

## Recent records of the Indo-Pacific species, *Lucifer hanseni* Nobili, 1905 (Crustacea; Decapoda; Luciferidae) from the Mediterranean coast of Israel

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### Abstract

Specimens of *Lucifer hanseni* Nobili, 1905 were obtained along the Mediterranean coast of Israel between 2008–2011. A single specimen collected in 1924 from Port Said harbour, Egypt, was hitherto the only record of the species in the Mediterranean Sea. The cluster of specimens documented herein suggests the species has recently established a population along the southern Levantine coast.

**Key words:** *Lucifer hanseni*, Decapoda, Erythrean alien, Mediterranean, Israel

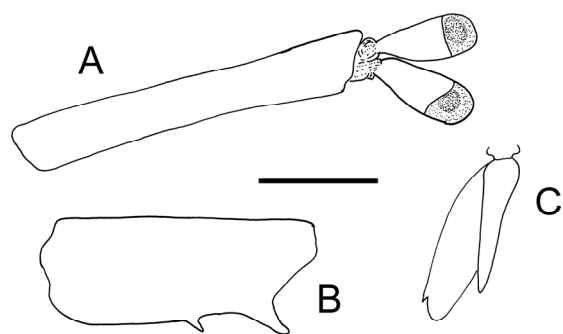
### Introduction

The Levantine littoral biota has an ever increasing component of Erythrean aliens (Galil 2009). Many of these have spread westwards, some reaching the western Mediterranean (Sánchez-Tocino et al. 2007; Daniel et al. 2009). A considerable proportion of these are crustaceans, with Galil (2011) listing 106 alien species in the Mediterranean. Four fifths of these are derived from the Indo-Pacific, 64 of which can be directly traced as having invaded the Mediterranean through the Suez Canal.

Decapoda are particularly well represented with 70 species (Galil 2011), although not all have established viable populations in the eastern Mediterranean and some are only known from a single record. One such species is *Lucifer hanseni* Nobili, 1905 (Balss 1927). Here several samples of *L. hanseni* collected between 2008–2011 are reported upon from the central Mediterranean coast of Israel, suggesting the recent establishment of a population occurring along the Levantine coast.

### Material and methods

The GOC Several samples were collected in 2008–2011 along the Mediterranean coastline of Israel: off Herzlia, 2.05.2011, depth 11–13 m, 9 specimens (2♀, 3♂, OUMNH.ZC.2012.04.0001, remainder in RE collection); off Maagan Michael, 14.04.2011, depth 5 m, 1 specimen (RE collection); northeast of Ashdod, 31°56.389N 34°41.76E, 09.09.2008, depth 10.8 m, 1 ♀ (TAU AR 29049); northeast of Ashdod, 31°51.028N 34°39.026E, 04.09.2011, depth 9 m, 4 ♀, 3 ♂ (TAU AR 29053); northeast of Asdod, 31°57.586N 34°42.322E, 09.09.2008, depth 10.5 m, 1 ♀ (TAU AR 29050); northeast of Ashdod, 31°58.110N 34°40.369E, 07.09.2011, depth 35 m, 1 ♀ (TAU AR 29051); northeast of Ashdod 31°55.747N 34°39.118E, 07.09.2011, depth 35 m, 1 ♀ (TAU AR 29052). Specimens are deposited in the Oxford University Museum of Natural History, United Kingdom (OUMNH.ZC), the Steinhardt National Collections of Natural History, Tel Aviv University, Israel (TAU) and the reference collection of R. Einav (Blue Ecosystems).



**Figure 1.** *Lucifer hanseni* Nobili, 1905 (OUMNH.ZC.2012.04.0001), male. **A**, cephalothorax; **B**, sixth abdominal segment; **C**, uropods.

## Results

### Family Luciferidae De Haan, 1849

*Lucifer hanseni* Nobili, 1905 (Figure 1)

*Lucifer hanseni* Nobili, 1905: 395; 1906: 25-27; Figure 3B; Plate 2, figures 1–1c. – Hansen, 1919: 63–65; Plate 5, figures 4a-4o. – Petit, 1973: 211–214; Figures 2.3a-b, 3.3a-b, 4.3a-c, 5.3a-b.

**Diagnosis (males):** Length of eye stalk short, less than half the distance between eye socket and labrum; thick and tubular. Rostrum falling short of antennular statocyst. Petasma with terminal portion of sheath acute, processus ventralis slender, acutely pointed. Sixth abdominal segment deep, anterior process shorter than posterior process, comparatively closer to posterior process than to anterior margin of segment. Marginal tooth of exouropod small, falling far short of distal lamina.

**Remarks:** Up to now, only one species of *Lucifer* Thompson, 1829 has been recorded from the Mediterranean coast of Israel, *L. typus* (see Galil and Shlagman 2010), a widely distributed species, occurring in most of the world's oceans and widespread in the Mediterranean. Males of both species can be easily separated on account of the larger, recurved anterior process on the sixth abdominal segment in *L. typus* (vs. smaller, non-recurved in *L. hanseni*) as well as the comparatively much longer eyestalks in *L. typus* (Petit 1973). As females lack the processes on the sixth abdominal segment, identification is more difficult, although the comparative length of the eyestalk can be used. Further details to separate both species can be found in Hansen (1919), Petit (1973) and Naomi et al. (2006).

**Distribution:** Suez Canal, Red Sea, Madagascar, Arabian Sea, Bay of Bengal, Andaman Sea, Indonesia, South China Sea, Inland Sea of Japan, Australia. Now confirmed in the Mediterranean Sea.

## Discussion

Prior to the present records, the only record of *Lucifer hanseni* in the Mediterranean is by Balss (1927) who recorded the species from Port Said, based on material collected during the Cambridge Expedition to the Suez Canal in 1924. This record has been variously treated in subsequent literature: Galil et al. (2002) considered it as having “only a single reliable record”. Similarly, Zenetos et al. (2005) considered it as a “casual” species, i.e., presumed not to be established. However, Holthuis and Gottlieb (1958) state that the identification of this material is not certain, referring back to Balss (1927).

Balss (1927) records the species from two stations, P4 and Kabret, specifically mentioning that the identification is not completely certain, as only females were available. Station P4 is situated in Port Said, being a coal basin on the eastern side of the Harbour, 5 m deep (Fox 1926). Gurney (1927a) in an appendix to Balss's paper states that only a single specimen was collected at station P4 (presumably female, see Balss 1927), but mentions the species to be abundant at more southerly locations within the Suez Canal (including at Kabret), with larvae also being abundant in the Bitter Lakes. Fox (1927), in a further appendix to the Balss (1927) paper, tabulates the species as being present in the Suez Canal from Great Bitter Lake southwards to the Gulf of Suez, in the northern part of the canal and Lake Timsah (only in 3 samples in the western half of the Lake, according to Gurney 1927a) and Port Said. Gurney (1927b), who himself took part in the Cambridge Expedition, when discussing the larval development of the species, mentions that the doubt expressed in Balss (1927) stems from the fact that the males sent to Balss were apparently lost in the post. Gurney (1927b) also states that males were rare in the plankton samples collected during the expedition, but that the two available adult males and two nearly adult males match the description in Hansen (1919) and there can be no doubt as to their identity. Evidently, more material collected

during the expedition was available to Gurney (1927a, b) and Fox (1927) than Balss (1927), even if some was indeed lost in the post (see Gurney 1927b) or perhaps not all was forwarded to be identified by Balss. The picture which emerges from this historical account suggests that only one species of *Lucifer*, viz. *L. hanseni*, was found during the Cambridge 1924 Expedition to the Suez Canal. This species was abundant in the canal south of the Bitter Lakes and with sporadic records further north, up to and including Port Said. The Balss (1927) identification, even though it only refers to a single female, appears to be accurate.

Since then, no further records of this species have been found in the Mediterranean, until the present records from Israel, nearly 90 years later. The number of specimens in the current records, as well as the presence of mature males and females does indicate that the species is now likely established in the south-eastern Mediterranean. As one of the locations where the species was recently collected had been sampled by the same means, biannually, for the past 22 years (BSG), it is likely that the sudden appearance of the species results from a recent invasion through the Suez Canal, rather than the species having gone undetected in the intervening period. The present records also constitute the first record in the Mediterranean in the wild, with the previous records from the Suez Canal and Port Said having been within man-made structures.

Species of *Lucifer* are generally considered to be planktonic (Omori 1992), sometimes accounting for a significant proportion of estuarine and coastal plankton (Dakin and Colefax 1940). *Lucifer hanseni* is no exception to this, having been recorded in densities up to 725 individuals per 1000 m<sup>3</sup> (Geetha 2005) in Indian coastal waters and making up 34.0% of planktonic penaeoids in Kuwait Bay (Grabe and Lees 1992). In line with these observations, Naomi et al. (2006) consider *L. hanseni* to be a pelagic species, mainly neritic up to 50 m in depth, occasionally occurring down to 200 m. In contrast, the present specimens were all obtained by benthic grab sampling in shallow water on a sand and sandy-silt bottoms. Whilst this at first glance may appear contradictory, other records exist of benthic occurrences of *L. hanseni*, notably in Moreton Bay, Australia (Poiner and Kennedy 1984) and Port Phillip Bay, Australia (Poore and Rainer 1979). Oishi and Saigusa (1997) provide evidence that coastal planktonic

taxa, such as copepods, *L. hanseni* and mysids are likely inactive during the day, sinking to near the bottom during the day and becoming active at night, spreading throughout the entire water column, with those emergence cycles further influenced by tidal and lunar cycles. Such an activity cycle would explain the presence of *L. hanseni* in grab samples, as the downwards pressure wave of grab deployment often catches hyper- and epibenthic species.

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