

NEW DISTRIBUTION PATTERNS OF GREEN FLUORESCENCE IN SMALL HYDROMEDUSAE

By

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Abstract

New distributional patterns of green fluorescence are found in four species of small hydromedusae such as *Bougainvillia bitentaculata*, *Eucheilota paradoxa*, *Halitiara formosa*, and *Solmaris rhodoloma* collected in July and November in 2010 at Shirahama, Wakayama Prefecture, Japan, and they are reported with photographs and notes.

Introduction

Based on examinations of diversified hydromedusae together with eudoxid of siphonophora, 12 green fluorescence distribution patterns have been reported (Kubota *et al.* 2008, 2009; Kubota 2010). In the present paper new fluorescence patterns, including hitherto unreported combinations of fluorescent body parts, are shown with photographs and notes.

Materials and methods

By towing a small plankton net vertically and/or horizontally in bays, or by hand-scooping from the surface seawater, four species of small (0.72-3.43 mm in umbrella diameter) hydromedusae were collected at Shirahama, Wakayama Prefecture in July 2010 (*Eucheilota paradoxa* bearing medusa buds) and in November 2010 (*Halitiara formosa*, *Solmaris rhodoloma*, and *Bougainvillia bitentaculata*). Most of the specimens examined here were immature except for *Halitiara formosa* in which female and male could be obtained together with an immature medusa.

Each individual of living medusa was placed in a depression slide glass and its fluorescence distribution pattern was observed under a epi-fluorescence microscope (Nikon ECLIPSE 80i, Japan) with blue light excitation (using the B-2A filter set). All photographs are shown as fluorescence images superimposed on transmission images of the same individuals. All observations were made within several hours after collection. One immature medusa of

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Halitiara formosa was examined for a week just kept it in a 60 ml polystyrene vessel in a laboratory without food at 25°C to confirm constant pattern of fluorescence (this medusa died without rejuvenation as is often the case except for the immortal case confirmed in *Turritopsis* spp.: e.g. see Kubota 2008).

Results and Discussion

In the present study, no individual variation was detected in *Halitiara formosa* and *Solmaris rhodoloma* for which multiple individuals, that were collected at the same occasion, could be examined. Up to now, 12 green fluorescence distribution patterns have been reported (Kubota *et al.* 2008, 2009; Kubota 2010), but in this study four new patterns were detected involving novel combinations of fluorescent body parts, particularly sense organs and exumbrella. All these distribution patterns of green fluorescence are listed below and are shown in Plate 1, numbering from the 13th.

- (13) Manubrium + radial canals + tentacles pattern: *Halitiara formosa* (Plate 1 A, B; n = 3).
- (14) Sense organs pattern: *Solmaris rhodoloma* (Plate 1 C: arrow; n = 5).
- (15) Exumbrella + subumbrella + tentacles [+ ?] pattern: *Eucheilota paradoxica* (Plate 1 D; n = 1).
- (16) Exumbrella + subumbrella [+ ?] pattern: *Bougainvillia bitentaculata* (Plate 1 E, F; n = 1).

In a female of *Halitiara formosa*, gonadal fluorescence was clearly displayed including its eggs. In all three specimens of *Halitiara formosa*, fluorescence of oral lips are most bright; no fluorescence on tentacular bulbs (Plate 1 A, B) in contrast to clear fluorescence on tentacles (Plate 1 B). In an immature medusa of *H. formosa* no change of fluorescence distribution pattern has been observed for a week. This result implies that any food taken by this medusa at initial stage of the observations and succeeding starved conditions does not affect fluorescence distribution pattern. Although examined in only one individual in both sexes of *H. formosa*, no sexually differed fluorescence distribution pattern, as is found in *Eugymnanthea japonica* (Kubota *et al.* 2008), was not detected.

As to *Bougainvillia bitentaculata* and *Eucheilota paradoxica*, much more individuals are needful to clarify presence of fluorescence on other body parts than umbrella, therefore in the above two new fluorescence pattern, [+ ?] is added for this possibility. The fluorescence distribution pattern between *Bougainvillia bitentaculata* without eyespots reported here (Plate 1 E, F) and *B. sp.* with eyespots described in Kubota (2010: manubrium pattern) is clearly different, confirming the interspecific difference in this character as is demonstrated in two species of *Eugymnanthea* (Kubota *et al.* 2008).

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Explanation of plate 1

Figures A-F: Unreported four patterns of green fluorescence (fluorescence images superimposed on transmission images of the same individuals except F) in small hydromedusae. A, B: *Halitiara formosa* (mature female: 1.89 mm in diameter); C: *Solmaris rhodoloma* (immature: 3.43 mm in diameter); D: *Eucheilota paradoxica* (immature: 0.96 mm in diameter); E, F: *Bougainvillia bitentaculata* (immature: 0.72 mm in diameter).

