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SHORT COMMUNICATIONS

Biometric investigations on the cnidae of the Aegean colour morphs of *Anemonia viridis*

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The sea anemone *Anemonia viridis* is one of the most common species of the North Aegean Sea. The variety in colour morphs exhibited by this species, causes problems to taxonomy and ecology, and suggests that *A. viridis* should be subdivided into two distinct species according to the colour of the individuals. The approach used in this study was based on the biometrical cnidae characteristics of the two colour morphs (*rustica* and *smaragdina*), as it is known that cnidae biometry has been used as a taxonomic tool for the phylum Cnidaria. More than 20,000 nematocysts were measured to try and find a correlation between these measurements and some body parameters indicative of the maturity grade of the individuals, as potential taxonomic characteristics. Stable cnidae characteristics of the two different colour morphs were compared. However, they differed only in the biometry of the tentacles' a-basitrichs. This slight difference does not support the proposal to subdivide *Anemonia viridis* into two different species.

Cnidae of different functional regions of sea anemones, such as tentacles, pharynx, filaments, column and pedal disc, show a characteristic distribution that is often taxonomically important (Schmidt, 1972; Manuel, 1981; Doumenc & Foubert, 1984; England, 1987). Many studies have dealt with the taxonomic reliability of the nematocysts of sea anemones (Williams, 1996, 1998; Chintiroglou, 1996; Chintiroglou & Simsiridou, 1997; Karalis & Chintiroglou, 1997; Chintiroglou et al., 1997; Allcock et al., 1998). Recently Bulnheim & Sauer (1984) and Williams (1992), attempted to distinguish the two colour morphs of *Anemonia viridis* (*rustica* and *smaragdina*) into two subspecies. Williams (1992) noted that biochemical differences between different populations of a species is insufficient evidence for the existence of a new species, but should also be accompanied by significant morphological variation among the individuals.

As a follow up of recent work on the cnidae of *A. viridis* forma *rustica* (Karalis & Chintiroglou, 1997), the investigation was expanded to include forma *smaragdina*. This was done in an attempt to compare the cnidae of the two colour morphs and find in order substantial evidence to support the separation of *A. viridis* into two different species. The present study is part of a research programme to investigate the taxonomic reliability of cnidae in the Mediterranean sea anemomes.

During the spring of 1986 samples of *A. viridis* were collected from different sites in the north Aegean Sea (Figure 1). A total of 30 specimens were collected. From these, 20 were of forma *rustica* and ten of forma *smaragdina*. The biotopes of the above mentioned areas were all of the photophilic algae biocoenosis (Pérès & Picard, 1964). Samples were randomly collected with respect to size. The methodology followed by Karalis & Chintiroglou (1997) was used to examine the anaesthetized samples and the biometry of cnidae. In all, an excess of 20,000 nematocysts from the 30 individuals were examined. Relationships between wet weight (WW), length (L) and length:width (L:W) ratio, were determined using Spearman's rank correlation test, (r_s). In order to compare cnidae biometry between *rustica* and *smaragdina* populations, the Mann–Whitney *U*-test (Siegel, 1956) was used.

Pair-wise correlations for the biometric parameters of the body of *A. viridis* forma *smaragdina* revealed that there is a positive relation between the two ratios, WW:height of column and WW:diameter of oral disc ($r_s=0.7$, $P<0.05$). Cnidae lengths and widths for *A. viridis* forma *smaragdina* and *rustica* are listed in Table 1. The lengths and L:W ratios of nematocysts in *A. viridis* morph *smaragdina* were not found to be significantly correlated ($P<0.05$) to body weight, and should be regarded as independent of size and/or age. From the comparisons of the morphs *rustica* and *smaragdina* it was found that the differentiating characteristics were length ($P=0.030.05$) and length:width ratio of tentacle a-basitrichs ($P=0.020.05$).

The combined use of biometric methodology and statistical analyses in order to compare the cnidom of different Cnidaria species has only recently been shown to be of importance. Chintiroglou (1996), Chintiroglou & Simsiridou (1997), and Karalis & Chintiroglou (1997), have demonstrated that the length, surface area and volume of several cnidae cannot be used alone as diagnostic taxonomic characteristics for *Actinia equina mediterranea* form I and II, *Edwardsia claparedii* and *Anemonia viridis*, since they are influenced by the body weight of individuals. On the other hand, following a comparison of cnidae of the two *Actinia equina mediterranea* (red and green) subspecies in the North Aegean Sea, Chintiroglou et al. (1997), found that the differences in the length:width ratio of the basitrichs from the actinopharynx, column and tentacles, and the atrichs form the acrorhagi are significant.

The biometric investigation and statistical analysis of the cnidom of the two colour morphs of *A. viridis*, from sites in the North Aegean Sea, indicated only slight differences in cnidom morphology. These could easily be attributed to zoogeographical variation as *A. viridis* is an organism with a wide distribution (Schmidt, 1972; Doumenc et al., 1985). The theory that the two colour morphs are really two distinct subspecies or species cannot be validated from the of cnidae variation in the Aegean Sea.

The taxonomic status of the colour morphs of *A. viridis* and whether they represent two species is still uncertain. Williams

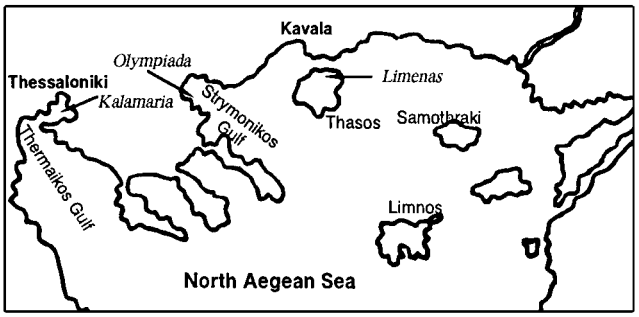

Figure 1. Map of the different sites.

Table 1. *Average length and width of the nematocysts of* Anemonia viridis *forma* smaragdina *(N=20) and forma* rustica *(N=10).*

	smaragdina			*rustica*		
	M	SD	Range	M	SD	Range
Tentacles						
basitrichs (a)	32.30	2.9	26.2–35.3	34.60	1.6	32.2–37.4
Acrorhagi						
atrichs	41.90	1.8	38.6–44.9	43.20	3.4	38.1–49.2
basitrichs (a)	18.30	1	16.7–20.2	19.20	2.5	16–25.5
Column						
atrichs	34.1	1.5	31.6–36	33.9	2.9	30.1–39.9
basitrichs (a)	16.9	0.9	15.3–18.6	17.1	0.9	15.6–19.5
Pharynx						
basitrichs (a)	28.5	3.2	22.9–31.7	30.6	2.5	24–34.8
Filaments						
basitrichs (a)	13.10	0.5	12.3–14	13.40	1.2	11.5–15.4
basitrichs (b)	34.8	3.2	29.9–40.6	34.1	3.3	26.9–40.7
micr. P-masti-gophores	24.6	3.8	20.5–32.1	23.2	2.6	19.5–28.4

M, mean; SD, standard deviation.

(1992) noted differences in the behaviour of the two colour morphs and suggested the existence of two different subspecies. Although he states that ecological/ethological observations are not enough to conclude on the taxonomy of the species. Bullnheim & Sauer (1984) compared iso-enzymes of the two populations, and stated that small differences did exist between the two colour morphs and suggested the existence of two distinct species. Additionally, they did not include in their investigation those anemones that ranged in colour between *rustica* and *smaragdina*. These transitional members (with respect to colour morphology) in many cases co-exist in the Aegean with members of the *rustica* and/or *smaragdina* forms. Karalis & Chintiroglou (1997) compared the cnidom of the two morphs. For *rustica*, it was already known that only the length and L/W ratio of the a-basitrichs from the tentacles, the length of the a-basitrichs from column, and the length and L:W ratio of the atrichs from the column could be considered as stable (thus diagnostic) morphological characteristics (Karalis & Chintiroglou, 1997). For *smaragdina*, the sum of the biometric characteristics of the cnidae were found to be stable and reliable taxonomic characteristics, as they were not influenced by body weight (size) and comparison of the cnidae characteristics from the two colour morphs showed the two populations differed only in the biometry of the a-basitrichs of the tentacles (both with regard to length and L:W ratio).

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