

A 'flood' of alien cardinal fishes in the eastern Mediterranean - first record of the Indo-Pacific *Cheilodipterus novemstriatus* (Rüppell, 1838) in the Mediterranean Sea

Menachem Goren*, Gregory Lipsky, Eran Brokovich and Avigdor Abelson

Lough Department of Zoology, George S. Wise Faculty of Life Sciences, Tel Aviv University, Tel Aviv 69978, Israel

E-mail: gorenm@post.tau.ac.il (MG), greglipsky@gmail.com (GL), eran.brokovich@mail.huji.ac.il (EB), avigdora@tauex.tau.ac.il (AA)

*Corresponding author

Received: 8 June 2010 / Accepted: 14 July 2010 / Published online: 25 July 2010

Abstract

Four alien species of Red Sea Cardinal fishes have been reported to date from the eastern Mediterranean, three of them discovered during the last five years. Here we report the finding of a fifth alien cardinal fish *Cheilodipterus novemstriatus* (Rüppell, 1838) in the eastern Mediterranean Sea. The fish was collected from the wreck of an old sunken ship off the Tel Aviv coast.

Key words: Mediterranean Sea, alien species, *Cheilodipterus novemstriatus* Lesspesian migration

Introduction

The Indo-Pacific cardinal fish, *Cheilodipterus novemstriatus* (Rüppell, 1838) is the fifth species of the family Apogonidae to settle in the Levantine Sea, eastern Mediterranean. Following the appearance of the first alien cardinal fish (*Apogon pharaonis* Bellotti, 1874) in the Levantine Sea in 1947 (Haas and Steinitz 1947), almost sixty years passed until appearance of the second one (*A. queketti* Gilchrist, 1903) in 2006 (Eryilmaz and Dalyan 2006); and then, within two years, two additional alien species were reported: *A. smithi* (Kotthaus, 1970) (Golani et al. 2008) and *A. fasciatus* (White, 1790) (Goren et al. 2009). Now, a fifth cardinal fish, the fourth within five years, is reported. This perceived flood of alien cardinal fishes demands our attention.

Materials and methods

The fish were collected by SCUBA divers with hand nets.

Abbreviations: TAU – fish collection of Tel Aviv University; TL - total length, SL – standard length.

Results and discussion

Cheilodipterus novemstriatus (Rüppell, 1838) (Figure 1, 2)

Apogon novemstriatus Rüppell, 1838:85, Pl. 22 (Figure 1) Type locality: Massawa, Eritrea, Red Sea.

Material examined: TAU – P. 13728, off Tel Aviv, 32°05'24"N, 34°45'32"E Israel. Two specimens, TL: 55 and 66 mm; 2 June, 2010 in a shipwreck (Sea Wolf) at a depth of 30 m by Lipsky and Brokovich.

A brief description of the specimen: A *Cheilodipterus* species with five narrow black stripes on white body. The lower stripe runs along ventral margin of body, curving upward in front of pelvic-fin insertion (Figures 1, 2). The upper stripe runs along upper profile of body from upper peduncle to head. A fourth stripe, wider and brighter, is found behind the pectoral base (Figure 1). A dark stripe runs from the isthmus to anus (Figure 2). A large black midlateral peduncle spot is surrounded by a yellow circle. Dark spot present on dorsal and ventral surfaces at base of the caudal peduncle, Ventral fins are covered with fine grey pigmentation.



Figure 1. *Cheilodipterus novemstriatus* - collected off Tel Aviv, Israel (TAU – P. 13728).



Figure 2. *Cheilodipterus novemstriatus* - ventral aspect (TAU – P. 13728).

Lateral line has pored scales 23, 24 (the double numbers, separated by a comma, related to the longer and shorter specimens respectively) and 3,3 scales without pores on the base of the caudal fin. Transverse rows of scales (counted backward from origin of second dorsal fin) 2.5/5.5. Median predorsal scales 6, the posterior one enlarged with a median notch. First dorsal fin with 7 spines; second dorsal fin with a spine and 9, 10 rays. Anal fin with 2 spines and 8 rays; pectoral fin with 12 rays. Twelve developed gill rakers on first gill arch (3+9).

Body proportions (of the two specimens): SL is 79, 82% of TL; head length is 34, 37% of SL; body depth is 29, 30% of SL; eye diameter is 32, 35% of head length; interorbital width is 20, 23% of head length; distance between upper lip to origin of first dorsal fin is 38, 41% of SL; distance between upper lip to origin of second dorsal fin is 57, 60% of SL; distance between upper lip to origin of anal fin is 63, 64% of SL;

longest pectoral ray is 18, 18% of SL; longest pelvic ray is 18, 18% of SL.

Distribution: Red Sea, Gulf of Oman, and Persian Gulf (Gon and Randall 2003; Froese and Pauly 2010).

Remarks: *Cheilodipterus novemstriatus* can easily be distinguished from all other cardinal fishes in the Mediterranean by its unique color pattern: white body with five narrow stripes on body and a large black peduncle blotch. It lacks any vertical bar on its body and/or black spot proximally on the dorsal and anal fins.

In the Red Sea, the source region of *C. novemstriatus*, there are two more species with similar color pattern: *C. pygmaios* and *C. quinquelineatus*. *C. quinquelineatus* can be distinguished from *C. novemstriatus* by the absent of black dark spots on dorsal and ventral surface at base of the caudal peduncle. *C. pygmaios* differs from *C. novemstriatus* by the lower count of pectoral fin rays (10-11

versus 12 in *C. novemstriatus*) and by the straight lowermost dark stripe on body (curving upward under the origin of the pectoral fin in *C. novemstriatus*).

In its native home range, *C. novemstriatus* is found mainly in shallow protected waters "in front of holes and ledges of coral or rocky reefs" (Gon and Randall 2003) although Brokovich et al. (2008) found this species down to 50 m in Eilat.

In the Mediterranean it has been found in a shipwreck where it shares the habitat with the native cardinal fish *Apogon imberbis* (Linnaeus, 1758). This might express a direct competition between the two species, whereas the other four alien cardinal fish dwell in different habitats (Goren et al. 2009). The location of the sampled specimens may also indicate a dramatic change in habitat type, from "shallow protected waters" in the Red Sea, to deep, exposed prominent structures in the Mediterranean Sea.

The finding of a fourth alien cardinal fish within less than 5 years supports the suggestion by Goren et al. (2009) that the present increase in cardinal fish species is an indicator of environmental changes in the eastern Mediterranean.

Acknowledgements

We thank Ms. N. Paz for editing the manuscript.

References

- Brokovich E, Einbinder S, Shashar N, Kiflawi M, Kark S (2008) Descending to the twilight-zone: changes in coral reef fish assemblages along a depth gradient down to 65 m. *Marine Ecology Progress Series* 371: 253–262, doi:10.3354/meps07591
- Eryilmaz L, Dalyan C (2006) First record of *Apogon queketti* Gilchrist (Osteichthyes: Apogonidae) in the Mediterranean Sea. *Journal of Fish Biology* 69: 1251–1254, doi:10.1111/j.1095-8649.2006.01185.x
- Froese R, Pauly D (eds) (2010) FishBase. World Wide Web electronic publication. <http://www.fishbase.org>, version 05/2010
- Golani D, Appelbaum-Golani B, Gon O (2008) *Apogon smithi* (Kotthaus, 1970) (Teleostei: Apogonidae), a Red Sea cardinalfish colonizing the Mediterranean Sea. *Journal of Fish Biology* 72: 1534–1538, doi:10.1111/j.1095-8649.2008.01812.x
- Gon O, Randall JE (2003) A review of the cardinalfishes (Perciformes: Apogonidae) of the Red Sea. *Smithiana* 1: 1–48
- Goren M, Galil BS, Diamant A, Gayer K, Stern N (2009) First record of the Indo-Pacific cardinal fish *Apogon fasciatus* (White, 1790) in the Mediterranean Sea. *Aquatic Invasions* 4: 311–313, doi:10.3391/ai.2009.4.2.21
- Haas G, Steinitz H (1947) Erythrean fishes on the Mediterranean coast of Palestine. *Nature* 160: 28, doi:10.1038/160028b0