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A few notes on the diet and the copulation of *Theba pisana* (Müller, 1774) snails: observations on terrarium kept animals

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Abstract. The specimens used to eat 17 grass species from all 44 species offered (38.6% from all). They refused to eat all 3 liana and 21 tree species and eat only leafs of *Paliurus spina-christi* from the offered bushes. Contrary they eat most of the fruits, vegetables and animal food. Hanging on the tips of the soles from the top of terrarium was observed during copulation.

Key words: diet, snail, invasive species.

Introduction

The terrestrial snail species, *Theba pisana* (Müller, 1774) (Gastropoda: Helicidae), usually occur in coastlands, in or near sandy habitats, in hot climates estivating, often directly exposed to the sun, attached to grasses, shrubs or succulent plants. In dunes it can live on nearly bare sand, poorly fixed by grasses. In the north the snails do not estivate but they climb on plants in dry weather. This species cannot survive serious winter frosts (Welter-Schultes 2012). The native range of *Th. pisana* is Mediterranean region and adjacent Atlantic coasts from central Morocco to Belgium, South-West England, South Wales, South-East Ireland and central Atlantic islands. It has been introduced in many areas with proper climate condition all over the world (Däumer *et al.*, 2012). This species is considered to be an invasive pest, damaging many types of crops, native wild plants (for example fynbos vegetation in South Africa) and animal species (Odendaal *et al.* 2008). However, the studies of the species diet and food preferences are scarce. This short note is a small piece of contribution to the knowledge of its feeding and copulation, data revealed from some terrarium kept animals.

Material and Methods

Five *Theba pisana* specimens were occasionally brought with ornamental plants from Malta Island, and were kept a small terrarium for about two months (21.09.2013 – 06.11.2013) (till the end of their life). In the same tank also one specimen of *Otala punctata* (O. F. Müller, 1774) from Morocco was living. Some feeding experiments were made, as offering a variety of different types of potential food and following direct observations. A total of 113 potential food items were provided. They were divided into following groups: leafs of grass and low vegetation, lianas, bush, trees, fruits; vegetables, nuts and seeds, other food with higher plant origin; lichens; mushrooms; animal food. Also, some observations on copulation behaviour were made and time and air temperature were noted.

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Results

Notes on the diet. The specimens used to eat 17 grass species from all 44 species offered (38.6% from all). They refused to eat all 3 liana and 21 tree species and eat only leafs of *Paliurus spina-christi* from the bushes offered. Contrary they eat most of the fruits, vegetables and animal food (Table 1).

Copulation. Date: 04.11.2013, air temperature: 18.6ºC; observed duration: 3 hours, from 16:10 to 19:10; behaviour: hanging on the tips of the soles from the top of terrarium was observed during copulation (Fig. 1).

Fig. 1. A pair of copulating *Theba pisana* hanging from the glass cover of the terrarium.

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Table 1. Different types of food offered to the *Theba pisana* specimens during the study period (in gray is the food which was accepted by the animals) (next page).

Date	Food type	Consumption	26.9.2013	*Fraxinus* sp.	-
	Plant food		27.9.2013	*Quercus* sp.	-
	Leaves		28.9.2013	*Cerasus sativa*	-
	Grass and low vegetation		28.9.2013	*Juglans regia*	-
21.9.2013	*Portulaca grandiflora*	-	28.9.2013	*Acer campestre*	-
22.9.2013	*Petunia* sp.	+	28.9.2013	*Crataegus* sp.	-
22.9.2013	*Apium graveolens*	-	4.10.2013	*Ailanthus*	-
22.9.2013	*Melissa* sp.	-	4.10.2013	*Gleditchia*	-
23.9.2013	*Chrysanthemum* sp.	+	4.10.2013	*Ficus carica*	-
23.9.2013	*Convonvulus* sp.	+	4.10.2013	*Robinia pseudoacacia*	-
23.9.2013	*Trifoilum* sp.	+	4.10.2013	*Pyrus* sp.	-
23.9.2013	*Lamium* sp.	+	4.10.2013	*Acer negundo*	-
23.9.2013	*Amaranthus* sp.	+	4.10.2013	*Morus* sp.	-
23.9.2013	*Taraxacum* sp.	+	4.10.2013	*Koelreuteria paniculata*	-
23.9.2013	*Cynodon* sp.	-	14.10.2013	*Celtis australis*	-
23.9.2013	*Polygonum* sp.	-	14.10.2013	*Ulmus* sp.	-
26.9.2013	unidentified moss	-	14.10.2013	*Acer tataricum*	-
26.9.2013	*Saponaria* sp.	-		**Fruits**	
26.9.2013	*Teucrium* sp.	-	19.9.2013	*Vitis vinifera*	+
26.9.2013	*Geranium* sp.	-	20.9.2013	*Prunus domestica*	+
26.9.2013	*Urtica* sp.	+	24.9.2013	*Prunus persica*	+
26.9.2013	*Mentha* sp. - not cultivated species	-	26.9.2013	*Rosa* sp.	-
26.9.2013	*Mentha spicata*	-	27.9.2013	*Cydonia oblonga*	+
26.9.2013	*Antirrhinum* sp.	-	28.9.2013	*Malus* sp.	+
26.9.2013	*Portulaca* sp.	-	28.9.2013	*Crataegus* sp.	+
26.9.2013	*Armoracia rusticana*	+	28.9.2013	*Rubus* sp.	-
26.9.2013	*Sambucus* sp.	+	14.10.2013	*Prunus spinosa*	+
28.9.2013	*Clinopodium* sp.	-	12.10.2013	*Rubus idaeus*	+
28.9.2013	*Agrimonia* sp.	-	16.10.2013	*Malus domestica*	+
28.9.2013	*Potentilla* cf *reptans*	-	5.11.2013	*Musa* sp.	+
28.9.2013	*Galium aparine*	-		**Vegetables**	
28.9.2013	*Achillea millefolium*	-	20.9.2013	*Solanum lycopersicum*	+
29.9.2013	*Capsicum annuum*	+	21.9.2013	*Capsicum annuum*	+
4.10.2013	*Rumex* sp.	+	22.9.2013	*Capsicum annuum*	+
4.10.2013	*Verbascum* sp.	+	21.9.2013	*Solanum tuberosum*	+
4.10.2013	*Atriplex* sp.	-	22.9.2013	*Daucus carota*	+
4.10.2013	*Artemisia* sp.	-	22.9.2013	*Beta vulgaris*	+
4.10.2013	*Tribulus* sp.	-	17.10.2013	*Brassica oleracea* var. *capitata*	+
4.10.2013	*Iris* sp.	-	19.10.2013	*Cucumis sativus*	+
4.10.2013	*Onopordum* sp.	-	20.10.2013	*Brassica oleracea* var. *botrytis*	+
4.10.2013	*Lactuca* sp.	+		**Nuts and seeds**	
4.10.2013	*Solanum lycopersicum*	+	22.9.2013	*Cicer arietinum*	-
4.10.2013	*Medicago sativa*	+	27.9.2013	*Juglans regia*	+
4.10.2013	*Xantium* sp.	-	29.9.2013	*Helianthus anuus*	+
4.10.2013	*Foeniculum vulgare*	-		**Other**	
14.10.2013	*Sedum* cf *album*	-	22.9.2013	bread	+
14.10.2013	*Fragaria* sp.	-	26.9.2013	print paper	+
7.11.2013	*Hordeum murinum*	+	6.11.2013	fine bark of dead, dry *Fraxinus*	+
	Lianas			**Lichens**	
28.9.2013	*Clematis* sp.	-		unidentified lichens	-
4.10.2013	*Humulus* sp.	-		**Mushrooms**	
14.10.2013	*Vitis vinifera*	-	23.10.2013	*Agaricus* sp.	-
	Bush vegetation		23.10.2013	*Macrolepiota* sp.	-
21.9.2013	*Crassula ovata*	-	23.10.2013	*Calvatia* sp.	+
23.9.2013	*Syringa* sp.	-		***Animal food***	
14.10.2013	*Paliurus spina-christi*	+	18.9.2013	aquarium fish food - vitamines	+
26.9.2013	*Rosa* sp.	-	24.9.2013	aquarium fish food - dry liver	+
28.9.2013	*Rubus* sp.	-	24.9.2013	aquarium fish food - dry *Daphnia*	+
14.10.2013	*Prunus spinosa*	-	19.9.2013	cat food - granules	+
	Tree vegetation		26.9.2013	*Columba livia* - excrement	+
23.9.2013	*Prunus cerasifera*	-	20.10.2013	dog food - granules	+
23.9.2013	*Carpinus* sp.	-	7.11.2013	sausage	+
26.9.2013	*Cercis siliquastrum*	-		**Predation or mucus eating /?/**	
26.9.2013	*Amygdalus* sp.	-	6.11.2013	live, contracted *Otala punctata*	+