



## Pattern of stigma numbers as a taxonomic character in some didemnid ascidians (Aplousobranchia: Didemnidae)

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### Abstract

Colonial animals are often lacking in taxonomic characters due to their small size and the simple morphology of zooids. Since zooid size is nearly uniform in many colonial ascidians, the stigma numbers in each row can be a useful taxonomic character. To evaluate their potential utility, we investigated intraspecific variations in stigma patterns in a subset of photosymbiotic didemnid ascidians, including five morphotypes of *Didemnum molle*, *Lissoclinum midui*, *Trididemnum clinides*, and *T. nubilum*. Stigma number patterns were almost stable in *L. midui* and *T. nubilum*. In contrast, there was considerable variation in stigma number even among clone zooids within the same colony in *D. molle* and *T. clinides*. Further, the stigma patterns did not differentiate the five morphotypes of *D. molle*. There was no significant correlation between the total number of stigma and the length of the thorax in any of the species examined here, suggesting that stigma number is probably invariable within each zooid. Stigma patterns can be usable as a taxonomic character in didemnid ascidians, particularly in species having one or a few patterns. Even in species with various patterns, the range of variation will be informative once such ranges are comprehensively described for didemnid species.

**Key words:** colonial ascidian, identification key, stigma pattern, Tunicata

### Introduction

Sessile organisms often have simpler morphologies than mobile organisms, due to the absence of motility organs. Among sessile organisms, colonial organisms often have fewer morphological characters than solitary organisms, since each individual, i.e., zooid, is miniaturized and more simplified. This causes difficulties for species identification in colonial species, such as cnidarians and tunicates. Therefore, it is important to evaluate morphological characters for use in taxonomic keys, particularly in colonial organisms.

The Didemnidae is an ascidian family belonging to the suborder Aplousobranchia, in which species are always colonial. The didemnid genera are mainly defined by the morphologies of the testes, vas deferens, and atrial siphon (e.g., Kott, 2001); therefore, even generic identification is sometimes difficult for specimens lacking testes. Colony shape and color can often provide important character states for species identification. Moreover, the numbers of adhesive organs in the larvae and/or number of coils in the vas deferens is necessary to identify some didemnid species; however, these character states are unavailable in colonies outside of the breeding season. Therefore, it is desirable to identify and evaluate taxonomic characters common to all colonies, regardless of season. Except for the genus *Diplosoma*, didemnid ascidians have varying shaped calcareous spicules in the tunic, and the specific shape and size ranges of the spicules in each species can be useful features for specific identification (e.g., Turon 1986; Monniot *et al.* 1991; Kott 2001). However, our quantitative study of spicules in some photosymbiotic didemnids revealed the presence of substantial intraspecific variations in the shape and size of tunic spicules. In addition, spicules are not always crucial features discriminating species (Hirose *et al.* 2010b).

Some tropical didemnids are known to associate with symbiotic cyanophytes, such as *Prochloron* and *Synechocystis* (see Lewin & Cheng 1989). In our faunal survey of the photosymbiotic didemnids of Taiwan–Ryukyu Archipelago (Hirose & Nozawa 2010; Hirose in press, and some references therein), we found