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***Diplogrammus randalli* (Pisces: Callionymidae), a new Lessepsian migrant recorded from the Mediterranean Sea**

D. SEYHAN¹, E. IRMAK¹ and R. FRICKE²

¹ Izmir Katip Celebi University, Faculty of Fisheries, Izmir, Turkey

² Lauda-Königshofen, Germany

Corresponding author: seyhandilruba@gmail.com

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Abstract

A new Lessepsian migrant, *Diplogrammus randalli* Fricke 1983, is recorded for the first time from the Mediterranean Sea. This species is easily distinguished from other Mediterranean callionymid fishes by its continuous ventrolateral fold skin below the lateral line and its preopercular spine shape.

Keywords: Callionymidae, Lessepsian, Mediterranean Sea, *Diplogrammus*.

Introduction

The dragonets of the family Callionymidae are a group of benthic-living fishes occurring in all temperate, subtropical, and tropical oceans of the world, comprising a total of 195 valid recent species (Fricke, 2016); ten species are known from the Mediterranean (Farias *et al.*, 2016), including seven species in the eastern Mediterranean with the two species *Callionymus filamentosus* Valenciennes, 1837 and *Synchiropus sechellensis* Regan, 1908 being Lessepsian migrants with Red Sea origin (Ben-Tuvia, 1953, Gökoğlu *et al.*, 2014).

The genus *Diplogrammus* was first described by Gill (1865) based on *Callionymus goramensis* Bleeker, 1858 by monotypy. Fricke (1983a) revised the genus *Diplogrammus* and distinguished six species which are distributed in the Indo-West Pacific [*Diplogrammus goramensis* (Bleeker, 1858), *Diplogrammus gruveli* Smith, 1963, *Diplogrammus infulatus* Smith, 1963, *Diplogrammus pygmaeus* Fricke, 1981, *Diplogrammus randalli* Fricke, 1983 and *Diplogrammus xenicus* (Jordan & Thompson, 1914)]. Recently, Red Sea species of *Diplogrammus* were reviewed by Fricke *et al.* (2014), who raised the total number of species known in the genus to seven in the Indo-West Pacific including the Red Sea.

The present paper represents a new case of Lessepsian migration for the Mediterranean Sea and the third callionymid species that entered through the Suez Canal.

Material and Methods

A single female specimen of *D. randalli* was collected from Fethiye, Muğla Province, Turkey (36.700556° N, 28.879722° E) on 26 August 2016. Sampling was con-

ducted during a part of close circuit rebreather (eCCR) underwater ichthyological survey. The specimen was captured alive with a hand net, and live photographs of the specimen were taken in an aquarium before fixation. The species was identified according to Fricke (1983a) and Fricke (2016). The collected specimen was preserved in 4% formalin and deposited in the Fish Collection Centre of İzmir Katip Çelebi University (IKC.PIS.1089).

The standard length (SL) is measured from the tip of the upper lip to the middle of the caudal-fin base. The predorsal length (PDL) is measured from the tip of the upper lip to the base of the first spine of the first dorsal fin; head length (HL) measured from the tip of the upper lip to the branchial opening. Fin-ray counts follow Fricke (1983b).

Results

The specimen was sampled at 3-meter decompression stop required for diving safety and the habitat was sandy-muddy. The most common syntopic fish species of *D. randalli* were the Lessepsian migrant gobiid fish *Vanderhorstia mertensi* Klauswitz, 1974, and juveniles of the native goby *Gobius niger* Linnaeus, 1758.

Description. Body elongate and depressed. Eyes moderately large. Main tip of preopercular spine nearly straight; first spine of first dorsal fin sub equal to first ray of second dorsal fin. Dorsal-fin spines IV, rays 8 (last ray divided at base); anal-fin rays 7; free opercular flap of skin present but not very well developed. Preopercular spine with a small main tip which is nearly straight, 7 slightly curved points on the dorsal margin of the preopercular spine additional to the main tip and one antrorse point at its base (Fig 1b). First dorsal fin with a very short

filament and first spine barely longer than first ray of the second dorsal fin; posterior margin of caudal fin rounded. No bluish lines on head and/or body. No elongate urogenital papillae observed. Lateral line without visible transverse canals. Head and body marbled brown. Pectoral-fin base with a black spot. Irregular dark brown blotches on the entire body (Fig. 1a). Ventral part of body whitish. Measurements and proportions are given in Table 1.

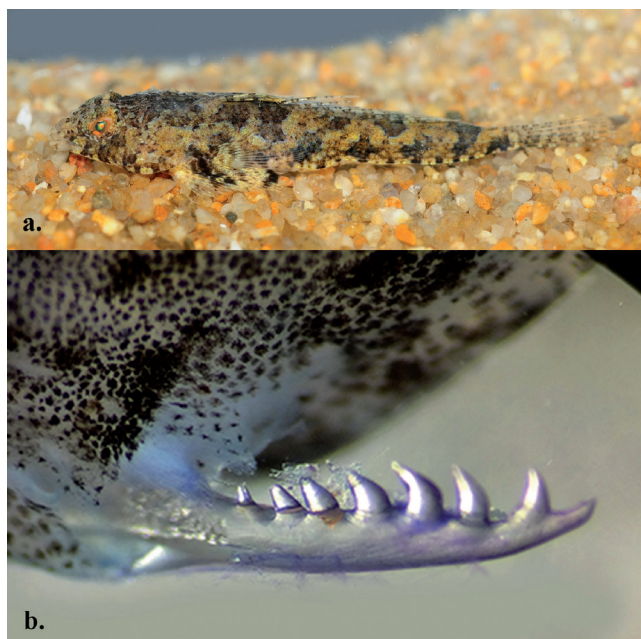


Fig. 1: Live coloration of *D. randalli* (IKC.PIS.1089) photographed in an aquarium(a), and left preopercular spine of the same specimen in preserved condition (b).

Discussion

Species of *Diplogrammus* live in shallow water on sand or coral rubble bottom, often in the vicinity of coral or rocky reefs in their native distribution ranges (Fricke *et al.*, 2014). The morphological features and habitat preference of the specimen are concordant with the description of Fricke *et al.* (2014). Species of *Diplogrammus* can be easily distinguished from other callionymid species in the region by their possessing a continuous, longitudinal dermal fold on the ventrolateral side of the body. *D. randalli* is originally endemic to the northern Red Sea (Gulf of Suez, Gulf of Aqaba, Sanafir Island) (Fricke *et al.*, 2014), and the present paper represents both a range expansion and the third Lessepsian callionymid species in the Mediterranean Sea.

“Lessepsian migration” was defined by Por (1978) for those species that immigrated from the Red Sea through the Suez Canal into the Mediterranean. Marine species could be introduced by several ways such as movements through corridors, transfer on drifting logs, and by anthropogenic means such as the deliberate introduction of species by ballast water or release of aquarium specimens (Spanier & Galil 1991). Gökoğlu *et al.* (2014) state that the Indo-Pacific callionymid species *S. sechellensis* reported from the Mediterranean Sea, may have been accidentally introduced to the Mediterranean by marine traffic and shipping activities most probably based on the fact that only one specimen was found and it was collected at significant distance from the Suez Canal. However, recent findings demonstrate that *S. sechellensis* has a wider distribution in the Mediterranean Sea

Table 1. Measurements and proportions for *Diplogrammus randalli*.

Measurement	mm	Proportion %S _L	Proportion %H _L
Standard length	35.38		
Body width	7.07	19.98	
Body depth	6.51	18.4	
Caudal peduncle depth	1.93	5.45	
Predorsal length	11.73	33.15	
Caudal fin length	8.01	22.63	
Head length	9.94	28.09	
Eye diameter	3.11	8.79	31.28
Snouth length (preorbital)	2.65	7.49	26.65
Interorbital width	0.78	2.20	7.84
1st dorsal spine length	5.91	16.70	
1st dorsal ray length	4.93	13.93	
Pectoral-fin length	7.17	20.26	
Pelvic-fin length	8.08	22.83	
Preopercular spine length	4.6	13.00	46.27

than assumed previously (Kondylatos *et al.*, 2016; Michailidis & Chartosia, 2016). The morphologic similarities, misidentification with the native callionymid species, habitat preferences and insufficient ichthyological surveys for coastal shallow waters may result in overlooking these species in other areas. Besides; trawling, dredging and other traditional methods are often insufficient to sample such small, rare, coastal benthic fishes. It is highly likely that these species have been overlooked in Egypt and Israel. The small and fragile larvae of callionymids would not survive in ballast tanks of large vessels, and the benthic living adults would not attach to such vessels. Neither *S. sechellensis* nor *D. randalli* is sold in the aquarium trade, so an accidental release from aquarium seems unlikely. We conclude that both *S. sechellensis* and *D. randalli* are common in the northern Gulf of Suez, and that it is most probable that the occurrence of both species in the Mediterranean is due to Lessepsian migration of pelagic larvae of these species through the Suez Canal.

The recent enlargement of the Suez Canal is expected to increase the number of Lessepsian migrants into the Mediterranean. Fricke *et al.* (2015) considered 97 confirmed Lessepsian fish species that have migrated into the Mediterranean Sea. Subsequently, several additional Lessepsian migrants were reported, including the serranids *Epinephelus geoffroyi* by Golani *et al.* (2015) and *Epinephelus areolatus* by Rothman *et al.* (2016), the shrimp-goby *Cryptocentrus caeruleopunctatus* by Rothman & Goren (2015), and the engraulid *Encrasicholina gloria* by Hata & Motomura (2016). The present total of at least 102 Lessepsian migrant fish species will undoubtedly further increase in the near future.

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