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TETRAODONTID COLONIZERS IN THE AEGEAN SEA; SECOND RECORD OF THE SPINY BLAASOP, *TYLERIUS SPINOSISSIMUS* (ACTINOPTERYGII: TETRAODONTIFORMES: TETRAODONTIDAE)

Maria CORSINI-FOKA [1*], Panagiotis MARGIES [2], Gerasimos KONDILATOS [1], and Panos S. ECONOMIDIS [3]

[1] *Hellenic Centre for Marine Research/Hydrobiological Station of Rhodes, Rhodes, Greece*

[2] *36 Niriidon Street, 85104 Kremasti (Rhodes), Greece*

[3] *79 Karakasi Street, 54453 Thessaloniki, Greece*

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Abstract. A second record of the small Indo-Pacific fish *Tylerius spinosissimus* (Tetraodontidae) (known as spiny blaasop) was documented at the beginning of 2009 in the waters of Rhodes Island (south-eastern Aegean Sea, Greece). The finding shows the putative establishment of a population of this alien fish in the Mediterranean with a centre the Dodecanese plateau.

Keywords: *Tylerius spinosissimus*, spiny blaasop, Tetraodontidae, non-indigenous fish, Lessepsian migration, Mediterranean

Up to date, seven species belonging to the family Tetraodontidae occur in the Hellenic waters, the only native oceanic puffer, *Lagocephalus lagocephalus* (L.) and six non-native species—one of the Atlantic origin: blunthead puffer, *Sphoeroides pachygaster* (Müller et Troschel, 1848) and five of the Indo-Pacific origin: half-smooth golden pufferfish, *Lagocephalus spadiceus* (Richardson, 1845); spiny blaasop, *Tylerius spinosissimus* (Regan, 1908); Suezian pufferfish, *Lagocephalus suezensis* Clark et Gohar, 1953; silverstripe blaasop, *Lagocephalus sceleratus* (Gmelin, 1789); and studded pufferfish, *Torquigener flavimaculosus* Hardy et Randall, 1983. According to Corsini-Foka and Economidis (2007), the last four species are very recent introductions (from 2003 to 2006), while the other two are older colonizers (Ananiadis 1952, Zachariou-Mamalinga and Corsini 1994). In Greek seas, among the 34 non-indigenous fish species distributed along 24 families, Tetraodontidae presents the highest score of species, accounting for the 18% of the total (Corsini-Foka et al. 2008). The success of tetraodontids in colonizing the Aegean waters could be attributed to a combination of factors, like a particular ability of adaptation to the new ecosystem, overcoming environmental impediments like temperature, salinity, currents, the ability to occupy available and diversified niches, life history strategies and food habits, as already discussed for fish invasions in the Mediterranean (Golani 1998, Mavruk and Avsar 2008). Furthermore, the feeding strategy of foraging in a group, as observed on *L. sceleratus* in the aquarium facilities of the Hydrobiological Station of Rhodes and *in situ,* clearly demonstrate the advantage of such behaviour (unpublished data). Anti-predator adaptations of tetraodontids, like inflation of the body and toxicity (Golani et al. 2006a, b) and burrowing habits, such as those observed on *T. flavimaculosus* by Bilecenoglu (2005) have to be furthermore considered as factors contributing to successful invasion. The evolution of the EMT (Eastern Mediterranean Transient) (Theocharis et al. 2002, Rilov and Galil 2009) and the increase of the Aegean sea water temperature (Theocharis 2008) could have furthermore contributed to the enhancement of their introduction, establishment and spreading, favouring the dispersion of their planktonic eggs and larvae.

Concerning the Mediterranean Sea, tetraodontid fauna is actually represented by ten species, adding to the above: prickly puffer, *Ephippion guttiferum* (Bennett, 1831); Guinean puffer, *Sphoeroides marmoratus* (Lowe, 1838); and bandtail puffer, *Sphoeroides spengleri* (Bloch, 1785) (see: Vacchi et al. 2007).

Currently, the species *L. suezensis* is abundant and *T. flavimaculosus* has an increasing occurrence in the south-eastern Aegean Sea; *L. spadiceus* is present also

* Correspondence: Dr. Maria Corsini-Foka, Hellenic Centre for Marine Research/Hydrobiological Station of Rhodes. Cos Street, 85100 Rhodes, Greece, phone: (+30) 22410 27308, fax: (+30) 22410 78321, e-mail: *mcorsini@hcmr.gr.*

Table 1

Morphometric measurements and meristic characters of *Tylerius spinosissimus* specimen from Rhodes

	Character	Value
Morphometric measurements [mm]	Total length	30.3
	Standard length	23.3
	Maximum body depth	10.1
	Caudal peduncle least depth	1.5
	Caudal peduncle length	4.4
	Head length	10.1
	Eye diameter	3.1
	Preorbital distance	2.8
	Postorbital distance	4.2
	Interorbital distance	3.8
	Dorsal fin length	4.8
	Anal fin length	2.4
	Pectoral fin length*	4.3
	Predorsal length	16.9
	Preanal length	17.3
Meristic characters	Dorsal ray count	8
	Anal ray count	6
	Pectoral ray count	15
	Caudal ray count	10

* First pectoral fin ray very short, 1.1 mm in length.

Fig. 1. The defrosted specimen of *Tylerius spinosissimus* (total length 30.3 mm) from Trianda Bay, Rhodes, January 2009

northern, since its first record was from Samos Island (Ananiadis 1952) and recently collected from the Sea of Marmara (Tuncer et al. 2008), while *S. pachygaster* is well established in the whole Mediterranean (Golani et al. 2002, 2006a), the Aegean Sea included (Eryilmaz et al. 2003, Zenetos et al. 2007). On the other hand, the highly toxic *L. sceleratus* invaded the whole Aegean Sea in a few years (Anonymous 2008) and it shows actually a population explosion in the Levantine coasts (Golani et al. 2007). This species and the blunthead puffer, *S. pachygaster*, are listed among the most successful invasive species in the Mediterranean, negatively affecting biodiversity, fishery and public health (Streftaris and Zenetos 2006).

The spiny blaasop, *Tylerius spinosissimus*, is a tropical, bathydemersal species (between 250–435 m) in its natural range of distribution, the Indo-West Pacific (Froese and Pauly 2009); it is a small sized tetraodontid, reaching 12 cm in total length and it has been reported as

a food item for the bathypelagic species—longnose lancetfish, *Alepisaurus ferox* Lowe, 1833 (see: Romanov and Zamorov 2007). The species was recorded for the first time in the Mediterranean Sea from the waters of the island of Rhodes (south-eastern Aegean Sea) (Corsini et al. 2005). Since no other specimens have been signalled from the Mediterranean, this occurrence was considered as casual (Pancucci-Papadopoulou et al. 2005, Corsini-Foka and Economidis 2007). However, on 20 January 2009, another specimen, 30.3 mm in total length, was collected in the bay of Trianda, NW coast of Rhodes Island, in a sandy-muddy bottom, at a depth between 50 and 80 m, at the same location reported by Corsini et al. (2005). The collection was performed by boat seining (also named Danish seining) (Jennings et al. 2007), a common method operating in Hellenic coastal fishery (Adamidou 2007). The specimen was identified following Smith and Heemstra (1986) and Matsuura (2001) and had the following meristics: dorsal fin rays 8, anal fin rays 6, pectoral fin rays 15, caudal fin rays 10. The above counts, along with the measurements of morphometric characters, appear in Table 1. Morphometrics were: standard length 1.3 (in total length); head length 2.3; predorsal distance 1.4; preanal distance 1.4 (all three above in standard length); caudal peduncle least depth 6.7; caudal peduncle length 2.3; eye diameter 3.3; preorbital distance 3.6; postorbital distance 2.4 (all five above in head length). Body features and colour as in previous description (Corsini et al. 2005) (Fig. 1). The fresh specimen was not inflated and the spines on the body were not evident; being the back dark and the belly whitish, it is easy to be confused with *L. sceleratus* or *L. suezensis*. The sample, fixed in 70% ethanol, has been preserved at the Hydrobiological Station of Rhodes collection (Catalogue number HSR-F45).

The species is grouped among the Lessepsian immigrants, the up to now two records showing an ability to colonize shallower niches. This unforeseen new habitat could indicate that a certain population might already be established along the Levantine coasts, but probably undetected or neglected because of the very small size of this fish (Corsini et al. 2005, Corsini-Foka and Economidis 2007). Assuming that propagules of *T. spinosissimus* are pelagic like in co-familiar species (cf. Golani et al. 2006b, Froese and Pauly 2009), the occurrence of this tetraodontid at the Rhodes marine area may be explained by the counter-clockwise circulation in the Levantine basin which seems to be the main factor for the propagation of Lessepsian species with pelagic propagules to the northern coasts, as discussed in Ben Rais Lasram et al. (2008). However, there are no other records from the Mediterranean, and the two currently known are exactly from the same place in the coasts of Rhodes, far from the Suez Canal. As previously discussed (Corsini-Foka and Economidis 2007), this fact could suggest that other vectors different from usual pathways, like ship ballast, aquaculture or aquaria purposes transport, have probably to be evaluated for the introduction of this fish, as observed for other taxa in Greek waters (Pancucci-Papadopoulou et al. 2005, Anonymous 2008). Although ship-mediated fish introduction is very rare in the Mediterranean Sea (Ben Rais Lasram et al. 2008), this type of vector was recently suspected for the occurrence of an alien fish—*Champsodon nudivittis* (Ogilby, 1895) at Iskenderun Bay, Turkey (Çiçek and Bilecenoglu 2009).

The second finding of the spiny pufferfish at Rhodes, six years after the first record, places *T. spinosissimus* among the alien species of the Mediterranean, i.e., species sighted no more than twice so far, as proposed by Golani et al. (2006a) and suggests that its occurrence has no more to be considered casual in the whole basin.

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