

ALGAL SUBSTRATUM PREFERENCES OF THE ALIEN FORAMINIFERAN *AMPHISTEGINA LOBIFERA* IN SHALLOW WATER

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Abstract

The Lessepsian foraminiferan *Amphistegina lobifera* is particularly numerous on algae in shallow water. We sampled foraminiferans from three algae (*Cystoseira* spp., *Padina pavonica* and *Halopteris* sp.) within the 0.75 - 2.0 m depth zone from five different sites around the island of Malta. There was a significant difference in the population density of live *Amphistegina* between the algae studied with *Halopteris* being preferred to *Padina* and with very sparse populations on *Cystoseira*.

Keywords: *Alien species, Behaviour, Foraminifera, Malta Channel*

Introduction

The symbiotic bearing foraminiferan *Amphistegina lobifera* is a Lessepsian immigrant in the Mediterranean Sea where it now occurs in Tunisia, Egypt, Libya, Turkey, Greece, Malta, Italy, Israel and Lebanon [1]. This foram has been very successful in some areas (e.g. Turkey and Greece) where it can constitute 80-90% of total foraminiferal abundance [2], reducing the native foraminiferal diversity by up to 30% [3]. In shallow water, *A. lobifera* is particularly abundant on algae, but casual observations suggested preference for particular types. Field studies were carried out to test this hypothesis.

Methods

Five replicate samples of each of three different algae (*Cystoseira* spp., *Padina pavonica* and *Halopteris* sp.) were obtained from the 0.75 - 2.0 m depth zone from five sites in Malta (Anchor Bay, Bahar ic-Caghaq, Fond Ghadir, Ghar Lapsi, Marsaskala) (Fig. 1), using a 10 cm x 10 cm quadrat. Sampling was undertaken between August and November 2017. With one exception, the algae chosen were present at all sites (*Padina* was not found at Fond Ghadir) and were the dominant species in the sampled areas. In the laboratory, any *Amphistegina lobifera* present on the algal thalli were removed and stained in 0.25 g/L Rose Bengal in 70% ethanol for 48 hours. Individuals were then separated into three categories: living, uncertain and dead. The living forams stained pink whilst the dead ones retained their original colour; those with an in-between colour were classified as 'uncertain'.

Results and Discussion

Living *A. lobifera* accounted for 80-93 % of the amphisteginids present on the algal thalli. The mean abundances of living specimens recorded from the different algae are presented in Table 1. There was a statistically significant difference in abundance of living *A. lobifera* between the different algae (Kruskal-Wallis H-test; $p < 0.004$), with *Halopteris* being preferred to *Padina* at all sites, and *Cystoseira* hardly having any forams at all.

In shallow water, amphisteginids are prone to dislodgment by wave action, especially when they are still juvenile (<500 μ m diameter) [4], while high light intensities can cause bleaching of their photosynthetic symbionts [5]. Both factors may contribute to the observed preference for *Halopteris* sp. since the thallus of this species consists of very dense lateral branches and axillary hairs, making it ideal for secure attachment and also serving to reduce light penetration. *Padina pavonica* was the next preferred species. Most forams on this alga were found on the underside of the thalli, suggesting that the broad thallus can act as a 'shield' from wave action while also having a shading effect. *Cystoseira* spp. was the least preferred algal species at the studied depths, most likely due to the larger spacing between the branches of the thallus. At greater depths the situation may be different due to decreased water movement and reduced need to shelter from sunlight.

Tab. 1. Mean (\pm SD) number of live *Amphistegina lobifera* standardised per m^2 on different algae from five sites round the island of Malta. Five replicate samples were collected from each site.

Site	<i>Cystoseira</i> spp.	<i>Padina pavonica</i>	<i>Halopteris</i> sp.
Anchor Bay	0	820 \pm 415	4380 \pm 3174
Bahar ic-Caghaq	20 \pm 40	1780 \pm 572	6040 \pm 3073
Fond Ghadir	20 \pm 40	N.A.	9580 \pm 3074
Ghar Lapsi	0	1400 \pm 539	8120 \pm 3066
Marsaskala	0	4540 \pm 1016	9680 \pm 1287

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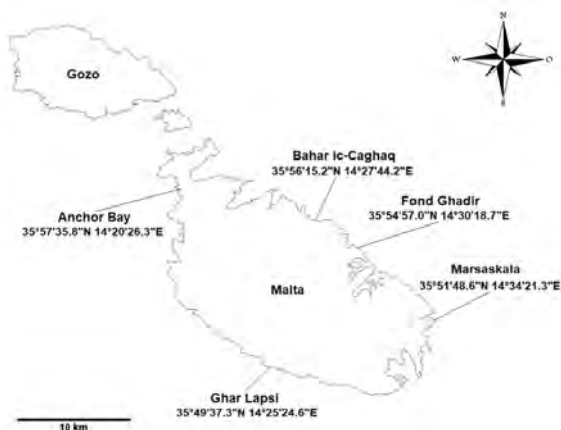


Fig. 1. Map showing the location and the GPS coordinates of the sites chosen for sampling.