

About the settling of *Erosaria turdus* (Lamarck, 1810) in Mediterranean

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Abstract

The localized finding of a dense population of *Erosaria turdus* (Lamarck, 1810) is recorded from the eastern coast of Djerba, southern Tunisia. On the basis of this finding and of previous records from the southeast corner of Mediterranean and from the Gulf of Gabès, a reassessment of the settling status of the species in Mediterranean is tempted.

The high density of individuals observed at the eastern tip of Djerba leads to infer the local breeding of the species off southern Tunisia. The assumed low spreading ability of *E. turdus* suggested by previous records leads to propose the progressive colonization of the species along the southern coasts of Mediterranean as being the most plausible hypothesis.

Riassunto

Viene riportato il ritrovamento localizzato di una densa popolazione di *Erosaria turdus* (Lamarck, 1810) dalle coste orientali di Djerba, sud Tunisia. Sulla base di questo ritrovamento e di quelli precedenti dalle coste sud orientali del Mediterraneo e dalle coste del Golfo di Gabès, viene tentata una revisione dello stato di insediamento della specie nel Mediterraneo.

L'alta densità degli individui osservati sull'estremità orientale di Djerba porta ad una ipotesi di riproduzione locale della specie al largo della Tunisia. Il dato suggerito dai precedenti ritrovamenti di bassa capacità di propagazione di *E. turdus* porta a proporre l'ipotesi di una progressiva colonizzazione della specie lungo le coste meridionali del Mediterraneo come più plausibile.

Key words

Cypraeidae, *Erosaria turdus*, spreading mechanism, Tunisia, lessepsian species.

Introduction

The elusive presence of *Erosaria turdus* (Lamarck, 1810) in Mediterranean has been displayed along the last 20 years through few records of isolated adult shells collected off the north eastern Egyptian coast and off the western Israelian coast.

After the discovery of a single living specimen within the Suez Canal (Egypt) just before the Second World War (Moazzo, 1939), *E. turdus* was recorded from one single juvenile shell collected near Haïfa, western Israel (Burgess, 1985), and from isolated adult shells from Dor, western Israel (Barash & Danin, 1986) and from Port-Saïd, north eastern Egypt (Giannuzzi-Savelli *et al.*, 1997).

These scarce records, from a restricted area located at the northern entrance of the Suez Canal and along the nearby Mediterranean coast ranging eastwards, supported the hypothesis of survival of larvae drained off the ballast tanks of trading ships or transported directly by currents off the Canal itself, rather than the result of the successful settling by permanent populations breeding in the place. Giannuzzi-Savelli *et al.* (1997) expressed this feeling with the sentence "*Distribuzione occasionale, immigrante lessepsiano*".

This status of *E. turdus* as an "elusive lessepsian species restricted to the vicinity of the Canal entrance" has been

recently contradicted by the record of adult specimens from southern Tunisia. During autumn 2003, Wimart-Rousseau & Wimart-Rousseau (2004) collected 2 paired live adult specimens of *E. turdus* at low tide just below the north western tip of Djerba. In May 2004, Delongueville & Scaillet (2004) obtained 13 individuals, one found as freshly beached shell in Sidi Mansour, a few distance north of Sfax, and 12 ones from fishermen operating off the same place, several out of these 12 individuals with remains of the soft parts inside the shell.

Wimart-Rousseau & Wimart-Rousseau (2004) did insist on the fact that they did not find any other shell or fragment of *E. turdus* during their stay in Djerba and they prudently claimed that the way of introduction of the species was unknown, showing implicitly their doubts about its permanent settling in the place. On the contrary, Delongueville & Scaillet (2004) presented their further record as the "confirmation of the settling of this species in the Gulf of Gabès", suggesting by the way that the wide distribution of *E. turdus* observed off Southern Tunisia in 2003-2004 can be interpreted as the proof that the species is firmly established in the place. The recent discovery by the authors of a dense live population of *E. turdus* on a limestone reef situated at the eastern tip of Djerba, together with the reinterpretation of the previous data, both lead to reassess the present status of this species in Mediterranean.

Results

A field research performed by the Authors along the coast of Djerba in October 2004 did not allow to find any further subject of *E. turdus* around the north western tip of the island where D. and J. Wimart-Rousseau collected their 2 paired adult specimens (pers. comm. of D. Gratecap: intertidal sandy bottom protected by a small islet located in the southwest of Bordj Djilidj), but we observed a series of 34 live adult specimens, one large juvenile shell and several adult shells of *E. turdus* clustered upon a small rocky reef located off Sidi Garus Point, at the eastern tip of the island.

This reef does protect the entrance of a large sandy lagoon. The back side of the reef shelters a typical lagoon fauna, dominated by *Bolinus brandaris*, *Neverita josephina* and *Nassarius mutabilis*. The outer slope of the reef is made of big rocks covered by calcareous algae and sheltering a poor selection of the *Posidonia* fauna. The submerged part of the upper reef (which remains flooded by water at low tide in its central part) is made of large tables and few rocks covered by a short coralligenous assemblage and it shelters principally *Conus mediterraneus*, *Ocenebra erinaceus*, *Muricopsis cristatus* and few *Hexaplex trunculus*. The population of *E. turdus* was observed in the inner part of the submerged crest of the reef, within an area of about 300 m². Specimens were found lying in crevices of the coralligenous platforms which are partially filled with sand and buried within an algal framework, or found along the overhangs of the crevices or spread in deposits of sandy gravels around rocks, mostly in exposed conditions and rarely in holes or under slabs.

This population is considered to have settled on this reef only recently, due to the fact that regular samplings in this precise place by J. Demartini, during the nineties (Demartini pers. comm.), did not yield any shell or specimen of Cypraeidae, and to the fact that all the empty *E. turdus* shells found on the reef were in a very fresh state.

Moreover, accurate samplings performed by a team of about 10 French collectors off the western and north western coasts of Djerba as well as off Sidi Garus (lagoon and northern crest of the reef) in October 2001 and at the Kerkennah Islands during October 2002, did not bring any clue of the presence of *E. turdus* in these places.

Discussion

Most Cypraeidae are assumed to have wide larval spreading on the base of their distribution, although breeding process and the duration of larval phase have not been specifically studied in most species. Cases of endemism and restricted distribution have been documented as well in this family, although these are far less common.

In the Red Sea, *E. turdus* is found in shallow sandy bottom areas where living coral is abundant (Burgess, 1985) and, under this conditions, it may occur in great numbers of individuals (Bosch & Bosch, 1982; Shara-

bati, 1984), that use to "move about freely in the daytime" (Burgess, 1985). *E. turdus* larval ecology has never been studied before, but the rather restricted range of distribution in north western Indian Ocean might testify for of a relatively poor ability of larval dispersal, probably due to a short larval phase.

The hypothesis of a direct introduction in the Mediterranean of adult specimens of *E. turdus* thanks to a direct migration of adults throughout Canal itself by "crawling" seems to be a very difficult event due to the presence of a "salt barrier" constituted by the Bitter Lakes. Nonetheless, the process has not to be considered impossible, as a live specimen have been already found in it (Moazzo, 1939).

On the whole, the very scarce occurrence of juvenile or adult shells of *E. turdus* in the vicinity of the northern entrance of the Suez Canal, with few specimens found alive in this area, compared to the abundance of the species in its native range (north western Indian Ocean), seems to confirm the limited dispersal capabilities of the species. Due to these data, the eastern basin of the Mediterranean has been considered an unsuitable place for *E. turdus*, where unfavourable environmental conditions exist preventing the settlement of a conspicuous population (Zenetos *et al.* (2004).

This large species in fact, if present, would not have been missed by the numerous divers and collectors sampling off the western coast of Israel, as it would not be missed also along the coasts of Cyprus and of southern Turkey.

On the other hand, the absence of *E. turdus* records from the northern coasts of Egypt cannot be interpreted as a real proof of its non occurrence, since this area has not been sampled for a long time.

About the settling of *E. turdus* off southern Tunisia

The sudden and massive intrusion of *E. turdus* off southern Tunisia is in contrast with the scarce and discontinuous records from the southeast corner of Mediterranean during the last 20 years. It must be stressed the fact that the shallow waters off southern Tunisia were regularly sampled since more than one century ago and more intensively during the last 25 years.

Therefore, due to the frequent checking by experienced collectors in the whole area and the diurnal behaviour of *E. turdus*, this recent apparition cannot be interpreted as a simple artefact, and it is assumed to be due to a recent process of introduction and spreading.

A first plausible interpretation to such an "intrusion" could possibly be interpreted as a simultaneous release of *E. turdus* larvae, e.g. by means of ballast waters of cruise yachts travelling in southern Tunisia or of trading ships anchoring in Sfax or in Tripoli, whose harbour welcome an increasing ship traffic during the last years.

In favourable environmental conditions, such a single release of larvae may have led to a successful metamor-

phosis and to the growth of individuals until the adult stage, and the dominant winds, blowing from Tripoli to southern Tunisia, may have enhanced the spreading of larvae in this area. According to this hypothesis, a first release of larvae in Tripoli may have allowed the progressive settling of *E. turdus* from Tripoli to Djerba and to the Gulf of Gabès.

However, the density of adult specimens observed upon the Sidi Garus reef in October 2004 seems therefore to be too high to support the hypothesis of survival and spread of larvae from a single release and this simple mechanism would not explain why they did not occur earlier in this area and why the same successful settling process (or at least local and periodic abundance of adult individuals) did not occur so easily in the eastern Mediterranean (or at least in the southeast corner of the Basin).

The sudden apparition of *E. turdus* in great number off the whole southern Tunisia could be explained with the equally plausible hypothesis of local breeding.

In the case of an introduced species however, even the finding of a clutch of adult specimens does not constitute a direct and positive proof of local breeding, because fertility, mating behaviour, egg deposition, hatching and spread of larvae, their survival in the plankton could partially or completely be compromised by a series of different environmental factors, different from the original ones, that could affect the spreading process of the species.

So, the occurrence of a local breeding generally has to be inferred from other indirect proofs and, in the present case, two kinds of factors could be accepted as clues of a local breeding of *E. turdus* off southern Tunisia:

- the numerous adult specimens discovered in the short delay of one year in a wide area, from the eastern coast of Djerba to the northern coast of Sfax.
- the high density of adult specimens found upon the Sidi Garus reef is not compatible with the random distribution of free-swimming larvae coming from a distance, or even from a single release event of ballast waters.

If local breeding occurred, highly success of colonization can be expected, since climatic conditions occurring off southern Tunisia (including the sea water temperatures) are not really different from the ones prevailing in the north of the Red Sea and in the southeast corner of Mediterranean.

Contrary to the feeling of Zenetos *et al.* (2003), *E. turdus* does not seem to be strictly dependent of a live coral environment for its adult development, and it can be reasonably assumed, considering the number of observed adult specimens, that the species is able to find good prey items also in the southern Mediterranean.

Furthermore, the former discovery of an adult live specimen of *E. turdus* in the Suez Canal (Moazzo, 1939) shows by itself that the requirements of the species are probably not so demanding, at least as regards as its adult stages.

About the spreading of *E. turdus* in southern Mediterranean

Given the above, the not successful settling of *E. turdus* in the southeast corner of Mediterranean cannot be considered *per se* the proof that the species is unable to colonize Mediterranean.

Moreover, considering that the molluscan fauna ranging along the Egyptian and the Lybian coasts of Mediterranean west from the Nile Delta was not studied at all during the last decades, we must conclude that our picture of *E. turdus* distribution in the south Mediterranean was not satisfactorily assessed. As a matter of fact, a possible spreading of *E. turdus* west from the Canal entrance has never been considered as a hypothesis deserving to be taken into account.

The progressive settling of *E. turdus* along the western coasts of Egypt and along the whole coasts of Lybia is therefore proposed here as being the most likely hypothesis about the way of spreading of the species in Mediterranean. A very slow settling, possibly requiring several tenth years, would be compatible with the poor spreading ability of the species suggested by the records from the southeast corner of the Basin.

The recent apparition of *E. turdus* in southern Tunisia should be just the result of such a progressive expansion of the species along the southern side of the Eastern Basin of Mediterranean, a long time after the initial introduction of the species by the way of the Suez Canal.

However, if this hypothesis will be confirmed, the failure of the species' colonization along the eastern coasts of the Basin remains to be explained.

The best way to verify what was the real spreading process of *E. turdus* in southern Mediterranean is probably to check the presence of the species (live and subfossil individuals) along the Lybian coast, especially off Cyrenaica. Such a checking would be also the opportunity to reassess the real composition of the lessepsian fauna in Mediterranean, which is suspected, on the basis of the remarks above, to be greatly underestimated in the present state.

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