

Assemblages of Orthoptera and Mantodea in isolated salt marshes and non-sandy habitats in an agricultural landscape (Danube lowland, South Slovakia)

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Zusammenfassung

Insgesamt 44 Heuschreckenarten (36,4% der in der Slowakei bekannten Arten) und eine Gottesanbeterinart wurden an 11 Sammelplätzen (hauptsächlich auf Salzböden) im Donaugebiet in der Südslowakei in 2002–2003 gefunden. Von xerothermophilen Arten wurden z.B. *Platycleis vittata*, *Melanogryllus desertus*, *Pezotettix giornae*, *Dociostaurus brevicollis*, *Euchorthippus declivus*, *Omocestus petraeus*, *Stenobothrus nigromaculatus*, *Stenobothrus crassipes* gefunden; Salzböden bevorzugte *Aiolopus thalassinus*. Diese Arten (mit der Ausnahme von *Pezotettix giornae*) wurden in den letzten 50 Jahren regelmäßig mit geringer Häufigkeit in entsprechenden Biotopen der Slowakei angetroffen und gelten bis heute als Indikatoren von xerothermen Habitaten und Salzböden in der Donau-niederung. Zu den seltenen hygrophilen Arten zählen z.B. *Ruspolia nitidula* und *Mecostethus parapleurus*. Zu den häufigsten Orthopterenarten gehörten die xerothermophile *Leptophyes albovittata*, *Metrioptera roeselii*, *Tettigonia viridissima*, *Gryllus campestris*, *Oecanthus pellucens*, *Euchorthippus pulvinatus*, *Chorthippus apricarius*, *Ch. biguttulus* und *Ch. brunneus* (100% Stetigkeit wie auch die Gottesanbeterin *Mantis religiosa*). Die Ergebnisse über die Verbreitung, Abundanz und Biologie von sechs seltenen Arten werden diskutiert.

Abstract

Altogether 44 Orthoptera species (36,4% of the species recorded in Slovakia) and one species of Mantodea were found in 11 studied, mostly saline, localities in the Danube lowland (South Slovakia) in 2002–2003. From the xero-thermo-philous species were found i.e. *Platycleis vittata*, *Melanogryllus desertus*, *Pezotettix giornae*, *Dociostaurus brevicollis*, *Euchorthippus declivus*, *Omocestus petraeus*, *Stenobothrus nigromaculatus*, *Stenobothrus crassipes*, from the species preferring salt marshes *Aiolopus thalassinus* was found. These rare species were found in these habitats in Slovakia already 50 years ago (except *Pezotettix giornae*), and they can be considered to be indicators of preserved salt marshes and xerothermic habitats in the Danube lowland. More rare were the hygrophilous species *Ruspolia nitidula* and *Mecostethus parapleurus*. The most frequently encountered Orthoptera species were the xerothermophilous *Leptophyes albovit-tata*, *Metrioptera roeselii*, *Tettigonia viridissima*, *Gryllus campestris*, *Oecanthus pellucens*, *Euchorthippus pulvinatus*, *Chorthippus apricarius*, *Ch. biguttulus* and *Ch. brunneus* (100% of the localities, always simultaneously with the mantid

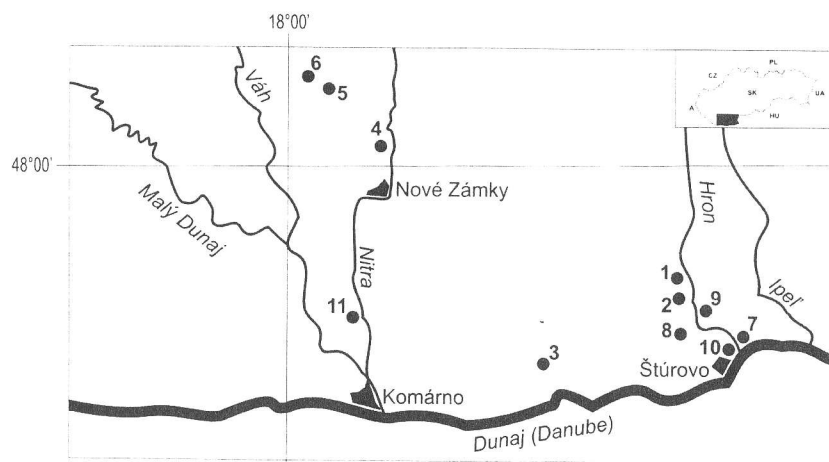
Mantis religiosa). Comments on the distribution, abundance and biology of six rare species are also given.

Introduction

Salt marshes and xerothermic steppes of the Danube lowland belonged and belong, together with sandy habitats, to the most valuable localities for the Orthoptera species of former Czechoslovakia (MAŘAN 1952, 1954, GULIČKA 1992, STANOVÁ & VALACHOVIČ 2002). Many of these localities have been lost because of intensive agriculture; on the other hand, many of them are at an advanced succession stage thanks to the extreme opposite – they have been abandoned – excluded from both use and protective management. Similar was the destiny of a major part of such habitats in eastern Slovakia. Their territory under the Vihorlat Mts. has been lost beyond recall – inundated with the Zemplínska Šírava water dam. Before the inundation, in 1961–1962 the Orthoptera fauna of this territory was subjected to a detailed study by GULIČKA (1967). In the surrounding countries, the importance of xerothermic and saline localities for Orthoptera was highly acknowledged in Hungary in the National Park Hortobágy and NR Bátorliget (NAGY 1983, 1991), and in the Pannonian part of Austria (BIERINGER & BERG 2001, BERG & ZUNA-KRATKY 1997).

The aim of this paper is to recognize the structure of Orthoptera and Mantodea assemblages in the most preserved saline localities, several selected xerothermic localities and wet meadows in the Danube lowland; and thus to contribute to the knowledge on the distribution and biology of several rare species having their northern distribution limit in Slovakia and to perform an analysis of the changes in the occurrence beginning with the 1950s.

Fig. 1: Location of the 11 study sites in the Danube lowland with localisation within Slovakia (Localities No. 1–11).



Material and methods

This study covers 11 localities in the Danube lowland, South Slovakia (47°46' – 48°07'N, 18°03' – 18°44'E, Fig. 1). These localities represent the most characteristic and most preserved salt marshes in the Danube lowland and selected xerothermic and waterlogged meadows on non-sandy substrates. A survey of both the quality and quantity of the studied assemblages was performed regularly – once in a month from May to October 2002–2003 and supplemented with irregularly collected ecological and phenological data beginning in 1991 (1994, 1996, 1999, 2000, 2001). The material was primarily collected using the method of sweeping of herbal and partially also shrub vegetation (min. 1000 sweeps per check). This method was completed with acoustical identification, beating from trees and shrubs and manual individual collection. The time used for the active collection was at least 2 hours per plot and control. In total, 19,000 Orthoptera individuals were identified.

The relative abundance of the individual species on the studied plots was expressed using the following classification scale: **1** – very rare (less than 3 adults), **2** – rare (3–10 adults), **3** – abundant (11–100 adults), **4** – very abundant (101 and more adults, Table 1). Relative semi-quantitative values of abundance listed in the results represent the highest recorded values of the adults corresponding to one locality and one control event (Table 1).

The material was identified directly in the field; controversial individuals were fixed using 75% benzinealcohol and identified in the laboratory, using identification keys (HARZ 1969, 1975). The system and the nomenclature follow the work by KOČÁREK et al. (1999), the geographical data about the origin and distribution INGRISCH & KÖHLER (1998) and HARZ (1969, 1975).

Short description of the study plots

This study covers 11 relatively preserved plots (partially in protected areas) situated at altitudes between 107 and 220 m a.s.l.:

- 1) **Kamenínske slanisko (KS)** – in the table), – National Nature Reserve – wet and periodically waterlogged, partly xerothermic saline meadow communities (e.g. *Limonium gmelini*, *Artemisia santonicum*, *Bolboschoenus maritimus*, *Camphorosma annua*, *Galatella punctata*, *Plantago maritima*), surrounded with an enclave consisting of a willow-poplar stand and a black locust stand adjacent to maize fields, cadastral territory (c.t.) Kamenín, (studied plot area 2 ha, 113 m a.s.l.), No. of the Slovakian Fauna Databank square (DFS) 8177.
- 2) **Čistiny near Kamenínske slanisko (KČ)** – Nature Reserve – waterlogged saline meadow communities (*Artemisia santonicum*, *Camphorosma annua*, *Festuca pseudovina*, *F. rupicola*, *Limonium gmelini*) bordered with an enclave of a willow-poplar floodplain stand, c.t. Kamenný Most, (1 ha, 113 m a.s.l.), DFS 8177.
- 3) **Búčske slanisko (BÚČ)** Nature Reserve, – territory of the reserve, wet meadows on saline soils and a pasture (*Atriplex littoralis*, *Carex praecox*, *Elytrigia repens*, *Festuca pseudovina*, *F. rupicola*, *Potentilla anserina*), sed-

ge stands along the water channel c.t. Búč, (2 ha, 110–112 m a.s.l.), DFS 8276.

- 4) **Slanisko Čiky South (PČ)** – salt marsh nominated for a protected area, with a valuable, locally highly preserved, highly diversified vegetation (*Artemisia antonicum*, *Tripolium pannonicum*, *Plantago maritima*, *Festuca pseudovina*, *Carex melanostachya*, *Carex vulpina*) 4 km SW from the town of Šurany, c.t. Šurany, (3 ha, 121 m a.s.l.), DFS 7974.
- 5) **Tvrdošovce – playground (TI)** (near the railway-station) – salt marsh remnant (*Potentilla anserina*, *Lotus tenuis*, *Carex praecox*, *Melilotus* sp.) and saline lake remnant (*Bidens tripartita*, *Heleochoa schoenoides*, *Juncus compressus*), used partially as a football playground, partially as a garbage dump for the village c.t. Tvrdošovce, (0.5 ha, 120 m a.s.l.) DFS 7974.
- 6) **Tvrdošovce – Panské lúky (TPL)** – salt marsh with preserved halophyte vegetation min. 3 ha (*Artemisia santonicum*, *Camphorosma annua*, *Carex praecox*, *Festuca pseudovina*, *Potentilla anserina*, *Tripolium pannonicum*), proposed for a protected area, adjacent to orchards and an enclave consisting of a poplar forest, c.t. Tvrdošovce, (3 ha, 112–115 m a.s.l.), DFS 7874.
- 7) **Kamenica nad Hronom (KA)** – a dike near the Hron River, with xerothermic vegetation, inter-embankment area of the river and wet meadows with dispersed solitary willows, 500 m SE from the village (*Arrhenatherum eliatum*, *Festuca rupicola*, *Gypsophila muralis*, *Pastinaca sativa*, *Picris hieracioides*), c.t. Kamenica nad Hronom, (1 ha, 110–112 m a.s.l.) DFS 8178.
- 8) **Vršok – Hegyfárok (HF)** – Nature Reserve, south oriented xero-thermophilous forest-steppes and meadows with preserved herbal vegetation (*Botriochloa ischaemum*, *Festuca rupicola*, *F. valesiaca*, *Peucedanum cervaria*, *Seseli* sp., *Stipa* sp.) and edges of old orchards and vineyards, c.t. Nána, (2 ha, 140–220 m a.s.l.), DFS 8177.
- 9) **Malá nad Hronom (MH)** – embankment near the Hron River, covered with xerothermic vegetation, wet meadows with dispersed solitary willow trees, inter, embankment area of the river near the village, c.t. Malá nad Hronom, (1 ha, 110–112 m a.s.l.), DFS 8178.
- 10) **Nimród (NIM)** – wet meadows (*Alopecurus pratensis*, *Arrhenatherum eliatum*, *Cardamine pratensis*, *Carex riparia*, *Potentilla reptans*) with dispersed tree groups, bordered with the railway Štúrovo – Chľaba 1.5 km south from the Kamenica village, c.t. Štúrovo, (2 ha, 109 m a.s.l.), DFS 8178.
- 11) **Alluvium of the Nitra River (ALNR)** – preserved wet meadows (*Alopecurus pratensis*, *Carex melanostachya*, *C. riparia*, *Gratiola officinalis*, *Potentilla reptans*, *Ranunculus acris*, *Trifolium pratensis*), adjacent to the embankment of the Nitra River, a territory of *Coracias garrulus*, 1 km south from the Martovce village, c.t. Martovce, Hurbanovo (2 ha, 107–110 m a.s.l.), DFS 8174.

Results and discussion

Structure of assemblages

During this study we identified in total 44 Orthoptera species (36,4% of all the Orthoptera species occurring in Slovakia) and one mantid (Tab. 1). Characteristic and rare were primarily some xero-thermophilous and hygrophilous species which reach their northern distribution limit in Slovakia (MAŘAN 1954). From the xero-thermophilous species we mention here *Platycleis vittata*, *Melanogryllus desertus*, *Pezotettix giornae*, *Dociostaurus brevicollis*, *Euchorthippus declivus*, *Omocestus petraeus*, *Stenobothrus nigromaculatus*, *Stenobothrus crassipes*, from the species preferring salt marshes *Aiolopus thalassinus*. These species (except for one population of *Pezotettix giornae*, which is remarkable from a zoogeographical point of view) were already known in these habitats in Slovakia 50 years ago (MAŘAN 1954). These species can be considered indicators of preserved salt marshes and xerothermic habitats in the Danube lowland. More rare were the hygrophilous species *Ruspolia nitidula* (in the National Red List EN – endangered, KRIŠTÍN 2001) and *Mecostethus parapleurus* (DD – data deficient). Another interesting discovery was that of a population of the predatory species *Decticus verrucivorus* (Kamenínske slanisko salt marsh, Table 1), in Slovakia preferring mountain meadows and pastures up to 1600 m a.s.l..

The most frequent Orthoptera species in the studied localities were the xero-thermophilous *Leptophyes albobittata*, *Metrioptera roeselii*, *Tettigonia viridissima*, *Gryllus campestris*, *Oecanthus pellucens*, *Euchorthippus pulvinatus*, *Chorthippus apricarius*, *Ch. biguttulus* and *Ch. brunneus* (100% of the localities, always simultaneously with the mantid *Mantis religiosa*). The most frequent species with the abundance fluctuating in dependence on year, season and locality were on the salt marshes: *Metrioptera roeselii*, *Aiolopus thalassinus*, *Chorthippus albomarginatus*, and on the xerothermic habitats *Calliptamus italicus* and *Euchorthippus pulvinatus*.

We identified 14 to 29 Orthoptera species per locality (the mean of 21,5 species/locality), which was in average by 3,5 less compared to the preserved sand localities in the Danube lowland (25 species, KRIŠTÍN et al. 2004b). The abundance of the individual species per locality depended on the vegetation type and species richness and on the degree of conservation and isolation. The richest in species were the xerothermic forest-steppes in the preserved locality Vršok – Hegyfárok (29 species). We found syntopic occurrence of several xerophilous species, like *Ephippiger ephippiger*, *Melanogryllus desertus*, *Calliptamus italicus*, *Euchorthippus pulvinatus*, *Gomphocerippus rufus*, *Stenobothrus crassipes*, and more hygrophilous species *Conocephalus fuscus*, *Aiolopus thalassinus*, *Chorthippus albomarginatus*, migrating from wetter meadows situated on the foothill of the xerothermic slopes. In 1952 *Acrida ungarica* (MAŘAN 1954) was found in this rocky forest-steppe; but today this species is typical in the Danube lowland only of the sand dune habitat (KRIŠTÍN et al. 2004b).

The preserved salt marshes were of poorer species number (19–26 species, Table 1) than the discussed xerothermic habitats. Today, these localities are endangered, situated isolated in intensively managed agricultural fields. For the Or-

thoptera assemblages, the most stable and most valuable seems to be the salt marsh Tvrdšovce – Panské lúky, with dominant *Aiolopus thalassinus*, *Euchorthippus pulvinatus*, *Chorthippus albomarginatus*, and typical *Omocestus petraeus*, *Stenobothrus crassipes* and *Platycleis vittata*. Poorer in species (14) was the degrading saline locality Tvrdšovce in the village, severely devastated and serving as a garbage dump.

Table 1: Grasshoppers, crickets (Orthoptera) and mantids (Mantodea) of salt marshes and selected non-sandy localities in the Danube lowland (South Slovakia). Localities: see chapter Methods and Fig. 1; abundance: 1 very rare – less than 3 individuals, 2 rare – 3–10 ind., 3 abundant – 11–100 ind., 4 very abundant – more than 100 ind., F% – frequency, sm – salt marshes, x – xerothermic habitats, h – hygrophytic vegetation, bold – rare or interesting species.

Locality	KS	KČ	BUČ	PČ	TI	TPL	MH	KA	HF	NIM	ALN	F%
Habitat	sm	sm	sm	sm	sm	sm	x	x	x	h	h	
Species/No. Of locality	1	2	3	4	5	6	7	8	9	10	11	
ORTHOPTERA												
Ensifera												
Tettigoniodea												
<i>Leptophyes albovittata</i>	2	2	2	2	1	2	2	3	3	2	2	100
<i>Phaneroptera falcata</i>	3	1	2	2		2	2	3	3	2	2	90.9
<i>Meconema thalassinum</i>									2			9.1
<i>Conocephalus fuscus</i>	3	2	3	3				1	3	3	3	72.7
<i>Conocephalus dorsalis</i>	1											9.1
<i>Ruspolia nitidula</i>								1		2	3	27.3
<i>Decticus verrucivorus</i>	3											9.1
<i>Metrioptera bicolor</i>	3		1	1		1			2		2	54.5
<i>Metrioptera roeselii</i>	4	3	3	2	2	2	2	2	1	2	2	100
<i>Pholidoptera griseoaptera</i>							1		1	1	1	36.4
<i>Platycleis albopunctata grisea</i>		1					2		2			36.4
<i>Platycleis vittata</i>						2	3				2	27.3
<i>Tettigonia viridissima</i>	2	1	3	1	1	2	2	1	3	2	2	100
<i>Ephippiger ephippiger vitium</i>							1		2			18.2
Grylloidea												
<i>Gryllotalpa gryllotalpa</i>						2						9.1
<i>Gryllus campestris</i>	3	2	3	3	1	2	2	1	3	1	2	100
<i>Melanogryllus desertus</i>	2								1			18.2
<i>Oecanthus pellucens</i>	3	2	1	2	2	2	2	3	3	3	1	100
Caelifera												
<i>Tetrix subulata</i>					1	1						18.2
<i>Tetrix bolivari</i>	1		1									18.2
<i>Calliptamus italicus</i>								3	4	3	2	36.4
<i>Pezotettix giornae</i>								3				9.1
<i>Aiolopus thalassinus</i>				3		4		1	2	1		45.5
<i>Mecostethus parapleurus</i>	1											9.1
<i>Oedipoda caerulescens</i>							1	1	2		1	36.4
<i>Dociopterus brevicollis</i>		2										9.1
<i>Euchorthippus declivus</i>	1	1										18.2
<i>Euchorthippus pulvinatus</i>	2	3	3	3	1	2	2	4	3	2	3	100

Locality	KS	KČ	BUČ	PČ	TI	TPL	MH	KA	HF	NIM	ALN	F%
Habitat	sm	sm	sm	sm	sm	sm	x	x	x	h	h	
Species/No. Of locality	1	2	3	4	5	6	7	8	9	10	11	
<i>Euthistira brachyptera</i>	1		2					1	2	1		45.5
<i>Gomphocerippus rufus</i>									3			9.1
<i>Chorthippus albomarginatus</i>	4	4	3	4	3	3		3	3	3	3	90.9
<i>Chorthippus apricarius</i>	3	2	2	4	3	3	1	3	1	3	1	100
<i>Chorthippus biguttulus</i>	2	1	2	2	2	2	2	1	2	2	2	100
<i>Chorthippus brunneus</i>	2	2	2	1	2	2	2	2	3	2	2	100
<i>Chorthippus dorsatus</i>	2	1	2	2	2	2		2		2		72.7
<i>Chorthippus mollis</i>	3	1	1	1	1	1	1	2	2	1		90.9
<i>Chorthippus parallelus</i>	3	1	2					3	2	2	2	63.6
<i>Chrysochraon dispar</i>	1		2					1		2		36.4
<i>Omocestus haemorrhoidalis</i>					2	1	2		3		2	54.5
<i>Omocestus rufipes</i>							1		2			18.2
<i>Omocestus petraeus</i>	1			1		1						27.3
<i>Stenobothrus nigromaculatus</i>										1		9.1
<i>Stenobothrus crassipes</i>		1	1	3		2	1		2	1		63.6
<i>Stenobothrus lineatus</i>	3		2					2	2		1	45.5
In total species 44	26	19	21	19	14	21	19	23	29	23	22	
MANTODEA												
<i>Mantis religiosa</i>	3	1	1	1	2	2	2	2	2	2	2	100

Comments on the occurrence and biology of some rare species

Comparing the structure of the Orthoptera assemblages in the salt marshes and in non-sandy localities in the Danube lowland today with the situation 50 years ago (MAŘAN 1954), we could not find in one single locality the species *Epacromis coerulipes*, *Myrmeleotettix maculatus*, *Stethophyma grossum* and *Stenobothrus stigmaticus*, identified in 1952–1953 by MAŘAN (1954) in the Kamenínske slanisko salt marsh. The last three species are still common today and we suppose that in a more detailed research they can be found in favourable localities. *Epacromis coerulipes* was found in Slovakia only once – in the Kamenínske slanisko salt marsh (MAŘAN 1954).

We have found only one southern Ponto-Mediterranean species: *Pezotettix giornae*. However, we suppose that this species could have escaped from attention in the past. *Pezotettix giornae* was found for the first time in Slovakia in 1998 (two females, 14.08.98) by KOČÁREK (1998) in the locality Kováčov, on the foot-hill of the Kováčovské kopce hills. We have found another locality at 3.5 km westward from the first one. On the xerothermic southern exposed and mown grassy embankments of the Hron River near the Kamenica nad Hronom village, we found this species by sweeping, together with *Calliptamus italicus*, *Euchorthippus pulvinatus* and seven species of the genus *Chorthippus* (Table 1). In total we found 12 adult females and 11 males of *P. giornae* along a 100 m long and 5 m wide grass stand covering the embankment, on 21.07.03. *P. giornae* reaches its northern distribution limit in Slovakia and from the adjacent territories it is known from Budapest in Hungary (NAGY 1997). The species is also known in

Romania, south Europe, and in the east from the Caucasus and Turkey, in the south from northern Africa (HARZ 1975). It probably ascends to the highest altitudes in Europe in the southern parts of Switzerland (1110 m a.s.l., THORENS & NADIG 1997).

The Paleotropical species *Aiolopus thalassinus* belongs in Slovakia to the typical representatives of the Panonian group – being mainly found in southern parts of western, central and also eastern Slovakia. Exceptionally it was also found in other localities in central Slovakia where it reached up to altitudes of 800–1948 m a.s.l. (Kráľova hoľa), thanks to its extraordinary vagility (KRIŠTÍN et al. 2002). We found this species in almost half of the studied sites (45,5%); the highest abundance was reached in the saline localities Tvrdosovce – Panské lúky (more than 100 ind./ha) and Čiky (50–80 ind./ha). In these localities we found the brown form only, in the remaining three the green form was also found and the same was the case in localities in eastern Slovakia (KRIŠTÍN et al. 2004a), resp. Gulička near Jurský Šúr (GULIČKA 1954). MAŘAN (1954) also recorded a massive occurrence of this species in the locality Kamenínske slanisko. However, in the present study we did not find a single specimen there.

The Ponto-Mediterranean species *Dociostaurus brevicollis* was found within our present study more frequently in sandy soils of Slovakia than in the other habitats (GAVLAS 2002 – Záhorie region, KRIŠTÍN et al. 2004a, b – Danube lowland). In only one of the studied localities we found adults from the end of June to October. In Hungary *D. brevicollis* is common in suitable localities (RÁČZ 1986, NAGY 1996), in the Czech Republic it has only been documented in the southeast part of the country (KOČÁREK et al. 1999), in Austria it is critically endangered (BERG 2002) and in Poland it is absent (BAZYLUK 1956).

We found the hygrophilous Euro-Siberian species *Mecostethus parapleurus* only in one locality Kamenínske slanisko salt marsh (1M, 01.08.02), in a depression in a wetland, together with *Conocephalus dorsalis* and *C. fuscus*. This species has quite regularly been occurring in wet vegetation in eastern Slovakia (GULIČKA 1967, KRIŠTÍN et al. 2004a) and in the Záhorie region (western Slovakia, GAVLAS 2002). It was also rare in other localities in the Danube lowland (FEDOR 2001).

The Southeast-European species *Stenobothrus crassipes* of the Pontic origin was regularly found in the studied localities (F = 63,6%). This contributes to the knowledge on the distribution in the Pannonian territory of Slovakia (KRIŠTÍN & SÁROSSY 2002).

Ruspolia nitidula, of Afro-tropical origin, has not only been found in the typical hygrophilous communities (see Table 1) but also in xerothermic habitats where it regularly sings and which it can reach thanks to its flying ability. This study has revealed that this species is much less rare as supposed (GULIČKA 1954) and it can be mapped using bat detectors.

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