

## A swarm of the seven-spot ladybird *Coccinella septempunctata* (Coleoptera: Coccinellidae) carried on a cruise ship

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**Abstract.** Several thousands of the seven-spot ladybird *Coccinella septempunctata* L., descended upon a cruise ship over several hours in daylight while in port in Morocco in April 2009. The ship had recently arrived from South America. Despite a treatment of fumigation beetles were found living after fourteen days following the inoculation event. This observation indicates an ocean transmission of large numbers of this species could take place and might have happened in the past.

### INTRODUCTION

*Coccinella septempunctata* L. is a predatory palearctic beetle now widely distributed in North America having arrived in the 1970s (Elliott et al., 1996; Alyokhin & Sewell, 2004). Its appearance in North America resulted in a decline of several native coccinellid species (Wheeler & Hoebeke, 1995; Evans, 2004). It is also known from other world regions (Kawauchi, 1983). In North America it was introduced as a biocontrol agent (Obrycki & Kring, 1998) and became dominant in apple orchards (Brown & Miller, 1998; Brown, 2003). In some areas it has become less abundant in some habitats as a result of the introduction of the Asian *Harmonia axyridis* (Pallas). This Asian species is currently displacing native ladybirds as it expands its range in European regions (Roy & Roy, 2009) and has recently arrived in South Africa (Stals & Prinsloo, 2007).

Consignments of *C. septempunctata* have been introduced to North America for the purpose of biological control as it is an avid predator of aphids. This beetle was found in abundance in port regions on the eastern coast of North America suggesting a further pathway may have been involved in its transmission that may include transfer with ship cargoes (Day et al., 1994). This species is unlikely to undertake a collective long-distance movements across oceans. However, there are known migrations to mountain regions where they may aggregate in abundance where such movements may be associated with air updrafts (Hodek et al., 1993). Indeed as early as 1970 (WHO, 1970) there was a warning that container traffic could be responsible for the transmission of animals. Containers are a widely established form of transport of goods by shipping.

Great numbers of *C. septempunctata* have been reported by Schaefer et al. (1987) who found them on the sea surface in Chesapeake Bay, USA, and stranded in abundance on beaches. It is possible that such swarms may have developed from an introduction to a nearby port region. Indeed Schaefer et al. (1987) suggested that their occurrence in North America arose from releases in relation to biocontrol but also that their arrival could also have been with ships originating from the north-eastern Atlantic region. In this account we provide information on a swarm of *C. septempunctata* carried upon a ship from North Africa to southern Europe providing evidence that a trans-ocean ship invasion is possible.

### METHODS

Two upper public deck areas of a cruise ship “The Splendour of the Seas”, of the Royal Caribbean Cruise line, with a cruising speed of 24 knots, overall length of 264 m and 70,000 gross tonnage, were examined while at sea. The upper open deck (deck 10) consisted of a running track, sitting-out area and at the stern, a sporting area including a climbing wall. The pool deck (deck 9) lay below the running deck shielded on all sides but with an open central area.

The ship left South America to arrive in Agadir and a day later was in port in daylight in Casablanca. The ships’ environmental officer, Mayte Menderico, became aware of the presence in the afternoon of 11 April 2009 (day 0). The author joined the ship at the next port of call Lisbon (day 2) and made observations from day 3 while en route: Lisbon – Cadiz – Malaga – Barcelona – Villefrance – Cessinatico – Corfu – Naples – Venice (day 14). Observations were made during daytime and at night each day throughout the cruise by observing their presence on decks 9 and 10 and from two balconies on deck 6.

Estimates of abundance were made in the lee of the funnel, deck 11, and other raised structures on the deck with the running track.

### RESULTS AND DISCUSSION

There were no *C. septempunctata* noticed by the crew of the ship on the Atlantic crossing from South America to Morocco. The beetles made an obvious appearance while the vessel was in Casablanca port on 11 April 2009 (day 0). Large numbers of *C. septempunctata* had descended to the stern area and on the climbing wall. Their numbers incited the ship’s environmental officer to ensure that the upper decks were fumigated overnight before the vessel arrived in Lisbon on day two. An examination on day three revealed some hundreds of trampled carcasses in the artificial turf of the jogging track and beside the central pools. Beetles were present on all exposed parts of the deck occurring mainly on horizontal surfaces. However, clusters of living individuals, of up to 12 per m<sup>2</sup> has assembled on the leeward side of the ship in crevices and overhangs and other recessed areas and along margins below the ship safety rails. These are similar recessed sites to where hibernation takes place in buildings (Hodek et al., 1993; Honěk, 1990; Hodek, 1996). It is likely that the swarm arose from *C. septempunctata* coming out of hiberna-

tion as this species is known to aggregate on rock ridges which are not unlike the stern section of the ship where the inoculation took place. Estimated numbers arriving would be in thousands. Such were their numbers that some were also found on suite balconies and other lower deck levels.

On day fourteen on arrival in Venice some pairs and individuals could be found in recessed areas probably amounting to hundreds on the ship although by this time on upper sheltered deck areas the numbers had declined to  $< 1$  per  $m^2$ .

Survival of *C. septempunctata* over fourteen days, and the effort to reduce their numbers by fumigating and sweeping of living and dead individuals, would indicate that many more would have survived if no controls had been taken.

It is indeed likely that ships in Europe could carry thousands of individuals to result in sufficient propagule pressure to enable a new population to become established on arrival in North America as Day et al. (1994) and Schaefer et al. (1987) have suspected. Swarming in ladybirds are not infrequent events known both in Europe, Africa and North America (Oliver, 1943; Edwards, 1957; Schaefer et al., 1987; Hodek, 1996; Pettersson et al., 2005; Ricci et al., 2005). A similar alighting of beetles onto containers, stacked on container ships, may provide such a mechanism for an arrival as many recesses occur between, and on, each container. These containers would be lifted ashore ensuring transmission from the ship.

Evidence provided here shows that a swarm of *C. septempunctata* was capable of surviving at sea on a ship within a timeframe of a transatlantic crossing of a container ship. Normally the shortest trip would be from Lisbon to Halifax at a speed of 19 knots. This would take less than six days and from Bremerhaven to New York would take less than eight days at the same speed (S. Gollasch, pers. comm.). While the numbers needed to establish a population are unknown it is likely that survival of some thousands should be able to overcome the Allee effect. Consequently it may not be the escape of biocontrol species alone responsible for the release to the wild in North America (Lynch & Thomas, 2000). Other insects that alight on ships may be able to establish distant populations having been transported in the same way.

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