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First Record of *Penicillus capitatus* Lamarck (Bryopsidales, Udoteaceae) from the Mediterranean Coast of Turkey

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Abstract

The first record of *Penicillus capitatus* Lamarck from the Gulf of Antalya (Turkey) is reported. The species was found only in the typical stage in April, May and June 2006 and in June 2007. The occurrence of this tropical species in the Gulf of Antalya should be considered as a sign of the climatic change towards a "tropicalization" that is affecting the Mediterranean Sea.

Key Words: *Penicillus capitatus*, Seaweeds, Mediterranean Sea, Turkey, Antalya Gulf.

INTRODUCTION

The genus *Penicillus* Lamarck, at present consists of 12 taxa at specific and infraspecific level [1]. They are all distributed in tropical and subtropical regions: three species are reported only from the Indian Ocean [2], while the remaining taxa *(P. capitatus* excepted) are reported from some localities of the Caribbean Sea and/or neighbouring areas [3], [4], [5]. Only *P. capitatus* is widely distributed throughout the above tropical Atlantic area [1] and it was also recorded from different areas of the Mediterranean Sea mainly with its stage *"Espera"* [6]. Our finding from the Antalya Gulf represents the first record of this species from Turkey where only the typical stage was found.

MATERIALS AND METHODS

Numerous specimens of *P. capitatus* were collected by SCUBA in two localities of the Gulf of Antalya (Fig. 1) near Kumluca (Cape Gelidonya), (36°20'15.30"N, 30°32'10.01"E) in May-June 2006 and in June 2007, at 20-22 m depth, on sandy substrata; at Side (36°45'36.46"N, 31°22'57.30"E) in April-May 2006 and in June 2007, at 0.5-1.5 m depth on mud substrata. In both localities *P. capitatus* occurs in communities with *Cymodocea nodosa* (Ucria) Ascherson.

The collected specimens, preserved in buffered 3% formalin in seawater as well as in exsiccata, were deposited in the Herbarium of Suleyman Demirel University Faculty of Egirdir Su Urunleri (Turkey); moreover, three specimens in exsiccata were deposited in the Herbarium of the Department of Botany, University of Catania (Italy): CAT 4369 and CAT 4370.

RESULTS AND DISCUSSION

Thalli (Fig. 2), erect (3-7 cm tall), brush-like, stiff, rather substantially calcified, are composed of interwoven coenocytic filaments (siphons) and show three morphologically distinct regions: base, stalk (or stipe) and capitulum. The base consists of a tangled cluster of main rhizoidal prostrate and/or mostly colourless descending siphons much finely ramified (Fig. 2) strongly adhering to sand. The stalk, simple, terete (1-3 cm tall, 1.5-2.5 mm in diameter) with a smooth surface, partly penetrating into the capitulum, consists of a medulla and a compact cortex. The medulla is composed of main ascending, longitudinally disposed, ramified and interwoven filaments, with an indeterminate growth (Fig. 3), provided with lateral branches (crampons) (Figs 3 and 4), radially disposed, closely ramified, thickened and calcified at the slightly capitate tips of ultimate branchlets, constituting the cortex.

Capitular tufts, spherical to oblong (rarely pyriform), narrowing toward the stalk, consist of free, slender and dichotomously branched siphons [2-3(4) cm long, 100-200 μm in diameter] occurring in different planes, crowded, not tapering, generally constricted above the forks (Fig. 5) and rather frequently elsewhere. At constrictions the wall shows a remarkable thickening (Fig. 6). These filaments are whitened by superficial calcification of their older part while show bright green tips in living or fresh specimens especially in the

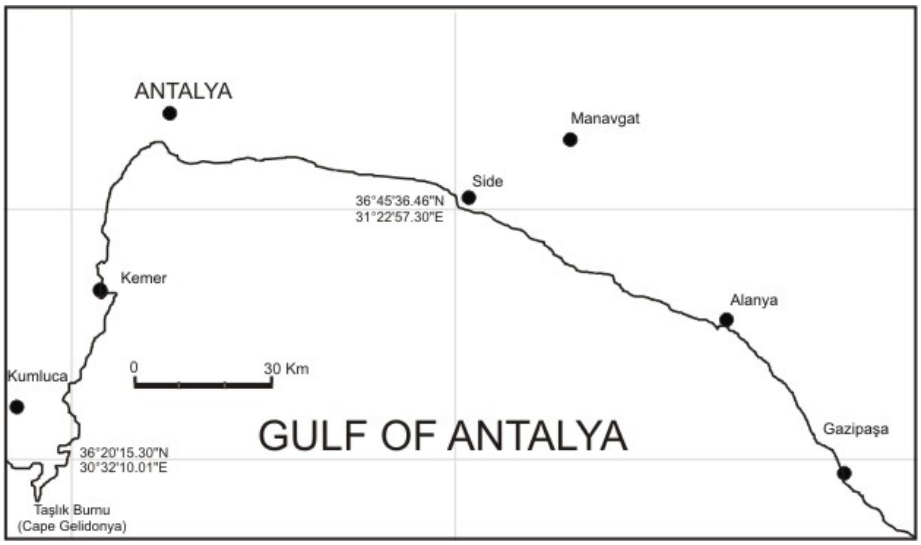

Figure 1. The locations of *Penicillus capitatus* in Gulf of Antalya.

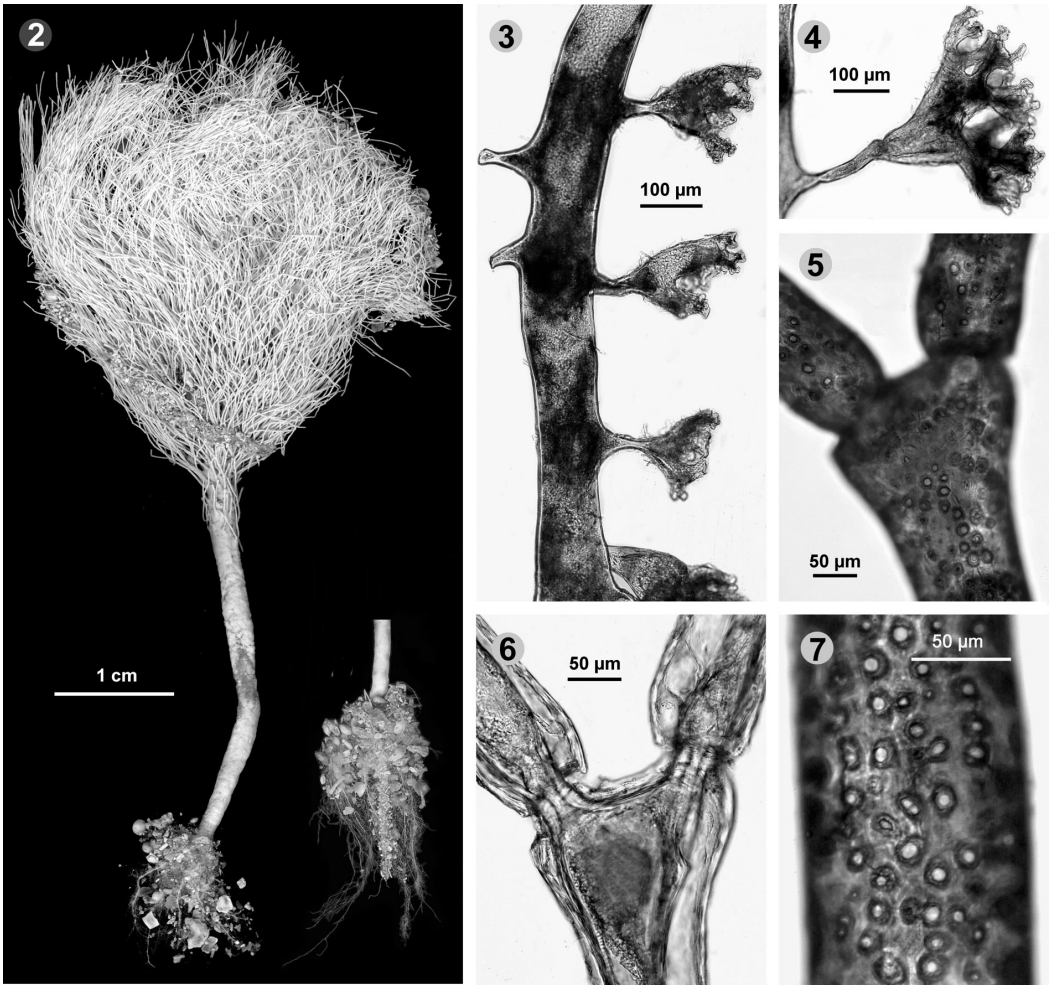

Figure 2. basal portion showing a mass of rhizoidal filaments.
Figure 3. A medullary filament and its lateral branches (crampons).
Figure 4. Detail of a crampon.
Figure 5. Detail of a capitular filament showing the constriction above the fork.
Figure 6. Detail of a fork (decalcified) showing the remarkable thickening of the walls at level of constrictions.
Figure 7. Detail of an old and calcified capitular filament showing numerous and randomly scattered pores.

growing season. The calcified parts show dense and randomly scattered round or ovoid pores (up to 10-12 um in diameter) (Fig. 7).

This species in nature shows two rather different morphological stages: that described above (typical stage) and the *"Espera"* stage, described by Decaisne [7] as *Espera mediterranea.* The latter lacks of stalk since the main ascending dichotomously branched siphons are free or, more frequently, only aggregated in a mat with a few delicate branched rhizoids.

The typical stage, found throughout the year in the Atlantic populations [8], is rather rare in the Mediterranean Sea populations where it was recorded only in late summer and autumn [9] [10] (Huve & Huve, 1964; Meinesz, 1972). Conversely, the *"Espera"* stage is very rare in the Atlantic populations [8] while it was commonly found throughout the year in the Mediterranean Sea [9] [10].

According to both Huve & Huve [9] and Meinesz [10], the *"Espera"* stage is a juvenile stage, but according to Friedmann *et al.* [8] this stage is a complete but reduced form developing when environmental conditions are suboptimal. That is supported by the rarity or total absence of this form in tropical seas where optimal environmental conditions do occur. The presence of numerous specimens *of P. capitatus* in the typical stage in in both stations of the Antalya Gulf (4-5 per m^2 and 2-4 per m^2 at Cape Gelidonya and Side, respectively), indicates optimal environmental conditions, like those occurring in tropical areas, for this species. Taking into account that during the accurate sampling of the phytobenthos of the Gulf of Antalya carried out in 1995 [the results of which were published by Turna et al. [11], no thalli of either stages of P. capitatus were found, the present occurrence of the typical stage of P. capitatus in that area confirms the hypothesis of both Francour et al. [12] and Bianchi [13] that due to global climate change a process of "tropicalization" is affecting the Mediterranean Sea.

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