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HYDROID AND YOUNG MEDUSA STAGES OF *DIPURENA* *STRANGULATA* (HYDROZOA, CORYNIDAE)^{1, 2}

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The genus *Dipurena* was established by McCrady (1857) for two species of Anthomedusae from Charleston Harbor, South Carolina. Mayer (1910a) synonymized McCrady's genus with *Slabberia* of Forbes (1846), but later (Mayer, 1910b) recognized *Dipurena* as the valid name of the genus because *Slabberia* had been applied to a leptomedusan by Oken (1815).

Kramp (1961) discussed seven species of *Dipurena* but considered at least two of them doubtful, *D. brownei* (Bigelow) and *D. dolichogaster* Haeckel. The validity of *D. pyramis* (Haeckel), a somewhat aberrant species of uncertain systematic position, has also been questioned (Kramp, 1959). The remaining four, *D. halterata* (Forbes), *D. strangulata* McCrady, *D. ophiogaster* Haeckel and *D. reesi* Vannucci, are relatively well-known and recognized species. An additional species, *D. simulans*, was briefly described by Bouillon (1965). Of the latter five, both hydroid and medusa phases are known for all but *D. strangulata*, the type species of the genus and a rather common hydromedusa along the United States east coast. During a recent survey of the Hydrozoa in southern Chesapeake Bay, unidentified capitate hydroids were found on sponges in the York River, Virginia. Through life-history studies the hydroids were linked to the medusa *D. strangulata*. A description of the hydroid and young medusa is the purpose of this paper.

MATERIALS AND METHODS

The hydroid *Dipurena strangulata* was found on colonies of the sponge *Microciona prolifera* collected from oyster grounds by dredging and from pier

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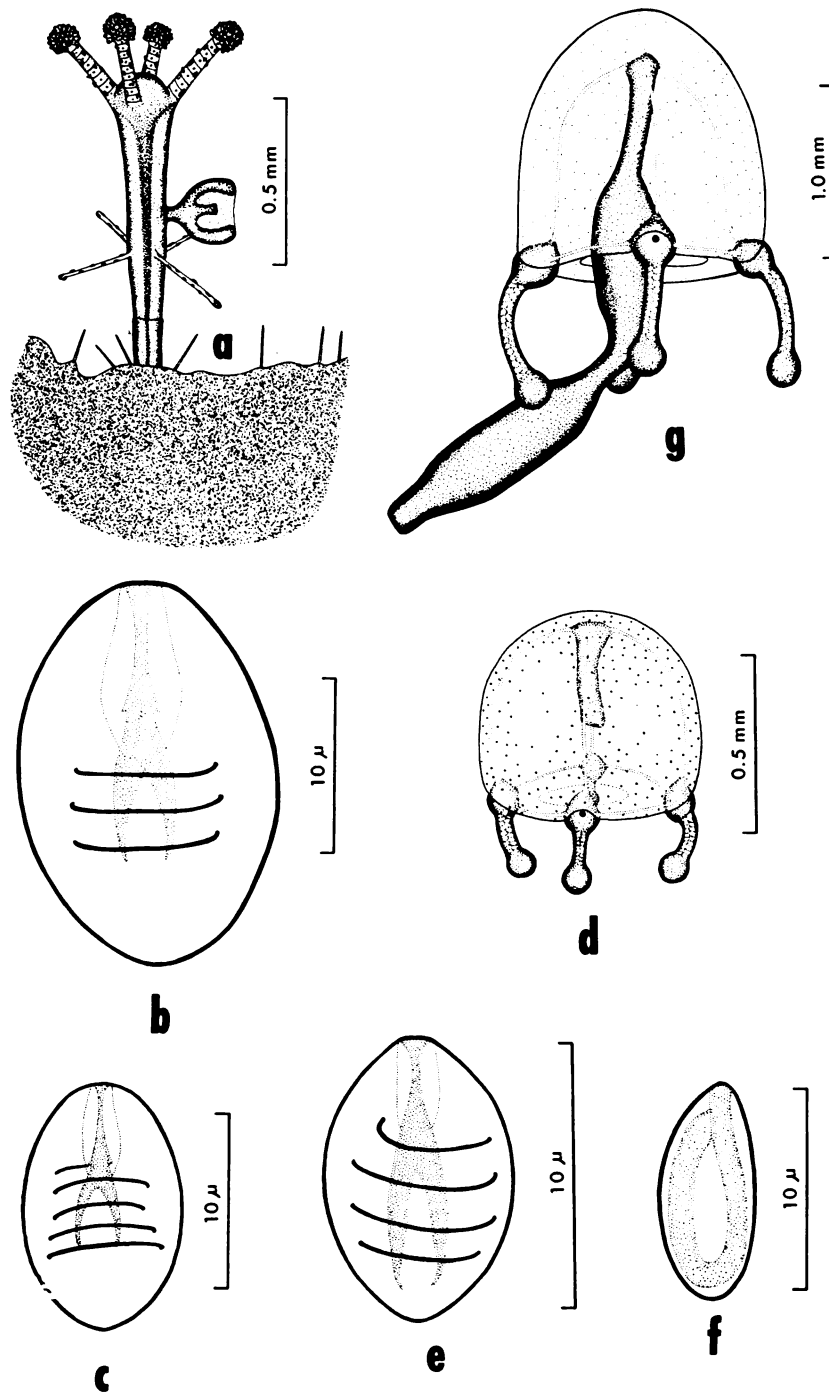


FIGURE 1. *Dipurena strangulata*, a. hydroid, b. large stenotele of hydroid, c. small stenotele of hydroid, d. young medusa, e. stenotele of young medusa, f. desmoneme of young medusa, g. mature, 6-day old laboratory-reared medusa.

pilings by SCUBA diving. All descriptions were made from freshly collected, living specimens, obtained at Gloucester Point, Virginia (37°14.7'N, 76°30.0'W). Medusae were obtained by isolating hydroids with medusa buds in large finger bowls. Liberated medusae were removed to petri dishes containing filtered seawater of 19‰ salinity. Cultures were maintained in an air-conditioned room at 23 ± 3 C, seawater was changed daily, and medusae were fed *Artemia* nauplii. Specific identification was made from medusae reared to the adult stage. The plankton of the York River at Gloucester Point was monitored for medusae at weekly intervals from September 1966 through December 1967 using a #20 mesh plankton net with an opening diameter of 11.5 cm.

DESCRIPTION

Hydroid (Fig. 1a)—Zooids of one type, arising singly from a stolon network embedded in the sponge substrate, perisarc thin, smooth, terminating slightly below the filiform tentacles. Hydranth short, nearly cylindrical when extended, reaching 0.8–1.0 mm above the substrate, 0.15–0.20 mm wide at the distal end, 4 filiform tentacles in a proximal whorl, 0.15–0.19 mm long, 0.03 mm wide, occurring about $\frac{1}{3}$ of the distance apically, 4–6 capitate tentacles in a distal whorl, usually extending above the dome-shaped hypostome, 0.2 mm long, 0.05 mm wide, with 8–11 endodermal cells, terminal knobs 0.08–0.10 mm wide.

Nematocysts (Figs. 1b, c):

stenoteles

large $20.6\text{--}25.0 \times 14.4\text{--}18.2 \mu$ (undischarged)

small $11.9\text{--}17.2 \times 7.9\text{--}11.3 \mu$ (undischarged)

Medusa (Fig. 1d)—Medusa buds attached by a short stalk to the hydranth just distal to the filiform tentacles, or on blastostyles, a maximum of 2 medusa buds observed concurrently on a single hydranth. Marginal tentacles 4, well developed before liberation, tentacle bulbs 4, of moderate size, each with a single, dark red, abaxial ocellus. Velum broad, mesoglea thin, radial canals and ring canal present, narrow. Manubrium tubular, tapering slightly from a somewhat bulbous base. Exumbrella with a few scattered nematocysts.

At liberation, medusa bell-shaped, 0.55–0.60 mm high, 0.50–0.55 mm wide, manubrium about 0.25 mm long. Each marginal tentacle with a single terminal knob.

Nematocysts (Figs. 1e, f):

stenoteles $10.4\text{--}11.2 \times 6.9\text{--}7.8 \mu$ (undischarged)

desmonemes $10.0\text{--}11.7 \times 4.2\text{--}4.9 \mu$ (undischarged)

Hydroids of *Dipurena strangulata* were first noticed on 18 June, 1967 at Gloucester Point. The hydroids were relatively common on *Microciona prolifera* and had probably been overlooked previously because of their small size. Medusa buds on these specimens suggested that the hydroid had been active for some time. Specimens were collected regularly at Gloucester Point in depths from 1.5 to 4 m throughout the rest of the summer and autumn until mid-November. During this time water temperatures ranged from a high of 28 C to a low of 10 C and salinities varied approximately from 18‰ to 24‰.

The medusa of *D. strangulata* was first collected at Gloucester Point on 29 June, 1967, and during the summer it was one of the most abundant medusae in the plankton samples. The manubrium of living specimens from the plankton was greenish and the tentacle bulbs varied from pink to red. In laboratory-reared specimens the manubrium turned green one or two days after liberation while the tentacle bulbs were cream-colored. Ocelli were dark red in newly liberated medusae but in older specimens appeared almost black. Gonads developed in cultured medusae after about three days, a constriction divided the gonad into two rings by four days, and by six days the manubrium extended beyond the velum (Fig. 1g). All laboratory-reared medusae still living 12 days after liberation from the hydroid were preserved.

The following specimens of *D. strangulata* have been deposited in the Museum of Natural Sciences, National Museums of Canada:

1. *Dipurena strangulata*, hydratype on *Microciona prolifera*, N.M.C. Cat. No. 568.
The term hydratype was introduced by Rees and Thursfield (1965) for material on which an original description is based of a hydroid whose medusa is previously described.
2. *Dipurena strangulata*, young medusa, 10 specimens, N.M.C. Cat. No. 609.
3. *Dipurena strangulata*, adult medusae, 3 specimens. N.M.C. Cat. No. 610.

DISCUSSION

The genus *Dipurena*, belonging to the family Corynidae, is characterized by having the gonads divided into two or more distinct rings about the manubrium of the medusa, and by a *Coryne*-like hydroid, having all tentacles capitate, or with both capitate and reduced filiform tentacles (Russell, 1953). Of the described *Dipurena* hydroids, *D. strangulata* most resembles *D. reesi*. The two species differ markedly from others of the genus in having a single whorl of capitate tentacles. In lacking additional scattered capitate tentacles the hydroids of *D. reesi* and *D. strangulata* resemble *Cladonema radiatum* Dujardin closely. Finding it practically impossible to distinguish *D. reesi* and *C. radiatum* from the descriptions alone, Brinckmann and Petersen (1960) studied the hydroids of both species and discovered that differences existed in: (1) the shape of the knob on the capitate tentacles; (2) the number of endodermal cells in these tentacles; (3) the morphology and complement of nematocysts; and (4) the position and shape of the filiform tentacles. In having stenoteles only, rather than stenoteles and microbasic euryteles, and in having no distinct terminal swelling at the distal end of the filiform tentacles, *D. strangulata*, like *D. reesi*, differs from *C. radiatum*. In certain other characteristics, however, *D. strangulata* differs from *D. reesi* and is similar to *C. radiatum*: (1) having the filiform tentacles about one-third of the distance apically on the hydranth rather than half way; (2) having fewer endodermal cells in the capitate tentacles (7-8 in *C. radiatum*, 8-11 in *D. strangulata*, and about 18 in *D. reesi*).

Although the hydroids of *C. radiatum*, *D. reesi* and *D. strangulata* may be similar, the morphological differences between their medusae are such that the more highly evolved and specialized *C. radiatum* is placed in a separate family (Rees, 1957). Rees noted a greater diversity of form occurs generally in medusae

because of the free planktonic phase, while the hydroids, being sedentary, frequently persist in a somewhat simpler form.

A thorough description of the adult medusa of *D. strangulata* was given by Mayer (1910a) but his description of the juvenile does not agree with my observations. In Mayer's specimens the bell was cylindrical with vertical sides, a slight apical projection was present, and two of the four marginal tentacles were undeveloped and represented by basal bulbs. Apparently laboratory culture of these medusae was not undertaken by Mayer and a misidentification could have been made in piecing together the life history from stages in plankton samples. Mayer's description closely resembles the young medusa of *Linvillea agassizi* (McCrady) obtained from the hydroid at Gloucester Point. According to Mayer both of these species were very abundant in Charleston Harbor during summer and early autumn, and he may have mistaken juvenile *L. agassizi* for *D. strangulata*. None of the species of *Dipurena* are known to resemble *Linvillea* in having two of the four marginal tentacles rudimentary at liberation.

While it may occur on other substrates, the hydroid of *D. strangulata* was found only in association with the sponge *Microciona prolifera*. Two other species of the genus were also originally described from a sponge substrate: Rees (1939) described *D. halterata* on the sponge *Haiclona cancellata*, and Bouillon (1965) found *D. simulans* developing in the oscula of the sponge *Adocia simulans*. Vannucci (1956) observed *D. reesi* growing on glass and *Ulva* in an aquarium, and *D. ophiogaster* was found on the stipe of an alga (Rees, 1941).

In addition to *D. strangulata*, several species of *Dipurena* have been described along the United States east coast. *D. cervicata*, described by McCrady (1857) from a single specimen, was synonymized with *D. strangulata* by Mayer (1910a) after a detailed study of the medusae in Charleston Harbor. *D. conica*, described by A. Agassiz in L. Agassiz (1862) from Buzzards Bay, Massachusetts, was also synonymized by Mayer (1910a) with *D. strangulata*. Earlier separation of these two had been based primarily on bell shape and manubrium length, characters showing wide variation in Mayer's specimens of *D. strangulata* from Charleston. Two species described by Mayer (1900) from Tortugas, Florida, *D. picta* and *D. fragilis*, have since been placed in synonymy. *D. picta* was synonymized by Mayer (1910a) with *D. catenata*, a synonym of *D. halterata* (Kramp, 1961). *D. fragilis* was relegated to a subspecies of *D. strangulata* by Mayer (1910a), but Kramp (1961) considered it fully synonymous. Hargitt's (1904) report of *Dipurella clavata* was synonymized by Mayer (1910a) with *D. strangulata*. However, Hargitt's (1902) original description of *D. clavata* appears to have been based on a juvenile specimen of *Linvillea agassizi*. Thus, the genus *Dipurena* is represented by two recognized species along the eastern United States; *D. strangulata* occurring from New England to Florida, and *D. halterata* occurring in Florida.

SUMMARY

The hydroid stage in the life history of *Dipurena strangulata*, a relatively well-known medusa along the United States east coast, is described for the first time. A previous description of the young medusa does not accord with observations recorded here, but is similar to and may have been based on young *Linvillea agassizi* rather than *D. strangulata*. Of the described hydroids of *Dipurena*, *D. strangulata*

is most like *D. reesi* morphologically, but differs in the position of the filiform tentacles and the number of endodermal cells in the capitate tentacles. The status of the various species of *Dipurena* described from the North American Atlantic coast is reviewed.

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