

First record of the hammer-headed garden worm *Bipalium kewense* Moseley, 1878 (Tricladida Geoplanidae) in Ischia (Campania, Italy)

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ABSTRACT

The land planarian *Bipalium kewense* Moseley, 1878 (Tricladida Geoplanidae) is a native flatworm species from Southeast Asia, but it has been introduced to about 50 countries, where it represents a dangerous alien organism. In this note, we report the first record of this species for the island of Ischia (Campania, Italy).

KEY WORDS

Alien species; exotic land planarian; Ischia; Italy.

Received 23.12.2023; accepted 10.02.2023; published online 20.03.2024

INTRODUCTION

Introduction and spread of alien species are considered one of the main threats to biodiversity at global and local scales, particularly on islands which are areas rich in endemic species. Indeed, this is mainly due to the rates at which specific species are introduced, as well as their possible destructive impact on native biota (Rato et al., 2015). Land planarians have been reported as alien species in soils throughout the world and, among those, some species are considered to be successful invaders, e.g. *Platydemus manokwari* de Beauchamp, 1963, *Arthurdendyus triangulatus* (Dendy, 1894), *Bipalium adventitium* Hyman, 1943, *Bipalium kewense* Moseley, 1878 and *Dolichoplana striata* Moseley, 1877 (Winsor et al., 2004; Álvarez-Presas et al., 2014; Justine et al., 2014, 2015; Mazza et al., 2016). The invasion by land planarians has been for long overlooked, although some countries such as Italy, UK, Iberian Peninsula, and France, are the

countries with the highest diversity of alien planarian species in Europe (Álvarez-Presas et al., 2014; Justine et al., 2014; Mazza et al., 2016; Mori et al., 2022a, 2022b). In recent times, records have also been reported for Eastern Europe (Mori et al., 2023).

Impacts of these species on native ecosystems are still mostly unknown, even if some species are being reported as potentially affecting populations of native invertebrate species (snails, slugs, earthworms, and even other planarians) by predation. Alien edaphic organisms can have dramatic effects on the environment, due to the direct effects on native soil organisms, and through their interactions with the environment aboveground (Sluys, 2016). The native range of *Bipalium kewense* (Tricladida Geoplanidae) appears to be Southeastern Asia, from northern Vietnam to southern Cambodia (Winsor, 1983). Hitherto, this species is recorded from more than 40 countries of North, Central and South America, The Caribbean, Africa, Europe, Asia and

Australasia, being one of the most widespread land planarian. *Bipalium kewense* is more widespread, having a cosmopolitan distribution (Pérez-Gelabert, 2010; Winsor, 1983). The primary mode of *B. kewense* dispersal (along with about 30 other invasive species of land planarians) appears to be by transport of exotic potted plants, with the soil containing the land planarians or their cocoons (Justine et al., 2014; Lago-Barcia et al., 2015; Winsor, 1983).

In this work we reported the presence of this species in a small Mediterranean island, Ischia, in Southern Italy.

MATERIAL AND METHODS

Ischia is an Italian island, belonging to the archipelago of the Flegrean islands together with Procida, Vivara and Nisida, and is part of the vast Flegrean volcanic district. It is located north-west of Gulf of Naples. It is the largest of the Flegrean islands and the sixth island among the smaller Italian islands extension, presenting a surface extension of approximately 46.3 km² and a perimeter of approximately 36 Km (Sbrana et al., 2011). The trend of temperatures and the distribution of precipitation during the year give the climate of Ischia marked Mediterranean characteristics. Due to the rugged orography and secondary volcanic activity, various microhabitats are present within the island. The most notable of which are fumaroles. Their emissions of water vapor result in a microclimate typical of tropical areas (Ricciardi et al., 2004). Flatworm samples were collected by hand under some flower pots in a private suburban garden at 67.3 meters above sea level and about 100 meters from the sea. The site is characterized by lava soil, gardening plants and grass, while the surrounding area by Mediterranean scrub and pine trees (*Pinus pinaster*

Aiton and *Pinus halepensis* Mill.). This garden is the same one where a population of the alien snake *Indotyphlops braminus* (Daudin, 1803) (Serpentes Typhlopidae) was found a few years ago (Paolino et al., 2019).

RESULTS

The collection data of this new report by *B. kewense* are: ITALY • 5 specimens; Ischia island (Campania); 67.3 meters above sea level; 40°44'30"N - 13°56'23"E; 5 Nov. 2023; private garden; M. Grano collection, Rome (Italy)

The body length of the observed specimens is 120 mm (Fig. 1).

This record updated the distribution of *B. kewense* in Campania, with two other records (E.M., unpublished) from Naples and Salerno urban areas (Table 1).

DISCUSSION AND CONCLUSIONS

In this note, we reported the first occurrence data of *B. kewense* in a small Italian island, Ischia (Southern Italy).

The land planarian *B. kewense* was first described from a greenhouse at Kew Botanical Gardens near London, England, in 1878. This species is believed to be native to Indo-China, and has been commonly found in American greenhouses since 1901. *Bipalium kewense* exhibits a disjunct distribution pattern. In Australia and the U.S., a similar pattern of occurrence is evident. Records also include Barbados, Colombia, Costa Rica, El Salvador, Indonesia, Madagascar, Malaysia, Mauritius, Mexico, Puerto Rico, Tahiti, Taiwan and Zimbabwe. The species appears to be dispersed with rooted plants. The natural range of *B. kewense*

Site	Latitude (°N)	Longitude (°E)	Habitat type	Month	Year
Salerno	40°40'56"	14°46'05"	private house	September	2022
Napoli	40°50'45"	14°15'38"	urban area	October	2022
Ischia	40°44'30"	13°56'23"	private garden	November	2023

Table 1. Records of *Bipalium kewense* in Campania (Italy).

extends from Vietnam to Kampuchea, possibly extending to Malaysia. Elsewhere it has been introduced by humans.

Before this work, the presence of *B. kewense* in Italy is only known for several regions of northern (Liguria and Lombardy), central (Abruzzi, Latium and Tuscany) and southern Italy (Calabria, Apulia, Sardinia and Sicily: Mori et al., 2022b). The occurrence of *B. kewense* in Campania is recent, with first record dating on 2022 for Napoli and Salerno urban areas. Land planarians thrive in high temperature and humidity, thus they are widely distributed in tropical and subtropical areas. Land planarians are soft, bilaterally symmetric, acoelomate, dorsally-ventrally flattened worms, 3 to 50 cm long by 0.2 to 0.5 cm wide. They lack a respiratory and circulatory system, a skeleton, and an anus. The heads of many land planarians are expanded lunate or tapering to a blunt point. Eyespots may be present on the head. Colors of Florida species range from greenish-gray to brown with dark narrow stripes on the dorsal side. A mouth, which also serves as an anus, is present near the mid-body on the ventral surface. A protrusible muscular plicate pharynx serves as a feeding organ and is attached to a three-branched intestine. The space between organs is filled with parenchyma. Circular and longitudinal muscles are present. A cerebral ganglion serves as a brain, innervating a ladder-shaped nervous system. Excretion of fluid wastes is accomplished with a primitive protonephridial system (Esser, 1981). *Bipalium kewense* is recognized by its pale color, dorsal dark median line, dark patch in neck region, and expanded lunate head. This species may attain lengths up to 30 cm (Chandler, 1974). Because land planarians are photo-negative during daylight hours and require high humidity, they are found in dark, cool, moist areas under objects such as rocks, logs, in debris, or under shrubs, and on the soil surface following heavy rains. Land planarians are also found in caves, but are rare in rural sites. Movement and feeding occur at night. High humidity is essential to survival. They can survive desiccation only if water loss does not exceed 45 percent of their body weight. Land planarians are most abundant in spring and fall. Land planarians mostly feed on earthworms, slugs, insect larvae, and are cannibalistic. Prey are located by chemoreceptors located in a single ciliated pit under the head or in



Figure 1. *Bipalium kewense* from Ischia (Campania, Italy).

a ciliated ventral groove. Struggling prey are held to the substrate and entangled in slimy secretions from the planarian. The pharynx is protruded from the mouth and into the prey. Food is reduced to small particles prior to entering the gastrovascular cavity. The food particles are taken up by epithelial cells in amoeboid fashion and formed into food vacuoles. Planarians store food in digestive epithelium and can survive many weeks by shrinking slowly in size without feeding. They can use their own tissues, such as reproductive tissue, for food when reserves are exhausted. Other animals rarely devour land planarians, since surface secretions appear distasteful, if not toxic. Protozoans, including flagellates, ciliates, sporozoans, and nematodes have been detected in land planarians. Because of their cannibalistic habit, land planarians may be their own worst enemy (Esser, 1981).

The great plant biodiversity present on Ischia island has allowed the establishment of a considerable animal biodiversity. In fact, the Ischia fauna finds itself favored by the conditions of the vegetation and climate present in the area. These make it possible to establish wealth animal populations. The presence of microhabitats also creates peculiar microclimates, capable of hosting species subtropical and tropical (Fruttidoro, 2019). Planarians are voracious predators of earthworms, and two species, *B. kewense* and

Dolichoplana striata Moseley, have been reported as nuisances in the southern U.S. in earthworm rearing beds (Hyman, 1940, 1943, 1951). Two additional flatworm species, *Artioposthia triangulata* and *Geoplana sanguinea*, were accidentally imported to Ireland and England. They were reported as being capable of eradicating entire earthworm populations on farms. In greenhouses, although some collectors believe they might damage plants, planarians are considered harmless. The presence of alien planarians could generate conservation problems in invaded ecosystems; it is in fact about potential, efficient predators of different components of the native invertebrate soil fauna (Boll & Leal-Zanchet, 2016; Carbayo et al., 2016; Ghezzi, 2022) which are important factors of good functionality of the decomposition cycle of organic matter e of nutrient circulation in the soil (Čapka & Čejka, 2021). In the presence of heavy infestations and a consequent conspicuous predation on various species of earthworms that occupy the different soil layers (Roy et al., 2022), there could also be negative consequences on fertility and permeability characteristics (oxygenation and ability to absorb water) of the invaded soils, with potential negative repercussions also on agricultural production of crops that were colonized (Murchie & Justine, 2021; Ghezzi, 2022).

ACKNOWLEDGEMENTS

The authors would like to thank Mrs. Rosanna Magno (Ischia, Italy) for its courtesy and helpfulness.

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