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Short Communication

Finella pupoides Adams A., 1860 (Gastropoda, Scaliolidae) – a population explosion underway, Mediterranean Sea

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Abstract

The alien Erythraean gastropod *Finella pupoides* has been recorded at low abundance in the Eastern Mediterranean for over half a century. Recently, its populations along the southeastern Levantine coastline have grown extremely abundant. Samples collected by Israel Oceanographic and Limnological Research surveys during 2010–2011 off the coast of Israel contained up to 3300 ind/m².

Key words: *Finella pupoides*; Gastropoda; Erythrean alien; eastern Mediterranean; population explosion

Introduction

Populations of alien Erythraean molluscs may remain at low densities for extended periods before spreading and becoming invasive (Mienis 2003). For example, a small Erythraean mytilid mussel, *Brachidontes pharaonis* (P. Fischer, 1870), was first recorded from the Israeli coast in 1937 (Haas 1937) yet in the early 1970s it was still "*c*. 250 times rarer" than the native mytilid *Mytilaster minimus* (Poli, 1795) (Safriel et al. 1980). A survey conducted thirty years later, however, discovered a major increase in abundance and *B. pharaonis* currently forms dense clusters on midlittoral and infralittoral rocks, and on man-made hard substrates (Mienis 2003).

Finella pupoides Adams A., 1860 is a small Indo-Pacific, detritivorous, scaliolid gastropod that is common in the Red Sea (Janssen et al. 2011) and recorded from the Suez Canal (Barash and Danin 1977, as *Eufenella pupoides*). *Finella pupoides* was first recorded in the Mediterranean from coastal waters of Israel and southern Turkey (Barash and Danin 1977; van Aartsen 2006) and subsequently reported from Lebanon (Bogi and Khairallah 1987) and Cyprus (Cecalupo and Quadri 1996). All along the Levant and the Aegean coast of Turkey, *F. pupoides* established stable populations (Tringali and Villa 1990; Niederhöfer et al. 1991 (as *Obtortio pupoides*), Buzzurro and Greppi 1996, 1997; Öztürk et al. 2004; Öztürk and Can 2006; Bakir et al. 2012). A single shell was collected in shell grit off Otranto, Italy, in 1999, but no specimens have been collected since (Trono 2006, Trono pers. comm.)

In the past couple of years it was noted that the number of *F. pupoides* specimens has been increasing in infaunal samples collected off the Israeli Mediterranean coast, at the Southeastern Levantine Basin. This study documents the recent increase in abundance of *F. pupoides*.

Materials and methods

Benthic samples were collected during surveys off the Israeli coast conducted by the National Institute of Oceanography, Israel Oceanographic and Limnological Research, aboard the R/V *Shikmona* between 2004 and 2011. Sediment samples were taken with a 32 × 35cm Van-Veen

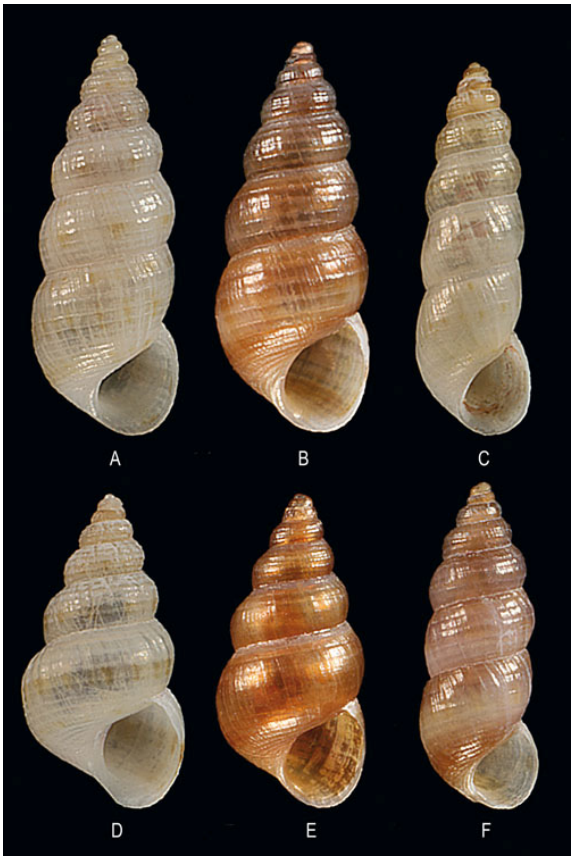

Figure 1. *Finella pupoides* Adams A., 1860. Collected off the Israeli coast. The shell heights shown were: A. 3.2 mm, B. 2.5 mm, C. 2.4 mm, D. 2.0 mm, E. 1.9 mm, and F. 2.1 mm.

grab (KAHLSICO, model WA265/SS214), volume 20 L, and penetrating up to 20 cm into the substrate. The sediment was preserved in buffered formalin 10% for 3–7 days, sieved through a 250 µm mesh sieve, and then stored in 70% ethanol. The specimens of *F. pupoides* obtained from these samples were deposited in the collection of the senior author (CB), Livorno, Italy.

Results and discussion

In the early 2000s, *F. pupoides* was collected along the Israeli coast from Haifa to Tel Aviv at depths between 5.5 and 29 m (Bogi and Galil 2006). Annual surveys conducted off the central coast of Israel (34°41E, 31°56N, 7–13 m) detected no *F. pupoides* in 2004, a single specimen in each of 2008 and 2010, but up to 88 ind/m² in 2011. Samples collected during an annual survey of the shallow sublittoral infauna along the length of the Israeli coast were entirely devoid of *F. pupoides* in 2005, 2006, 2007, and contained single specimens in 2008 and 2009. Yet, in 2010, at depth of 10 m in Haifa Bay next to Haifa port (32°49.940N, 35°02.534E), 726 ind/m² were found. In samples collected that same year at 25 m depth in Haifa Bay (32°51.705 N, 34°59.223E), up to 3300 ind/m² were recorded. In September 2011, in southern Haifa Bay (32°50.15N, 35°00.41E) at depth 14 m, up to 1815 ind/m² were recorded. Interestingly, Çinar et al. (2012) noted a similar numerical increase, next to Mersin harbour, Turkey (ca. 440 km distant from Haifa), where the maximum density of *F. pupoides* was 800 ind/m².

The large number of specimens available to us permitted examination of the variation in profile, sculpture and coloration. The protoconch comprises two smooth whorls. The typical form has an elongated profile, strongly convex whorls, the last two of equal diameter (Figure 1A), but specimens with an even more conical profile are not rare (Figure 1D, E), as are more slender specimens (Figure 1C, F). The spiral sculpture consists of cords differing in prominence. The typical color is whitish with brown spots on mid whorl. However, uniformly brown (Figure 1B, E) or white specimens are not rare (Buzzurro and Greppi 1996). Individuals ranged in size (height) between 1.9 and 4.0 mm.

Once established in the Mediterranean, the temporal dynamics of the Erythraean species are markedly varied. Bodenheimer (1935) hypothesized that local increase in abundance in populations of the Indo-Pacific species introduced through the Suez Canal could take considerable time. Although in some cases the interval between the initial establishment and rapid numerical increase and geographic spread has been exceedingly short (Galil 2006), a time lag, possibly reflecting an interval required for population growth needed to promote propagule pressure, is a more common pattern. In some cases, the time-lag may extend over half a century; e.g., the gastropods *Cerithium scabridum* Philippi, 1848 and *Indothais lacera* (Born, 1778) [= *Thais lacera* (Born, 1778) were collected off of Jaffa by 1891 and 1928, respectively, (Hart 1891; Mienis 1977) but only 90 and 64 years later, respectively, along the southeastern coast of Turkey (Enzenross et al. 1990; Niederhöfer et al. 1991). The jack, *Alepes djedaba* (Forsskål, 1775) and the swimming crab *Charybdis hellerii* (A. Milne-Edwards, 1867) were both collected in Haifa Bay in 1924, but not until nearly three and

six decades later, respectively, in Iskenderun, Turkey (Akyüz 1957; Kocataş 1981). The last two species are easily distinguished from the native Mediterranean biota, are collected along intensively fished coasts, and so were unlikely to be overlooked. The actual time lag is probably longer than the records imply because chances of detecting the earliest colonists of an unintentionally introduced species are slim.

The implication of a long time lag is that even were new introductions prevented, populations of some of the Erythraean aliens already in the Levant may still increase and spread in future. The longer management of the Erythraean invasion is delayed, the larger the "invasion debt" we accrue.

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References

Akyüz EF (1957) Observations on the Iskenderun red mullet (*Mullus barbatus*) and its environment. *Proceedings and Technical Papers, General Fisheries Council for the Mediterranean* 4: 305–326

Bakir BB, Öztürk B, Doğan A, Önen M (2012), Mollusc fauna of Iskenderun Bay with a checklist of the region. *Turkish Journal of Fisheries and Aquatic Sciences* 12: 171–184

Barash Al, Danin Z (1977) Additions to the knowledge of Indo-Pacific Mollusca in the Mediterranean. *Conchiglie* 13(5–6): 85–116

Bodenheimer FS (1935) Animal life in Palestine. An introduction to the problems of animal ecology and zoogeography. L. Mayer, Jerusalem, pp 1–506

Bogi C, Khairallah NH (1987) Nota su alcuni molluschi de provenienza Indo-Pacifica raccolti nella baia di Jounieh (Libano) – Contributo I. *Notiziario del CISMA* 10: 54–60

Bogi C, Galil BS (2006) Nuovi ritrovamenti lungo le coste Israeliane. *Notiziario S.I.M Supplemento al Bollettino Malacologico* 24(5–8): 16–18

Buzzurro G, Greppi E (1996) The Lessepsian molluscs of Tasuçu (South-East Turkey). *La Conchiglia* 28(279): 3–22

Buzzurro G, Greppi E (1997) Notes on the mollusks of Cyprus, with special attention to the alloctone species. *La Conchiglia* 29(283): 21–31, 61–62

Cecalupo A, Quadri P (1996) Contributo alla conoscenza malacologica per il nord dell'isola di Cipro (Terza e ultima parte). *Bollettino Malacologico* 31(5–8): 95–118

Çinar ME, Katagan T, Öztürk B, Dagli E, Açik S, Bitlis B, Bakir K, Dogan A (2012) Spatio-temporal distributions of zoobenthos in Mersin Bay (Levantine Sea, eastern Mediterranean) and the importance of alien species in benthic communities. *Marine Biology Research* 8: 954–968, http://dx.doi.org/10.1080/17451000.2012.706305

Enzenross L, Enzenross R, Niederhöfer HJ (1990) Wissenschaflich interssante Funde aus der Sammlung Enzenross (marine Invertebraten). *Jahreshefte der Gesellschaften fuer Naturkunde in Wuerttemberg* 145: 283–294

Haas G (1937) Mollusca marina. In: Bodenheimer FS (ed), Prodromus faunae Palestinae, Essai sur les Eléménts zoogéographiques et historiques du sud-ouest du sous-règne Paléarctique. *Mémoires présentés a l'Institut d'Égypte* 33: 275–280

Hart HC (1891) Some accounts of the fauna and flora of Sinai, Petra and Wadi 'Arabah. Palestine Exploration fund, London, pp 1–255

Galil BS (2006) The marine caravan – the Suez Canal and the Erythrean Invasion. In: Gollasch S, Galil BS, Cohen AN (eds), Bridging divides: maritime canals as invasion corridors. Monographiae biologicae 83. Springer, pp 207–300

Janssen R, Zuschin M, Baal Ch (2011) Gastropods and their habitats from the northern Red Sea (Egypt: Safaga) Part 2: Caenogastropoda: Sorbeoconcha and Littorinimorpha. *Annalen des Naturhistorischen Museums in Wien, Serie A* 113: 373–509

Kocataş A (1981) Liste préliminaire et répartition des crustacés décapodes des eaux turques. *Rapports et Procès-Verbaux des Réunions, Commission Internationale pour l'Exploration Scientifique de la mer Méditerranée* 27(2): 161–162

Mienis HK (1977) An early record of *Thais carinifera* from the Mediterranean coast of Israel. *Levantina* 7: 70

Mienis HK (2003) Native marine molluscs replaced by Lessepsian migrants. *Tentacle* 11 (2003):15–16

Niederhöfer H, Enzenross L, Enzenross R (1991) Neue Erkenntnisse über die Ausbreitung von "Lesseps'schen Einwanderern" (Mollusca) an der türkischen Mittelmeerküste. *Club Conchiglia Informationen* 23(3–4): 94–108

Öztürk B, Buzzurro G, Benli, HA (2004) Marine molluscs from Cyprus: new data and checklist *Bollettino Malacologico* 39(5–8): 49–78

Öztürk B, Can A (2006) Indo-Pacific gastropod species in the Levantine and Aegean Seas. *Aquatic Invasions* 1(3): 124–129, http://dx.doi.org/10.3391/ai.2006.1.3.4

Safriel UN, Felsenburg T, Gilboa A (1980) The distribution of *Brachidontes variabilis* (Krauss) along the Red Sea coasts of Sinai. *Argamon* 7: 31–43

Tringali L, Villa R (1990) Rivenimenti malacologici dalle coste Turche (Gastropoda, Polyplacophora, Bivalvia). *Notiziario del CISMA* 12: 33–41

Trono D (2006) Nuovi dati sulla malacofauna del Salento (Puglia meridionale). *Bollettino Malacologico* 42(5-8): 58–84

van Aartsen JJ (2006) Indo-Pacific migrants into the Mediterranean 4. *Cerithidium diplax* (Watson, 1886) and *Cerithidium perparvulum* (Watson, 1886) (Gastropoda, Caenogastropoda). *Basteria* 70: 33–39