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Rapid Communication

Records of new and rare alien fish in North African waters: the burrowing goby *Trypauchen vagina* (Bloch and Schneider, 1801) and the bartail flathead *Platycephalus indicus* (Linnaeus, 1758) in Egypt and the cobia *Rachycentron canadum* (Linnaeus, 1766) in Libya

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Abstract

The first records of *Trypauchen vagina* (Bloch and Schneider, 1801) from Mediterranean Egyptian waters and of *Rachycentron canadum* (Linnaeus, 1766) from Libyan waters are hereby described, providing new information on the expansion of these two Lessepsian fishes along the southern Mediterranean coasts lying to the west of the Suez Canal. The finding of another Lessepsian fish, *Platycephalus indicus* (Linnaeus, 1758) from a region further west of its previously-known introduced distribution within Egyptian Mediterranean waters, is also reported, indicating an ongoing successful establishment of this species, previously considered uncommon within the same waters.

Key words: non-indigenous fish, Lessepsian migrants, Gobiidae, Rachycentridae, Platycephalidae, South Mediterranean Sea

Introduction

The number of non-indigenous taxa of Red Sea and Indo-Pacific origin introduced into the Mediterranean Sea via the Suez Canal has continuously increased since the opening of this man-made shipping corridor, constituting today one of the major threats to marine biodiversity and ecosystem services (Katsanevakis et al. 2014; Galil et al. 2017, 2020). Concerning Lessepsian migrant fish (see Golani 2010), more than one hundred species have been recorded to date from the Mediterranean and many of these have successfully colonized the waters of the eastern Mediterranean (Bos and Ogwang 2018; Engin et al. 2018; Golani and Fricke 2018; Galil et al. 2020).

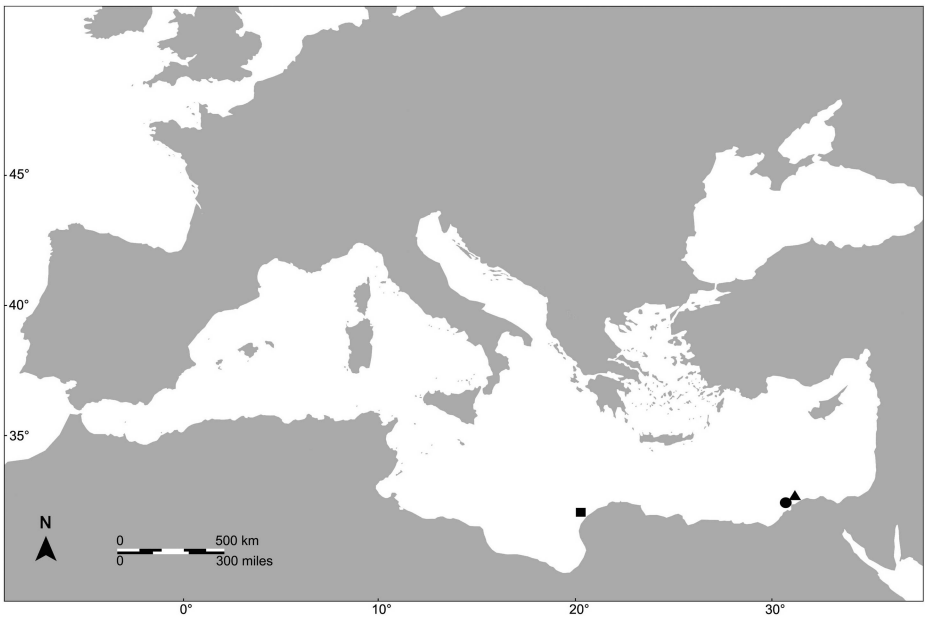

Figure 1. Map of the Mediterranean Sea showing the locations of the findings of *Trypauchen vagina* (●) Egypt, *Platycephalus indicus* (▲), Egypt, and *Rachycentron canadum*, Libya (■).

More than 60 Lessepsian migrant fish species have been recorded to date from Mediterranean Egyptian waters (Al Mabruk et al. 2021a and references therein; Deef 2021) and at least 29 from Libyan waters (Shakman et al. 2019; Al Mabruk and Rizgalla 2019; Bariche et al. 2020; Osca et al. 2020; Abdelghani et al. 2021; Al Mabruk et al. 2021b).

In the present study, the first record of the gobiid *Trypauchen vagina* (Bloch and Schneider, 1801) for Mediterranean Egyptian waters and the first record of *Rachycentron canadum* (Linnaeus, 1766) from Libya are documented, contributing to current knowledge on the expansion of these two Lessepsian fish species west of the Suez Canal. In addition, the finding of a third Lessepsian fish species—*Platycephalus indicus* (Linnaeus, 1758)—far from its known distribution within Egyptian waters is also described, and this could corroborate a successful establishment in the area of the same fish species, previously considered uncommon.

Materials and methods

Four specimens of *T. vagina* were collected by means of a trammel net having three faces (a device known in Arabic as "Kanar"), off Abu Qir Harbor, Egypt (31°28′24.3″N; 30°08′37.6″E) (Figure 1), at approximately 20 m of depth, over a muddy seabed. One specimen was captured on 23 January 2021 and it was in a poor physical state. Three additional specimens (a, b, c) of the same species were collected on 12 February 2021. The above four samples are deposited at the private collection of one of the authors (OMN). The same fisherman observed and discarded a specimen of "a strange red fish" on early January 2021, while on 14 March 2021, another 17 specimens of the same species were collected from the same

location, at the same depth and through the same fishing gear as for the previously-caught individuals.

On 22 February 2021, one specimen of *P. indicus* was captured through the same trammel net type as the one used for *T. vagina*, at Abu Qir Harbour (31°18′6.84″N; 30°07′7.14″E) (Figure 1) and at 7 m of depth, over a sandy-muddy seabed. On 14 March 2021, at the same location and depth and with the same fishing gear, another specimen of *P. indicus* was caught.

Diagnostic features of *T. vagina* and *P. indicus* specimens were observed under a stereoscope and measurements were made with a caliper (accuracy 0.01 cm), according to Fischer and Bianchi (1984).

One specimen of *Rachycentron canadum* was captured on 8 April 2019 by means of trammel net, at 5–10 m of depth, off Al Karmah, 25 km southwest of Benghazi, Libya (approximate coordinates 31°58′50.38″N; 19°57′9.71″E), over a mixed rocky-sandy seabed (Figure 1). The photo of this sample was submitted to the social media citizen science platform for Libyan waters called "Marine Biology in Libya" (https://www.facebook.com/MarineBiologyinlibya) and later the fish was consumed and not preserved.

Results

Trypauchen vagina (Bloch and Schneider, 1801)

(Figure 2)

Body elongate and compressed. Pelvic fins united forming a complete funnel-shape disk. Whole body covered with cycloid scales, except the head; an oval pouch at the dorsal margin of the operculum (Figure 2). Meristic counts (specimens a, b, c): D (total elements) 58-58-52 damaged, A (total elements) 46-45-45, P 16, V I+5, C 16, Longitudinal scale row 69-72-69. Measurements of specimens a, b, c, expressed as % of total length (TL) and standard length (SL), are given in Table 1. The TL of the 17 specimens caught in March 2021 ranged between 13 cm and 16 cm. Colour of freshly caught specimens: Body and head almost uniformly reddish in specimens a, c, brownish with pink shadows in sample b (Figure 2). Fins translucent rose. The meristic and morphometric characteristics (Table 1) and the colour patterns of *T. vagina* specimens were in agreement with Murdy (2006), Salameh et al. (2010) and Akamca et al. (2011) and, in particular, these allowed us to distinguish our *T. vagina* specimens from the very similar cogeneric *T. pelaeos* Murdy, 2006.

Platycephalus indicus (Linnaeus, 1758)

(Figure 3)

Body elongate, head strongly depressed. Meristic counts: D1 I/VI/I, D2 13, A 13; P 18; V I+5; LL 80; GR 8. First dorsal fin with a single small isolated spine anteriorly, 6 longer spines connected by a membrane followed by a small spine apparently separate. Measurements of the specimen caught

Figure 2. The fresh specimens of *Trypauchen vagina* collected on February 2021 from Abu Qir Bay, Egypt, and detail of head, specimen a (Black bar: 1 cm) (photo by Ola M. Nour).

Table 1. Main morphometric measures, expressed as % of Total Length (TL) and Standard Length (SL), and weights of three *Trypauchen vagina* and one *Platycephalus indicus* specimens caught in February 2021 at Abu Qir Bay, Egypt.

	Trypauchen vagina			*Platycephalus indicus*
Morphometric measure	%TL			
	a	b	c	
Standard length	86.8	86.0	85.3	86.3
	% SL			
Head length	17.4	16.9	17.6	31.8
Eye diameter	1.4	1.4	1.6	4.2
Head width	6.5	7.1	6.6	
Inter orbital distance	2.4	2.3	2.4	4.5
Snout length	5.8	5.2	4.9	9.1
Upper jaw length	5.8	5.2	4.1	11.4
Lower jaw length				15.6
Body depth	12.3	12.3	10.7	12.0
Predorsal length	21.0	20.1	21.3	33.1
Prepectoral length	20.3	15.6	18.0	27.6
Prepelvic length	17.4	15.6	16.4	35.4
Preanal length	36.2	35.1	32.8	56.2
Caudal peduncle length				8.8
Distance between two dorsal fins				6.2
Weight (g)	10.2	15.1	8.1	282.0

Figure 3. *Platycephalus indicus* freshly captured off Abu Qir, Egypt, on February 2021 (A: dorsal view, B: ventral view, C: lateral view and detail of tail) (Black bar: 1 cm) (photo by Ola M. Nour).

in February 2021, expressed as % of TL and SL, are given in Table 1. Colour of fresh specimen: brownish with darker bands above, whitish below; first and second dorsal, pectoral and pelvic fins with small, dark brownish spots along rays; caudal fin with a black horizontal stripe on lower rays, two black blotches on upper rays and a prominent yellow blotch near middle of fin (Figure 3). Meristics, measurements and colour of the specimen examined agreed with Knapp (1999), Rizkalla and Akel (2016), Chen and Gao (2017), Chen et al. (2020). The specimen caught in March 2021 was a juvenile of approximately 13 cm TL; the caudal fin colour pattern was brownish with slightly darker spots and it differed from the adult described above.

***Rachycentron canadum* (Linnaeus, 1766)**

(Figure 4)

Globally, the species *R. canadum* is the only one within the family Rachycentridae. Identification was based on submitted photographic material, given that the caught specimen was not available, following Fischer and Bianchi (1984). The specimen had a TL of 98 cm. Body elongate, subcylindrical; head broad and depressed. Mouth large, terminal, with projecting lower jaw. First dorsal fin with 8 spines; second dorsal fin long; anal fin similar to dorsal, but shorter; caudal fin lunate, upper lobe longer than lower (Figure 4).

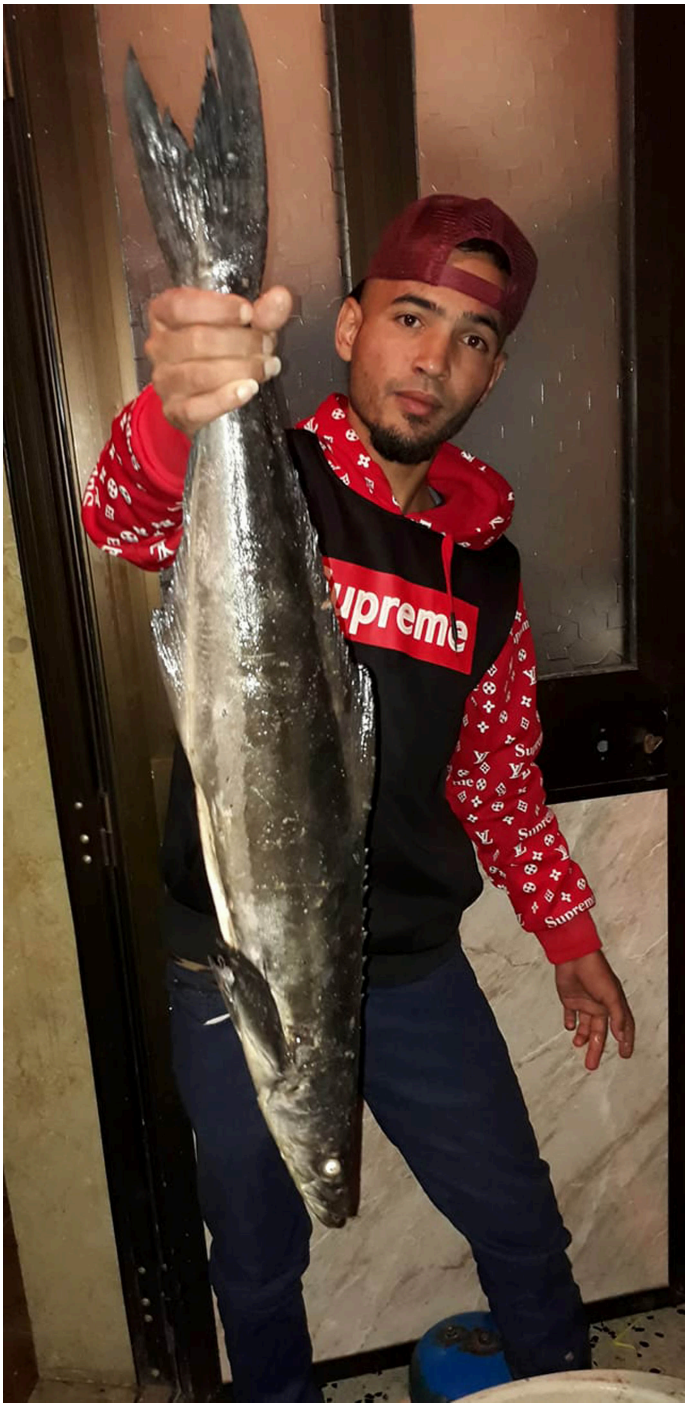

Figure 4. The fresh specimen of *Rachycentron canadum* captured off Al Karmah, Benghazi, Libya, in 2019 (photo by Muftah Al Meidani).

Colour of fresh specimen: back and sides dark brown, with two longitudinal light bands; belly yellowish.

Discussion

Eleven non-indigenous gobiids have been reported to date in the Mediterranean (Engin et al. 2018; Kovačić 2020), among which *T. vagina*, a species with a broad Indo-West Pacific distribution which, although still officially unrecorded from the Red Sea, is listed among the fishes introduced

into the Levantine Sea via the Suez Canal (Golani et al. 2013; Galil et al. 2020). This species was first recorded in 2009 from Israel (Salameh et al. 2010) and repeatedly from the northeastern Mediterranean, Turkey (Akamca et al. 2011; Siokou et al. 2013; Ergüden et al. 2018; Çiftçi and Ayas 2018). The first record of *T. vagina* for Mediterranean Egyptian waters and for North African waters documented through the current study, adds a fifth Lessepsian gobiid to the four already known in Egypt, namely *Coryogalops ochetica* (Norman, 1927), *Favonigobius melanobranchus* (Fowler, 1934), *Oxyurichthys petersi* (Klunzinger, 1871), *Silhouettea aegyptia* (Chabanaud, 1933) (Golani 2010; Akel and Karachle 2017; Galil et al. 2020). It is unknown whether *T. vagina* was either already present within the same region and thus was unreported until now, or whether it has recently expanded its distribution to this area, which is located relatively close to the Suez Canal. Nevertheless, it is to be noted that the first findings of more than twenty *T. vagina* specimens over a limited period of time could probably indicate a fast adaptation and a successful establishment of the species within the same region.

The burrowing goby *T. vagina* does not wander far from its own burrow in silty and muddy habitats in shallow estuarine and coastal waters (Murdy 2006). To date, in the northeastern Levantine waters, Turkey, it has been collected from 20 m to 30 m of depth (Akamca et al. 2011; Siokou et al. 2013; Ergüden et al. 2018; Çiftçi and Ayas 2018), similarly to the specimens from Egypt reported in the present study. On the other hand, in Israel, it was collected in deeper waters, from 60 m to 200 m of depth. This might reveal a high degree of plasticity of *T. vagina* through an ability to adapt to a range of temperatures broader than the range known from its native region, allowing the species to invade deeper water levels, as widely discussed in Galil et al. (2019). Different survival responses to an accidental sudden decrease of temperature were previously observed in a number of Lessepsian fish species maintained in captive conditions (Corsini-Foka 2010).

Platycephalus indicus is widespread in estuaries and in shallow waters, up to a maximum depth of 15 m, within the Indo-West Pacific region, from the Red Sea and East Africa to southern Japan, the Philippines and New Guinea (Knapp 1999; Golani and Fricke 2018). In the Mediterranean Sea, *P. indicus* was first recorded from Israel (Ben-Tuvia 1953) and later from Egypt, at an unknown location and at an unspecified date (Krefft 1963 in Halim and Rizkalla 2011) and from Lebanon (Mouneimné 1977). After a long interval, its presence was documented in Syria (cf Ali 2018) and again in Lebanon (Bariche 2012) and Egypt, at Port Said (Rizkalla and Akel 2016). Although generally considered a rare Lessepsian fish in the eastern Levantine Sea (Rizkalla and Akel 2016; Galil et al. 2020), it appeared in recent bottom trawler catches off Port Said (Ragheb et al. 2019). The finding described in the present study from a new area of Egyptian waters, west of Port Said, could suggest that this platycephalid is

expanding its population toward the southwestern waters of the basin, and it is presumably becoming less uncommon than previously thought.

The cobia *R. canadum* is a prevalently pelagic fish which is, however, also known from shallow coral reefs and off rocky shores, occasionally in estuaries, with a circum-global distribution in tropical and warm temperate seas of the western and eastern Atlantic Ocean and in the Indo-Pacific, Red Sea included, with the exception of the eastern Pacific (Fischer and Bianchi 1984; Shaffer and Nakamura 1989). In the Mediterranean Sea, the species was first recorded from waters off Israel in 1978 (Golani and Ben-Tuvia 1986), while in the last decade, it was recorded in the southeastern Aegean Sea, Turkey, in 2013 (Akyol and Vahdet 2013) and repeatedly from Lebanon, in 2012, 2014 and 2020 (Crocetta et al. 2015; Ragkousis et al. 2020). According to Golani and Fricke (2018) and Galil et al. (2020), *R. canadum* has been introduced into the Mediterranean through the Suez Canal. The first record of the species reported through the present study from the shallow waters of Libya is also the first record for the North African coastline. Such a capture should be considered as representing a casual one as it is too early to consider the species to be an established one.

The successive enlargements of the Suez Canal have favoured the introduction of novel marine species of Red Sea and Indo-Pacific origin into the Mediterranean basin (Galil et al. 2017), whilst the warming of the basin due to climate change facilitates the successful establishment and range expansion of these allochthonous species (Bianchi et al. 2017; Zenetos and Galanidi 2020). Knowledge on the geographical expansion of tropical and sub-tropical biota, as is the case for Lessepsian migrant fish species within locations lying both to the east and west of the Suez Canal Mediterranean opening (see Golani 2010; Galil et al. 2020) and on their establishment has been increasing in recent years. This is due to the intensification of research, the dissemination of scientific information and citizen science campaigns, with the latter being spearheaded by the contribution from social media platforms (Al-Mabruk et al. 2021b). This additional data is fundamental in order to quantify the impact of Lessepsian biota on Mediterranean marine ecosystems pursuant to informing effective management and conservation policies.

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