropsis multicirrata*; section of endodermal ocellus (after Linko 1900a); 1: entoderm, 2: radial canal, 3: subumbrellar ectoderm, 4: sensory epithelium, 5: upper nerve ring, 6: sensory epithelium, 7: pigment cup of ocellus, 8: statocyst, 9: velum, 10: exumbrellar ectoderm, 11: lower nerve ring.
Figure 5. *Tiaropsidium roseum*. Nematocysts of adult medusae (microbasic mastigophores and basitrichous isorhizae).

(Haleciidae) (Boero & Sarà, 1987). This could reinforce Boero & Sarà’s hypothesis that the Haleciidae and the Campanulinidae s.l. are phylogenetically close. But, following Werner’s (1965) description of merothrichous isorhizae these nematocysts have almost never been recorded again. They could have been confused with microbasic or macrobasic mastigophores, as for example by Boero (1981) for the nematocysts of *Campalecium medusiferum* Torrey. Our observations show that they are much more common than previously suspected.

The gonotheca of *Tiaropsidium roseum* is similar to that of *T.mediterraneum* and is different from those of most other Leptomedusae, being developed almost
in one plane. The medusa bud, then, is compressed by the gonotheca. The newly released medusa is almost identical with a young specimen of *T.roseum* figured by Mayer (1910). The sense organs of *Tiaropsidium* medusae, having both ocelli and statocysts, are among the most complicated ones in hydromedusae: *Tiaropsis* and *Octogonade* are the only other known genera with such compound sense organs. Bouillon & Nielsen (1974) have described a sense organ with a possible photoreceptory function at the base of the statocyst of *Clytia hemisphaerica* (Leptomedusae, Campanulariidae), but its morphology is very different from that of ocelli and could have evolved independently of those of other Leptomedusae.

4. DISCUSSION

Bouillon (1985) reported the hydroids of Mitrocomidae, to which *Tiaropsidium* is referred, as being 'Cuspidella' like. The hydroids of both *T.mediterraneum* and *T.roseum* have opercular flaps sharply demarcated from the hydrothecal margin, whereas those of 'Cuspidella' are not demarcated from the hydrotheca. In this respect *Tiaropsidium* resembles *Calycella* (which has fixed gonophores) and *Lovenella* (which has free medusae). On the other hand Boero (1987) has described a species of *Phialella* with opercular flaps demarcated from hydrothecal margin, the other species of this genus not having demarcated flaps. This character, then, can evidently be inconstant even within a recognized genus.

The features of the sense organs of *Octogonade, Tiaropsis* and *Tiaropsidium* are completely different from those of other hydromedusae, comprising an ocellus and a statocyst which form a compound sense organ, in some way analogous to the rhopalium of the scyphomedusae. The ocelli of the three genera are endodermal in origin (Linko 1900a, b, Singla 1974) (Fig. 4). Kramp (1932) considered this type of ocellus as unique among hydromedusae, but Mayer (1910: 210) cited, without histological description, endodermal ocelli in *Toxorchis kellneri*. These sense organs are anyhow unique because of their association between endodermal ocelli and open statocysts. Furthermore, the sensory cells of these ocelli are inverted, as in higher animals. The presence of such a complex organ in a hydromedusan is usually here considered as a family character and a new family, the Tiaropsidae fam. nov., is proposed thereafter. Kramp (1932), in a revision of the Mitrocomidae, divided this family into four natural groups, putting *Tiaropsis, Tiaropsidium* and *Octogonade* together in the fourth (see also Hadzi, 1958). He proposed this grouping mainly because of the presence of the peculiar ocelli which ‘distinguish them not only from the other Mitrocomidae, but from all other hydromedusae as well’ (p. 376).

**Diagnosis of Tiaropsidae.** Hydroids with opercular flaps demarcated (*Tiaropsidium*) or not demarcated (*Tiaropsis*) from hydrothecal walls. Hydrothecae tubular, with reduced peduncle. Hydranths without intertentacular web. Gono-
theca tubular, operculate (*Tiaropsis*) or rounded, compressed, without operculum (*Tiaropsidium*). Merotrichous isorhizae present in hydranth of *Tiaropsidium*; nematocysts of other genera unknown. Medusae with four (*Tiaropsis* and *Tiaropsidium*) or eight (*Octogonade*) radial canals. Tentacles of two types (long normal tentacles and short tentacularae) in *Octogonade* and *Tiaropsidium*, of one type (tentacularae) in *Tiaropsis*. Sense organs compound, comprising ocelli and open statocysts. Microbasic mastigophores and basitrichous isorhizae present in adult medusae.

Three genera are referred to the Tiaropsidae, namely: *Tiaropsis*, *Tiaropsidium* and *Octogonade*. These genera have to be removed from Mictrocomidae, the diagnosis of this family then being modified to read as follows:

*Diagnosis of Mitrocomidae.* Hydroids 'Cuspidella' like; hydrothecae sessile and tubular, with operculae comprising numerous flaps not sharply demarcated from hydrothecal margins. Gonothecae, where known, oval, with short peduncles, growing from hydrorhizae. Medusae with four or more simple radial canals; with bases of manubria attached to subumbrellae along continuation of radial canals. Marginal tentacles hollow, marginal cirri present in some genera. Gonads oval or linear, on radial canals. Statocysts open.

The genera referred to Mitrocomidae are: *Cosmetira, Cosmetirella, Cyclocanna, Foersteria, Halistaura, Halopsis, Mitrocoma*, and *Mitrocomella* (see Bouillon 1985, for diagnoses).

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