



Occurrence of a filefish closely related to *Stephanolepis diaspros* (Osteichthyes: Monacanthidae) off northern Tunisian coast (south-western Mediterranean Sea)

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Abstract: In this paper, the authors present morphological aspects, main morphometric characteristics and meristic counts of 3 adult specimens, 1 female and 2 males closely related to those of the reticulated leatherjack *Stephanolepis diaspros* Fraser-Brünner, 1940; however the colour patterns were rather close of those of the relative species *S. hispidus* (Linnaeus, 1766). These specimens were captured off Tabarka (northern Tunisia) and constituted, to date, the northernmost record of *S. diaspros* in the region and the westernmost in the Mediterranean Sea. Additionally, examination of stomach contents revealed that the three specimens exclusively ingested polychaetes, the main species recorded being the worm *Platynereis dumerilii*.

Résumé : Présence d'un poisson-bourse proche de *Stephanolepis diaspros* (Osteichthyes : Monacanthidae) devant la côte septentrionale de la Tunisie (sud-ouest de la Méditerranée). Dans cet article, les auteurs présentent les aspects morphologiques, les principaux caractères morphométriques et les comptes méristiques de trois spécimens adultes, 1 femelle et 2 mâles proches du poisson-bourse *Stephanolepis diaspros* Fraser-Brünner, 1940 ; toutefois, les motifs de coloration ressemblent plutôt à ceux de l'espèce voisine *S. hispidus* (Linnaeus, 1766). Ces spécimens ont été capturés devant Tabarka (côte septentrionale de la Tunisie) et constituent, à ce jour, le signalement le plus septentrional de *S. diaspros* dans la région et le plus vers l'ouest de la Mer Méditerranée. En outre, l'examen des contenus stomacaux révèle que les trois spécimens ont exclusivement ingéré des polychètes, l'espèce la plus fréquente étant le ver polychète *Platynereis dumerilii*.

Keywords: Osteichthyes • Monacanthidae • *Stephanolepis diaspros* • Morphology • Diet • Tunisia • Mediterranean Sea

Introduction

The reticulated leatherjack *Stephanolepis diaspros* Fraser-Brüner, 1940 is distributed in Arabian and in Red Sea (Randall, 1995; Golani et al., 2002), and entered the Mediterranean Sea through Suez Canal, such as other lessepsian migrant species (*sensu* Por, 1978). Since the first record off Palestine (Steinitz, 1927), *S. diaspros* was successively reported in several areas of the eastern Mediterranean Basin (Golani et al., 2002), and a sustainable population was successfully established in Turkish seas, for instance (Taskavak & Bilecenoglu, 2001; Sangun et al., 2007).

S. diaspros occurred off the Tunisian coast where it was first recorded by Chakroun (1966) in the Gulf of Gabès, furtherly, reported by Bradaï (2000) and Bradaï et al. (2004) in the area. Northward, a single specimen was recorded by Bdioui et al. (2004) in a brackish area, the Bizerte Lagoon. Investigations regularly conducted in fishing sites and fish markets located along the northern Tunisian coast allow us to find at Tunis fish market three

filfishes close to *S. diaspros*, and these findings suggest a north-western migration of the species, not only throughout the local shore, but also in the Mediterranean. The westernmost Mediterranean specimen of *S. diaspros* recorded to date was reported off Palermo (Sicily) by Catalano & Zava (1993).

In this paper, we present a description of the three observed specimens, the first main morphometric measurements, counts made in Tunisian *S. diaspros*. We give some biological observations and we comment the distribution of the species in the area and in the Mediterranean.

Material and Methods

On 09 April 2008, we have found at Tunis fish market, three specimens close to the reticulated leatherjack *Stephanolepis diaspros* among an important lot of grey trigger fishes *Balistes carolinensis* Gmelin, 1788. According to information provided by the fishermen, the specimens were captured by trammel-nets, off Tabarka (36°57'N - 8°45'E), city close to Algerian border, on northern Tunisian coast, at a depth of about 10 m, on rocky bottom. The specimens were preserved in 5% buffered formaline and deposited in the ichthyological collection of the Faculté des Sciences of Tunis and received the catalogue numbers: FST-STE-diaspros 1, 2 and 3.

Main morphometric data and meristic counts follow Dulcic & Pallaoro (2003); they are presented in Table 1, including percent of total length (% TL), for each measurement. Total mass, eviscerated mass, liver mass, and gonad mass are also given in Table 1. The gonads were microscopically examined to define the sex and the maturity stage of specimens. The stomach contents were removed, sorted and identified to the lowest possible using keys and fields (Riedl, 1963; Fischer et al., 1987). The preys were counted and weighed. Measurements were recorded to the nearest mm and masses to the nearest gram.

Results

The Tunisian specimens are presented as follows: body deep and compressed, snout slightly concave, small terminal mouth with teeth minute arranged in two rows, first dorsal fin consists of a single strong spine with barbs on the posterior edge, originating above posterior margin of eye. Second dorsal fin and anal fin opposite. Second dorsal fin filamentous. Caudal fin rounded. Pelvic fin absent, but replaced by rudimentary skin. Body covered with rough shaygreen-like skin composed of very small scales with delicate spinules. The caudal peduncle of the male consists of a series of horny patches in several rows. Head length

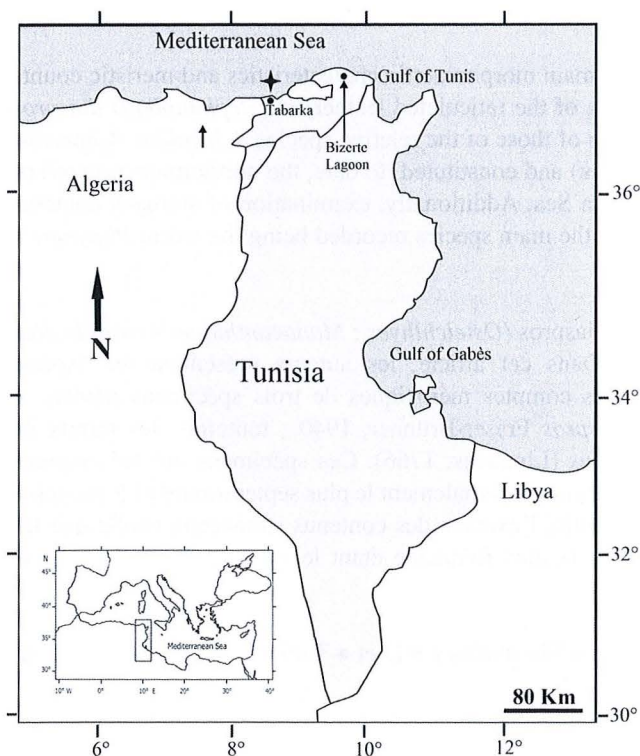


Figure 1. *Stephanolepis diaspros*. Map of the Mediterranean Sea showing Tunisia and map of the coast of Tunisia pointing out the capture site of the specimen (black star).

Figure 1. *Stephanolepis diaspros*. Carte de la Mer Méditerranée montrant la Tunisie et carte de la côte de Tunisie mettant en évidence le site de capture du spécimen (étoile noire).

Table 1. *Stephanolepis diaspros*. Morphometric (in mm and % TL) data, meristic counts and biomasses recorded in three individuals from northern Tunisian coast and compared with those of Dulcic & Pallaoro (2003).

Tableau 1. *Stephanolepis diaspros*. Données morphométriques (en mm et pourcentage de la longueur totale) et méristiques, et biomasses relevées chez 3 spécimens de la côte septentrionale de la Tunisie et comparées à celles de Dulcic & Pallaoro (2003).

References	FST-STE-diaspros1		FST-STE-diaspros2		FST-STE-diaspros3		Dulcic & Pallaoro (2003)	
Characteristics	mm	%TL	mm	%TL	mm	%TL	mm	%TL
Total length (TL)	154	100	164	100	175	100	77.3	100
Standard length (SL)	125	81.17	133	81.10	140	80.0	61.8	79.95
Head length	34	22.08	35.7	21.77	36.3	20.74	22.9	29.62
First predorsal length	41.1	26.69	42	25.61	44.2	25.26	19.9	25.74
Second predorsal length	72.4	47.01	76.5	46.65	77.9	44.51	34.7	44.89
Preanal length	74.3	48.25	75.6	46.10	79.1	45.20	34.4	44.50
Prepectoral length	42.9	27.86	43.1	26.28	43.8	25.03	21.3	27.55
First dorsal fin length	7.6	4.94	8.1	4.94	9.1	5.20	3.7	4.79
Second dorsal fin length	51.8	33.64	55.5	33.84	59.2	33.83	18.2	23.54
Anal fin length	47.2	30.65	50.3	30.67	54.4	31.09	20.3	26.26
Pectoral fin length	14.3	9.29	15.2	9.27	17.6	10.06	10.2	13.20
Caudal fin length	28.8	18.7	31.0	18.90	33.7	19.26	27.9	36.09
Maximal body length	60.3	39.16	62.4	38.05	66.6	38.06	34.9	45.15
Minimal body length	12.4	8.05	13.1	7.99	14.4	8.23	6.7	8.67
Eye diameter	6.8	4.42	7.4	4.51	8.2	4.69	7.1	9.18
Interorbital length	11.6	7.53	11.9	7.26	12.9	7.37	5.6	7.24
Preorbital length	21.3	13.83	29.2	17.80	31.7	18.11	13.6	17.59
Postorbital length	6.8	4.42	7.0	4.27	8.3	4.74	2.2	2.85
Meristic counts								
First dorsal fin rays	I		I		I		I	
Second dorsal fin rays	33		30		30		30	
Anal fin rays	31		30		30		30	
Pectoral fin rays	13		13		13		13	
Caudal fin rays	I+10+I		I+10+I		I+10+I		I+10+I	
Masses (g)								
Total mass	60.7		73.1		94.7			
Eviscerated mass	58.3		69.8		87.6			
Liver mass	0.54		0.32		0.76			
Gonad mass	1.16		0.16		0.17			
Food item masses (g)								
Polychaetes	2.11		2.13		4.06			
Unidentified items	0.5		0.95		1.9			

20.7-22.1%, second dorsal fin length 33.6-33.8%, anal fin length 30.6-31.1%, pectoral fin length 9.3-10.1%, eye diameter 4.4-4.7%, all of total length. Meristic counts were as follows: D1, I; D2, 30-33; A, 30-31; P, 13; C, I + 10 + I.

Colour brown to olive green-grey, with black spots and sinuous grey lines on sides, dark bands non-visible in caudal.

Microscopic observations of gonads showed that the specimen FST-STE-diaspros 1 was one adult female, with ovaries in a resting phase, while the two other specimens were adult males. The guts of three specimens contained identified preys and/or partially or totally digested preys. All the identified preys were polychaetes, among them the main prey species both recorded and identified was the rag worm *Platynereis dumerilii* Audoin & Milne Edwards, 1833.

Discussion

General morphology and counts are in agreement with Tortonese (1967 & 1986), Fischer et al. (1987), Golani et al. (2002), Dulcic & Pallaoro (2003) and Bdioui et al. (2004). Additionally, total of length percents given in Table 1 show similarities but also evident differences between the data given by Dulcic & Pallaoro (2003) and ours. The differences concern second fin length and anal fin length larger in our specimens, while head length and pectoral fin length are larger in the specimen from the Adriatic Sea. However, the main difference observed in specimens from the two areas consists in eye diameter, 4.4-4.7% and 9.2% of total length, for Tunisian specimens and for the one from the Adriatic Sea, respectively. Additionally, colour patterns

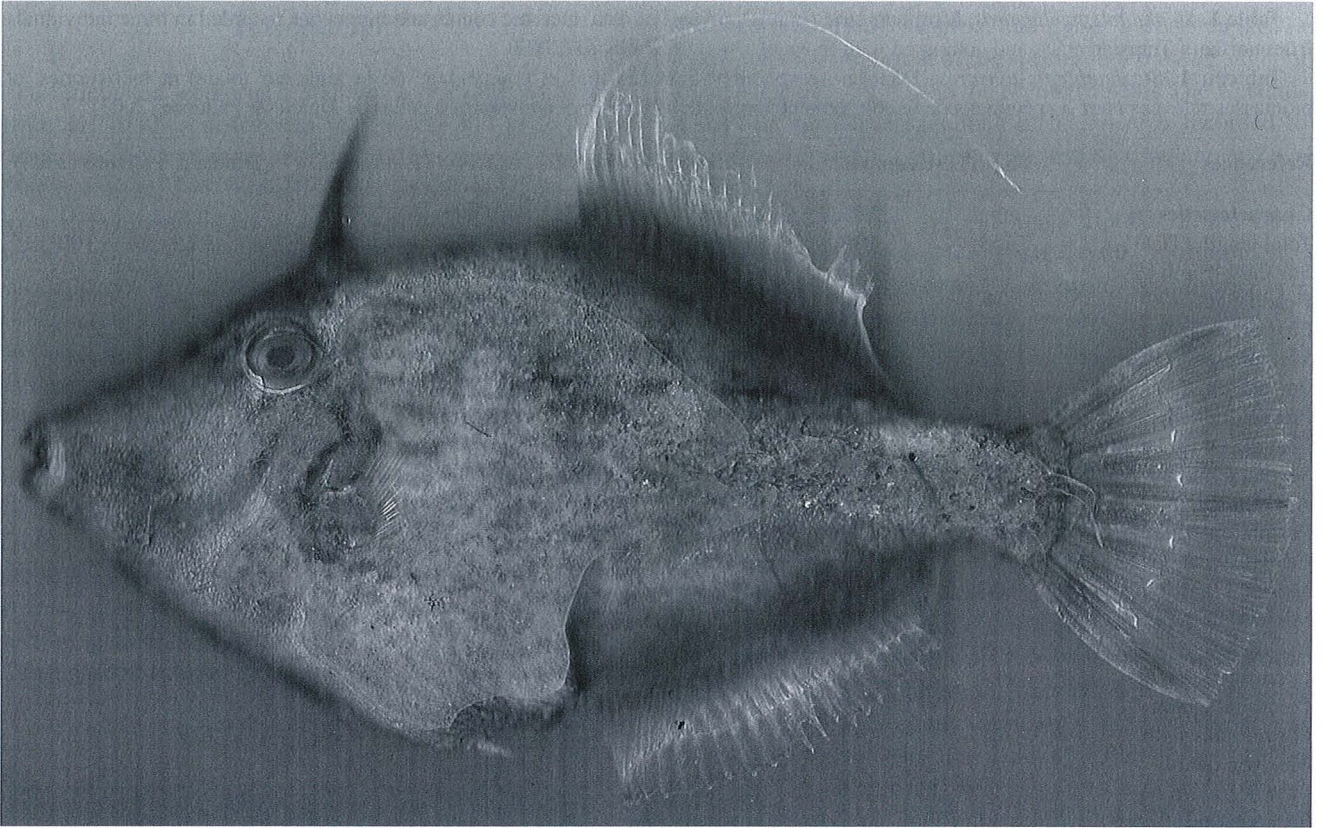


Figure 2. *Stephanolepis diaspros*. Specimen collected off the northern Tunisian coast (FST-STE-diaspros 3).

Figure 2. *Stephanolepis diaspros*. Spécimen récolté devant la côte nord de la Tunisie (FST-STE-diaspros 3).

were not similar to those described in the literature (see Tortonese, 1967 & 1986; Dulcic & Pallaoro, 2003), for instance dark lozenge shaped areas on body sides and two dark bands were not clearly observed. By contrast, they are rather similar to those observed in the close relative species *S. hispidus* (Linnaeus, 1766) referring to Blache et al. (1970), Tortonese (1986) and Sanchez (1991). Additionally, Tortonese (1986) noted that no valid and constant features can be quoted for distinguishing the two species in FNAM area (eastern Atlantic and Mediterranean), that are only well separated geographically. *S. hispidus* is commonly found off Madeira Island and elsewhere on both sides of the Atlantic, eastern from Madeira to Angola and western from New England to Brazil. Consequently a new revision of the genus is needed. At present, it is still expected.

S. diaspros is well known in the eastern Mediterranean basin (Golani et al., 2002; Dulcic & Pallaoro, 2003). Its distribution extended continuously in the area and it migrated westward to the Gulf of Gabès, where Ktari-Zouari et al. (2003) confirmed that a sustainable population was successfully established in the area. By contrast, eastward off the Libyan coast the species was considered as rare by Shakman & Kinzelbach (2007). Bdioui et al. (2004)

observed from Bizerte Lagoon the smallest *S. diaspros* recorded in Tunisian waters. They reported that it was captured close to boat deck, so they considered the specimen passively carried into Bizerte Lagoon, probably via shipping. The Tunisian *S. diaspros* described herein are both large and adult specimens, this suggests that the species successfully migrated to northern Tunisian area and confirms Bdioui et al.'s finding (2004) in Bizerte Lagoon. Our findings constitute the westernmost range extension of *S. diaspros* off the Tunisian coast and the northernmost in the Mediterranean. Additionally, they also confirm Golani's opinion (1998) who considered that once a Lessepsian species has established a self-sustaining population in the Mediterranean, there are no physical parameters precluding its dispersal westward. Similar patterns were described for *Scomberomorus commerson* Lacépède, 1800 by Ben Souissi et al. (2006) and *Fistularia commersonii* Rüppell, 1835 by Pais et al. (2007) and Psomadakis et al. (2008).

Golani et al. (2002) and Dulcic & Pallaoro (2003) noted that *S. diaspros* feeds on small invertebrates plucked from rocks. Similar patterns were observed on the diet of Tunisian specimens. However, polychaetes constituted the main prey items, while Zouari-Ktari et al. (2008) noted that

S. diaspros from the Gulf of Gabès fed on benthic organisms, mainly crustaceans, foraminifers, gastropods, ostracods, sea urchins and phytobenthos, considering polychaetes as occasional preys. The foraging activity, the large spectrum of prey items in a rich biological environment could explain the extraordinary success of the self-establishment of the species in Mediterranean areas such as the Tunisian coast.

Additionally, other parameters contribute to the large expansion of teleost species such as the tendency to aggregate around floating objects (Castro et al., 1999). Such patterns were observed in monacanthids due to the fact that they present a long larval duration extending their dispersal range (Castro et al., 2002; Ben-David & Kritzer, 2005), the extent of expansion of *S. diaspros* off the Tunisian coast needs to be supported by sufficient records, in order to state that the species was definitively established northward, the collected specimens constituted at most northernmost records of the species, in the area. Moreover, some morphometric characters showed that our specimens present similarities with the relative *S. hispidus*, lacking of data about the species does not allow us to state but to conclude that the Tunisian specimens were closely related to *S. diaspros*, until a revision of the genus *Stephanolepis* was clearly carried out in order to separate *S. diaspros* from *S. hispidus*, or to include them in a single species.

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