

Orthoptera and Mantodea of Istria and the Croatian Island Šipan

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Abstract. In 12 localities in Croatia studied in the years 2001 to 2002 and 2004 to 2006 a total of 36 Orthoptera species and 3 species of Mantodea were found. The most frequently encountered Orthoptera species were *Pezotettix giornae*, *Aiolopus strepens*, *Acrida ungarica*, *Tylopsis liliifolia*, *Calliptamus italicus* and *Oedipoda caerulescens*. Rare species include *Locusta migratoria*, *Phaneroptera falcata*, *Sepiana sepium* and *Tettigonia viridissima*. No differences between the north and the south of the Croatian coastline were found with regard to common species. Comments on the distribution and biology of some species are also given.

Kurzfassung. An 12 Plätzen in Kroatien, die in den Jahren 2002-2003 und 2004-2006 untersucht wurden, wurden zusammen 36 Arten von Orthoptera und 3 Arten von Mantodea aufgefunden. Die am häufigsten angetroffenen Orthoptera waren *Pezotettix giornae*, *Aiolopus strepens*, *Acrida ungarica*, *Tylopsis liliifolia*, *Calliptamus italicus* und *Oedipoda caerulescens*. Seltenerer Arten waren *Locusta migratoria*, *Phaneroptera falcata*, *Sepiana sepium* und *Tettigonia viridissima*. Es wurden keine Unterschiede zwischen dem Norden und Süden der kroatischen Küstenlandes im Vorkommen der Gruppe der häufigen Arten gefunden. Zu ausgewählten Arten werden Verbreitung und Biologie kommentiert.

Keywords: Orthoptera, Mantodea, croatia, faunistics

Introduction

Istria is the biggest peninsula in the Adriatic Sea. It is located between the Gulf of Trieste and the Bay of Kvarner. The Istrian peninsula has a surface area of 3,476 square kilometres. It can be divided in three completely different areas according to geological and geomorphic structure. The hilly northern and north-eastern part, due to its scarce vegetation and nude karst surfaces, is also known as White Istria. South-west from White Istria stretches an area that is considerably richer morphologically, containing lower flysch mountainous tracts consisting of impermeable marl, clay, and sandstone, which is why this part is called Grey Istria. Limestone terrace along the coastline, covered with red earth, form an area called Red Istria. One third of the Istrian peninsula is covered with woods. Along the coast and on the islands pine woods, macchia and garrigue (PRAVDIN 1964) prevail, interspersed by holm oak and strawberry tree.

The elafite island Šipan covers a surface of 16.5 square kilometres and is located north west of Dubrovnik. It is characterised by a coastal mountain range which encircles an inner plain. The mountains are usually tree covered, while the inner plain is extensively used for agriculture and cattle breeding. The climate of the Istrian coastline (Red Istria) and the island Šipan is basically Mediterranean. There are not many new papers dealing with Orthopteroidea in Istria (KRAUSS 1878, INGRISCH 1977) and the Croatian coastline near Dubrovnik (ADAMOVIĆ 1964, KARAMANN 1961).

Material and methods

This study covers seven localities in Istria and five on Šipán. The excursions started in the year 2001, in the period from August through October. The same season was selected for the other excursions to Šipán, Pula and Vrsar (2002, 2004, 2005, 2006), because the chances of finding adult individuals was higher during that period. The time dedicated to active collection varied from site to site. In the main, xerothermic habitats were selected; wet or waterlogged meadows were not investigated.

The material was primarily collected using a standard insect net. The animals were located acoustically, and where possible, the surrounding vegetation was checked. The insects were fixed using 70% benzinealcohol and identified in the laboratory using identification keys (HARZ 1969, 1975, SCHMIDT & LILGE 1996, SZIJJ 2004). Information on distribution was taken from HARZ (1969, 1975), SCHMIDT & LILGE (1996) and ADAMOVIĆ (1964).

Short description of the study plots

This study covers 12 sites on the Croatian coastline. Climate conditions were relatively similar.

- 1) **Šipán (Habitat I)** – Coastal sun-exposed dry slope - dominated by sparsely covered rocks, the vegetation seldom grows over 1 m in height and usually consists of grasses and dry bushes.
- 2) **Šipán (Habitat II)** – Coastal meadow - east of the Šipanska Luka Bay. Short growing grasses and several trees and palms, because of the proximity to the coastal shore line, a constant wind dominated the locality.
- 3) **Šipán (Habitat III)** – Heterogeneous agricultural fallow area south of Šipanska Luka surrounded by farmland and olive trees, characterised by heterogeneous grasslands and bushes which grow up to 70-80 cm.
- 4) **Šipán (Habitat IV)** – Agriculturally unused meadow - grassland located on the inner plateau of the island, adjacent areas are used for agriculture, viniculture and cattle breeding, grass-dominated pasture which grows up to 40 cm enriched by a few bushes.
- 5) **Šipán (Habitat V)** – Cattle pasture - several hundred meters north of Habitat IV, grasses usually do not grow above 5 cm.
- 6) **Vrsar (Habitat I)** – Campsite near shoreline (Porto Sole) - dominated by short growing grasses, bushes are rare, on a southward inclined slope and highly sun exposed, in this habitat human activities have a strong influence on the vegetation.
- 7) **Vrsar (Habitat II)** – Agricultural fallow with areas of unused meadow – surrounded with holm oaklets and blackberry bushes (Garrigue), grassland up to 20 – 30 cm, the adjacent areas are used for agriculture, (200 m north of Porto Sole).
- 8) **Vrsar (Habitat III)** – Hill with arid vegetation - the first investigation area lies on a dry slope which is covered by rocks, the second area lies on top of the hill in front of a hedged field, the slope is surrounded by olive trees and bushes, near the fence short grasses, bushes or no vegetation dominates the area, (1.5 km south of Vrsar).
- 9) **Vrsar (Habitat IV)** – Unused meadow with bushes (Garrigue) - the vegetation consists of dry grasses which grow up to 40 cm, bushes and many short growing thistles, this area is close to a few electricity pylons and lies on a cycle track to Limski Fjord, (3 km east of Porto Sole).
- 10) **Vrsar (Habitat V)** – Pine wood surrounded by meadow - a pine wood with a lot of hedges, brushwood and brakes, the adjacent area is an unused meadow with short grasses up to 10 cm, this plot lies on the same cycle track as Habitat IV, (4 km east of Porto Sole).

- 11) **Pula (P)** – situated on the southern tip of the peninsula. Areas surrounding the marine school Valsaline.
- 12) **Limski Kanal (Lim)** – the channel-like bay known as the Limski Kanal is 6 km long and lies between Rovinj and Vrsar, the site of investigation was at the end of this bay, high growing dry grasses up to 50 cm with groups of bushes (Macchia) and small intensively farmed surfaces dominated this location.

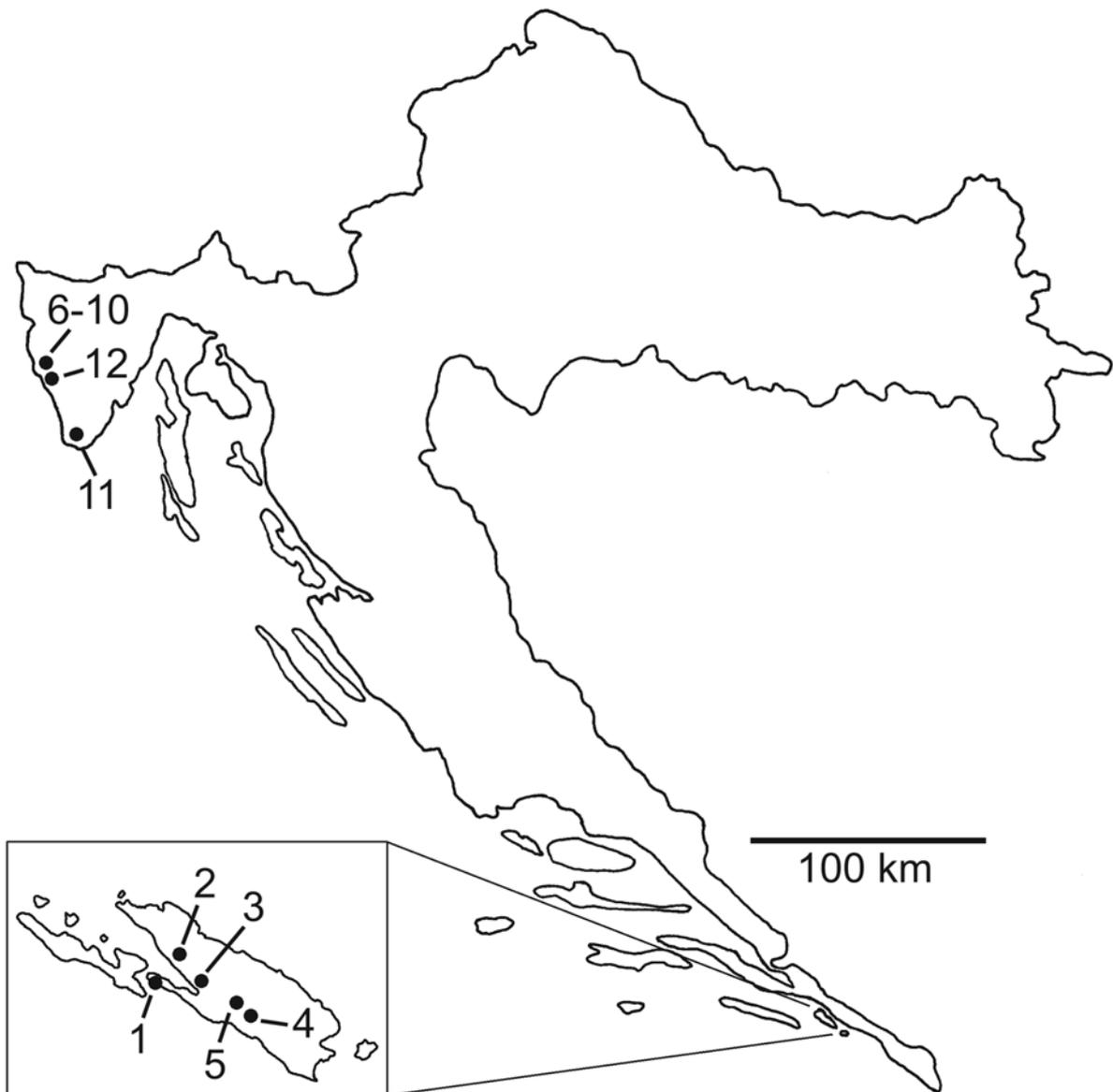


Fig. 1. Map of Croatia. 1-5 (Habitats on Šipan), 6-10 (Habitats at Vrsar), 11 (Pula), 12 (Limski Kanal).

Results

During this study we identified a total of 36 Orthoptera species and 3 mantids (Tab. 1).

The most frequent Orthoptera species in the studied localities were *Pezotettix giornae*, *Oedipoda caerulescens*, *Aiolopus strepens*, *Calliptamus italicus* and the palae-arctic, xero-thermophilous species *Oedipoda caerulescens*. The rare species included *Locusta migratoria*, *Phaneroptera falcata*, *Sepiana sepium* and *Tettigonia viridissima*.

The most frequent Mantodea species were *Mantis religiosa* and *Ameles decolor*. The latter species prefers dry meadows, areas with sparse plant coverage, small bushes up to 30 cm and sun exposed places. *Mantis religiosa* was found, especially in the region of Vrsar, only in areas with higher growing grasses.

Comparing the results, no major differences between the north and the south of the Croatian coastline could be found with regard to the common species.

Tab. 1. Orthoptera and Mantodea of selected localities on Šipan, Vrsar, Pula and Limski Kanal (Croatia) with habitat (see methods).

Locality and Habitat	S I	S II	S III	S IV	S V	S	Vr I	Vr II	Vr III	Vr IV	Vr V	P	Lim
ENSIFERA													
<i>Phaneroptera nana nana</i>						X							
<i>Phaneroptera falcata</i>							X						
<i>Meconema meridionalis</i>						X							
<i>Decticus albifrons</i>								X					X
<i>Platycleis affinis</i>		X	X	X	X	X							
<i>Platycleis intermedia</i>						X		X					
<i>Tettigonia viridissima</i>				X									
<i>Tylopsis lillifolia</i>			X			X		X		X		X	X
<i>Rhacocleis germanica</i>		X	X			X		X			X		X
<i>Yersinella raymondi</i>							X		X			X	
<i>Eupholidoptera chabrieri schmidti</i>							X					X	X
<i>Sepiana sepium</i>											X		
<i>Conocephalus discolor</i>													X
<i>Acheta domesticus</i>							X						
<i>Gryllomorpha dalmatina</i>						X							
<i>Pseudmogoplistes squamiger</i>								X					
<i>Mogoplistes brunneus</i>						X							
CAELIFERA													
<i>Anacridium aegypticum</i>	X			X		X						X	
<i>Locusta migratoria</i>			X										
<i>Calliptamus italicus</i>	X	X	X			X			X	X	X		X
<i>Pezotettix giornae</i>		X				X		X		X	X	X	X
<i>Acrida ungarica</i>			X	X	X	X	X	X	X				
<i>Acrotylus patruelis</i>			X	X		X							
<i>Acrotylus insubricus</i>						X							
<i>Aiolopus thalassinus</i>					X	X						X	

<i>Aiolopus strepens</i>						X		X	X	X			X
<i>Oedipoda caerulescens</i>	X	X	X	X	X	X		X	X			X	X
<i>Oedipoda germanica</i>									X			X	
<i>Euchorthippus declivus</i>								X		X			X
<i>Chorthippus parallelus</i>												X	
<i>Chorthippus brunneus</i>	X	X				X		X				X	
<i>Chorthippus dorsatus</i>												X	
<i>Chorthippus biguttulus</i>		X										X	
<i>Chorthippus vagans</i>										X			
<i>Omocestus rufipes</i>										X			X
<i>Omocestus haemorrhoidalis</i>		X	X			X							
MANTODEA													
<i>Mantis religiosa</i>		X	X			X		X					X
<i>Ameles decolor</i>								X	X	X	X	X	
<i>Empusa fasciata</i>								X					

Discussion

Šipan. In coastal habitats *Calliptamus italicus*, very common throughout the Mediterranean (HARZ 1957), was found either sporadically or frequently but was not recorded on the inner plain. In contrast, *Oedipoda caerulescens* was found in all habitats. It is assessed to be palaeartic and xerothermophil, preferring sandy, sparsely vegetated environments and for this reason a typical indicator for arid habitats (HARZ 1957). In the more sheltered areas of habitats III, IV and V *Acrida ungarica* was dominant. *A. ungarica* prefers xerotherm vegetation growing on sandy grounds as well as rocky and loamy steppes. It usually avoids cultivated areas and was not found in coastal surroundings. Large numbers of juvenile Acridinae were noticed in Habitats IV and V in the inner part of Šipan. They were not specified any further. In all habitats (except Habitat I) Ensifera were found in bushes and higher grasses. The most common species was *Platycleis affinis*.

Locusta migratoria cinerascens was recorded once in Habitat III. According to information given by inhabitants a major locust plague took place in 1999. The migratory locust exists permanently in its solitary phase in the Ulcinj District, Montenegro, Yugoslavia (ADAMOVIC 1964). Thus, the single individual in Habitat III may be part of a permanent stable population.

In addition, *Tyliopsis liliifolia* was found in Habitat III. Adults were detected in 50 cm high grasses. *T. liliifolia* is very common throughout the Mediterranean (HARZ 1969). With localisation in Habitat II and III xerothermophil *Acrolytus patruelis* (Oedipodinae) was always found in relative proximity to the seashore. Not on the inner plain of the island (SCHMIDT & LILGE 1996).

Recording species diversity allows statements to be made on the status quo of chosen areas and disregards natural and human changes. However, these changes have to be considered because many species, including some rare ones, colonise new territories. Due to the dynamics of pioneer vegetation societies, changes in species composition have to be expected. For this reason it is necessary to carry out annual and long-term observations of faunal changes in order to obtain more substantial information (KRIEGBAUM 1989). The taxa identified are not representative of the number of taxa which actually exist in the area (KARAMANN 1961, ADAMOVIC 1964). Investigations into Orthopteroidea in the Dubrovnik region revealed a total of approximately 55 species. The short period of time available for sampling, a relatively

low number of investigated habitats, the absence of freshwater habitats and most importantly the season of the year (October) are reasons for the comparatively low number of taxa found.

Istria. The most frequent Orthoptera species in Istria were *Pezotettix giornae*, *Decticus albifrons*, *Aiolopus strepens*, *Tylopsis liliifolia*, *Calliptamus italicus* and the palaeartic, xero-thermophilous species *Oedipoda caerulescens*.

The two latter species usually occurred together in similar habitats, at the sides of paths in the proximity of shrubs in dry, sun-exposed locations with little to no vegetation. These seem to be the crucial habitat components (BROSE 1997) for their occurrence.

Pezotettix giornae was very frequently represented in habitats II, IV and V, but it did not reach the status of a plague. This species actually reproduces massively in Slovenia some years (INGRISCH & KÖHLER 1998). However *Euchorthippus declivus*, which sometimes also reaches plague status, was rare. Other rare species were *Phaneroptera falcata* and *Sepiana sepium*. The latter species was a single find in a pinewood with a lot of hedges, brushwood and brakes (Habitat V). *Eupholidoptera chabrieri schmidtii*, *Phaneroptera falcata* and *Yersinella raymondi* were found in Habitat I only in bushes and hedges around the buildings of the campsite. Because of anthropogenic influences in that area the grasses are short and the plant communities not particularly diverse. We found a low number of species in that location.

Conocephalus discolor is more common in southern Europe (HARZ 1969) than the short-winged species *Conocephalus dorsalis*. We found *C. discolor* near the coast at the end of the Limski Kanal, in the absence of wet meadows or waterlogged areas. This corresponds to information given by KLEUKERS ET AL. (1996) that *C. discolor* also colonizes dry (urban) wasteland, edges of fields and ruderal grassland vegetation. The grasses must be dense and not too short. Higher growing, tall grasses are a habitat factor which plays a big role for a lot of other species such as *Tylopsis liliifolia*, *Pezotettix giornae* and *Mantis religiosa*.

The investigated areas are important for agriculture and very suitable for Mediterranean farm crops such as grape vines, olives and aromatic herbs. These human activities and especially in Istria the influences of tourism are the main reasons for changes in the structure of the vegetation and in the Orthoptera species diversity. Thus the main threat to many Mediterranean ecosystems and their endemic species, which in part are limited to small circulation areas, also lies in the radical development of always new areas for tourism. As in Central Europe, factors such as changes in land and forest use can also endanger plants and animals.

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