

## Protected Orthoptera species of agro-ecosystems in Hungary

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### SUMMARY

The locusts (*Orthoptera: Acrididae*) are one of the most feared pests in the world. Now in Hungary locust plagues are not a real danger. Orthopterans live in the Carpathian Basin are mostly 'friendly' moreover endangered members of natural, semi-natural and agro-ecosystems. Here we collect distribution and habitat preference data of protected orthopterans living in agricultural landscapes in Hungary and provide information about them in order to call attention of farmers and help its protection.

Generally we can assume that intensive land use and increasing use of chemicals in plant protection endanger species that live inboard and neighbouring of cultivated lands. The positive effects of traditional land use can be proved in case of more species. The conservation of these rare and vulnerable species needs activity of both nature conservation and agriculture.

**Key words:** species conservation, crickets, locusts, pests, land use

### INTRODUCTION

The most known Orthopterans are locusts (*Acrididae*) which are one of the most feared pests in the world. In spite of pest control programs the locusts can consume vast swathes of crops and cause large damage in many regions of the world. In these days in the Carpathian Basin and especially in Hungary locust plagues are not a real danger. However up to the 19<sup>th</sup> century swarms of Migratory locust (*Locusta migratoria*) had swept through this region and than in the 20<sup>th</sup> century Moroccan locust (*Docostaurus maroccanus*) caused large locust plagues.

Although some orthopterans are dangerous pests, most of them are 'peaceful' moreover endangered species of not only the natural and semi-natural habitats, but also of the agro-ecosystems. Beyond that considering their abundance and biomass orthopterans are often the main invertebrate consumers in grasslands and play significant role in the food-webs (Curry et al., 1994; Andersen, 2001).

In Hungary 121/124 Orthoptera species occur (Nagy, 2003; Nagy and Rácz, 2007) and 31 of them are protected (KÖM, 2001). Two of them – Eastern green bush-cricket (*Tettigonia caudata*) and Heath bush-cricket (*Gampsocleis glabra*) – especially prefer different kind of agricultural landscapes, while others live in hedges and abandoned patches in agricultural lands. Thus the protection of these species needs contribution of both conservation managers and farmers.

We collect distribution and habitat preference data of protected Orthoptera species living in agricultural lands in Hungary and provide information about them. We aimed calling farmers and agronomist attention to protection of these vulnerable species.

### MATERIAL AND METHODS

We collected and summarized the distribution and habitat preference data of protected Hungarian Orthoptera species live in agro-ecosystems. In this paper eight Orthoptera species (6 Ensifera and 2 Caelifera) are characterised considering their relation to agriculture. During the study we survey more than 30 publications and our unpublished data. The main data of species are presented in the *Table 1*.

#### Orthoptera species

Subordo: Ensifera

*Isophya modesta* (Frivaldsky, 1867) – Hungarian name: szerény tarsza

Grass-green coloured medium-stratured micropter bush-cricket with short green wings. The average of body length: 23-27 mm. The ovipositor is 16-18 mm in length (Harz, 1957, 1969). Because of its colour and sheltering way of life the specimens are hard to recognize.

This Balkanian (Moesian) species (RÁ CZ, 1998) occur in Central Europe. The sporadic populations are mostly well separated from each-other. *I. modesta* is rare in Hungary, it occurs in the Villány Hills, the Mecsek, the Mátra, and the Bükk Mountains (Nagy, 1981, 2002; Nagy and Rácz, 1996; Nagy and Nagy, 2000).

The specimens usually stay on large leaf of *Dicotyledonous* plants. They prefer the sunny hillsides covered by steppe grasslands and dense rocky grasslands. The adults can be found from end of May to beginning of July.

This species has no economical importance populations live only in the neighbouring natural and semi-natural grasslands of vineyards. It never occurs in cultivated areas and in the lowlands. The populations are

endangered by vineyards. The habitat loss caused by extension of vineyards has an indirect, while the intensive chemical plant protection has a direct effect on the *I. modesta* populations live in the neighbouring natural habitats. The species can not escape from disturbance because of their limited moving ability. It happens especially in the Villány hills where the *I. modesta* can be found even in the abandoned vineyards and in the hedges and shrubs between existing vineyards (unpublished data of Nagy, A.).

*Isophya modestior* Brunner von Wattenwyl, 1882 – Hungarian name: illir tarsza

This medium-statured micropter bush-cricket is green with little reddish-brown dots. The elytra are yellowish-white and cover the third part of abdomen. The average of body length is 18-24 mm. The ovipositor is 11-14 mm in length (Harz, 1957, 1969).

This Balcanian (Ilyrian) chortobiont species (RÁCZ, 1998) occur in Southeast Europe. *I. modestior* is protected rare species in Hungary. This species is occurring in the Villány Hills, the Mecsek and the Kőszeg Mountains. The adults can be found from end of May to beginning of July. The extensions of vineyards are endangering this species as in case of *I. modesta*.

*Polysarcus denticauda* (Charpentier, 1825) – Hungarian name: fogasfarkú szöcske

*P. denticauda* is a large-statured (28-36 mm), stocky, micropter bush-cricket. It is normally grass-green, sometimes reddish-brown. The ovipositor of females is 18-27 mm in length. The upper wings are yellow with brown veins. The look of specimens shows spatial differences. In East Europe multicoloured populations also can be found (Harz, 1957, 1969).

This Ponto-Mediterranean species is distributed in Central- and Southeast Europe. In Hungary *P. denticauda* occurs both in lowlands and mountainous areas. Although it is a rare species in Hungary in the mountain grassland (the Mátra and the Bükk Mountains, the Budai and the Pilis Hills) it is easy to find (Szelényi et al., 1974; Nagy and RÁCZ, 1996; Nagy, 1983, 1987, 1997, 2002; Nagy and Szövényi, 1999a). In western part of the country it can be locally common moreover it can cause local swarms in wet grasslands (Harz, 1957, 1969; Nagy, 2002). The adults can be found from end of May to August depends on microclimate of habitats.

This species live only in dense wet grasslands dominated by *Dicotyledonous* plants. It has special microclimate needs, considering especially humidity of soil and air. In arable land never occur. The local outbreaks cause damages only in hayfields.

The lowland populations of *P. denticauda* are endangered by habitat loss caused by intensification of land use and mainly by the chemical plant protection, while the mountainous ones are unperturbed.

*Tettigonia caudata* (Charpentier, 1845) – Hungarian name: farkos lombszöcske

It is a large-statured (25-40 mm) bush-cricket with green body. Its legs are yellowish. It can be easily separated from other *Tettigonia* species occur in Hungary (*T. viridissima* and *T. cantans*) on the basis of morphological characteristics and its song. The females have long straight ovipositor (Harz, 1957, 1969).

The Ponto-Caspian *T. caudata* is distributed from Central Europe to West Siberia (Harz, 1957, 1969). In Hungary this species had been common up to the beginning of the 20<sup>th</sup> century (Pongur, 1918). During the 20<sup>th</sup> century it became rare or even it became extinct in some areas (e.g. in the Kőszeg Mountains (Szövényi and Nagy, 1999)).

This species has no special habitat needs. It can be found in mainly ago-ecosystems, in weed- and loess-grasslands and in meso- and hygrophilous mountain-grasslands (Kisbenedek, 1997; Nagy and RÁCZ, 1996). Gausz and Gallé (1968) found it in the *Cypero-Juncetum* community. The adults can be found from June to October.

In consequence of the intensification of land use, fragmentation and loss of habitats frequency of the species dramatically decreased during the 20<sup>th</sup> century (Kenyeres and Bauer, 2001). The extensive land use is favourable to *T. caudata*. The hedges and weed patches can provide both food source and suitable habitats for the species.

The fragmented and isolated populations are endangered by intensive land use and changes of landscape structure (disappearing of hedges and decreasing of habitat diversity). The increasing use of insecticides affects directly while the use of herbicides affects indirectly to the survival of the local populations.

*Gampsocleis glabra* (Herbst, 1786) – Hungarian name: törös szöcske

*G. glabra* is a usually green sometimes yellow coloured, medium-statured (20-26 mm) bush-cricket. Its pronotum is light brown with yellow margin on the lateral lobe. The first wings are green, longer than abdomen, with brown dots. The females have relatively large ovipositor 15-21 mm in length (Harz, 1957, 1969).

This Ponto-Caspian thamnobiont species (RÁCZ, 1998) occur in West-, Central- and East Europe. In Hungary it can be found only in the lowlands, where its distribution is sporadic (Varga and RÁCZ, 1986; RÁCZ, 1986; Nagy, 1983, 1987; Nagy and Szövényi, 1998, 1999a; Nagy et al., 1999). This bush-cricket is rare in the Hungarian Orthoptera fauna.

*G. glabra* prefers the hygrophilous grasslands, and meadows where the surface seasonally covered by water. This species lives in natural and semi-natural grasslands neighbouring to agricultural fields and in hedges. Sometimes it occurs inboard of arable lands but it has no economical importance. The adults can be found from June to August.

The intensification of land use, the undue mowing and the chemical plant protection also endanger the populations live in agricultural landscapes. Because of these reasons it already became rare in Austria and Germany.

*Pholidoptera litoralis* (Fieber, 1853) – Hungarian name: bújkáló avarszöcske

*P. litoralis* is a medium-statured (19-27 mm) micropter bush-cricket. In contrast with other *Pholidoptera* species live in Hungary it is mostly green, brownish-green or greenish-yellow. It has a black coloured pronotum with light margin. The wings are reddish-yellow. The females have long (23-25 mm) straight ovipositor (Harz, 1957, 1969).

*P. litoralis* is distributed in the north Mediterranean region. In the Pannonian biogeographical region it occurs mostly in mountainous areas. In Hungary it can be found only in the surroundings of the Körös River (southeast Hungary). This occurrence is unusual because of low height above the sea level (approx. 80-90 m). These populations are connected with the nearest Transylvanian ones (Nagy and Szövéni, 1999a, 1999b; Nagy et al., 2000; Nagy, 2002.)

In Hungary this species prefer the high dense wet-grasslands, meadows and edges of park-forests (Nagy, 2002). The adults can be found from June to August.

In agricultural landscape it can be found only in the hedges, pastures and hayfields. It has no economic importance. The populations are endangered by intensive mechanical-mowing and chemical plant protection.

Table 1

**Protected Orthoptera species live in agro-ecosystems in Hungary with its scientific name (Nagy, 2003) faunal- and life form type, geographical range (Rácz, 1998), frequency category in Hungary (on the basis of 10 x 10 km UTM distribution data; Nagy and Rácz, 2007) and protection status (KÖM, 2001; Council of Europe, 1992; Korm. Rendelet, 2004).**

Species	Geog. range	Faunal type	Life forms	Freq. cat.	Protection
Subordo: Ensifera					
<i>Isophya modestior</i> Brunner von Wattenwyll, 1882	North-East-Carpathian	Balcanic (Ilyrian)*	Ch	I	P
<i>Isophya modesta</i> (Frivaldszky, 1867)	Central-Southeast-European	Balcanic (Moesian)	Ch	I	P
<i>Polysarcus denticauda</i> (Charpentier, 1825)	Central-Southeast-European	Ponto-Mediterranean	Ch	I	P
<i>Tettigonia caudata</i> (Charpentier, 1845)	Central-East-European	Ponto-Caspian	Ch-Th	I	P
<i>Gampsocleis glabra</i> (Herbst, 1786)	European-Asian	Ponto-Caspian	Th	II	P
<i>Pholidoptera litoralis</i> (Fieber, 1853)*	Southeast-European	North-Mediterranean	Ch-Th	I	P
Subordo: Caelifera					
<i>Odontopodisma rubripes</i> (Ramme, 1931)	North-East-Carpathian	Dacian	Th	I	P, N-2000, AII, AIV
<i>Locusta migratoria</i> Linnaeus, 1758	Cosmopolitan	Policentric	Ch*	I	P

\*: faunal- and life form types and geographical range on the basis of unpublished data of I. A. Rácz.

Th: thamnobiont (species live in only high and dense grasses, shrubs and forests); Ch: chortobiont (grass-dwelling species, live in different kinds of grasslands); P: protected species in Hungary; N-2000: listed in the NATURA 2000 species list; AII and AIV: listed in the Annex II and Annex IV of the Habitats Directive (Animal and plant species of community interest whose conservation requires the designation of special areas of conservation (Annex II) or need a strict protection (Annex IV)); Frequency categories: I: rare (relative frequency: <0.0625); II: scattered (relative frequency: 0.0626-0.125)

Subordo: Caelifera

*Odontopodisma rubripes* (Ramme, 1931) – Hungarian name: erdélyi hegyisáska

*O. rubripes* is a medium-statured (15-23 mm) grass-green micropter locust. This species has very small and narrow wings. Its legs are singularly scarlet (Harz, 1957, 1975; Nagy, 2002).

This Carpathian subendemic (Dacian) species occur only in the eastern part of the Carpathian Basin. The central part of its area located in Transylvania (Romania). In Hungary it can be found only in the Bereg and in the Szamos-hát. Near Bátorliget village there is an isolated population in the Bátorligeti-ósláp (Bátorliget Marsh)

(Nagy, 1990a, 2002). Considering phenology *O. rubripes* is an early species, adults can be found from end of May to July (unpublished data of A. Nagy).

This species prefer especially dense and wet vegetation types as meadows, marshes, shrubs in the bank of ditches and hedges. Secondly it occurs in forest clearings and roadside shrubs (Nagy, 2002).

The *O. rubripes* has no economical importance and never occurs in arable lands, but prefer hedges and bank of ditches. The populations are endangered by loss and fragmentation of their habitats. The intensive mechanical-mowing and the drainage have especially negative effect. The intensive insecticide use in the orchards, which is a common land use in the Bereg region, also influences the survival of local populations live in neighbouring habitats.

*Locusta migratoria* Linnaeus, 1758 – Hungarian name: keleti vándorsáska

It is a large-statured (30-60 mm) robust, generally green, rarely brown macropter locust species. The third legs are light red. Specimens show large differences in colouring (Harz, 1957, 1975). The species has two different forms the 'peaceful' soliter and the migrant gregaria. The two type show differences considering both their morphology and behaviour. The gregaria type is larger, more agile and dark coloured than soliter, however the soliter also can good fly (Uvarov, 1921).

The species have wide distribution, it occurs in Central-, East- and South Europe and in the greatest part of Asia. In central part of Africa and in Madagascar different subspecies occur (Harz, 1957, 1975).

*L. migratoria* is hygrophilous it prefer wet habitats as meadows, river banks and marshes (Harz, 1957). In these days the gregaria type still makes large swarms in different part of their geographical range. During locust plagues it can be found in all kinds of natural, semi-natural and agricultural habitats otherwise it prefers fallow lands and natural habitats.

In the Carpathian Basin in the beginning of the 20<sup>th</sup> century was the latest locust plagues caused by *L. migratoria*. The large swarms swept through the region and reached even south Germany. After the regulation of the Tisza River and its tributaries habitats of the species desiccated and finally mainly disappeared. Because of human activity the species nearly have become extinct, while the other xerophilous pest the Moroccan locust (*Dociostaurus maroccanus*) appeared in this area (Nagy 1964, 1988, 1990b, 1995).

Now there are only some soliter populations in northeast part of the Hungarian Great Plain (Alföld) e.g. near Hajdúbabos village and city of Debrecen. Consequently for today remain populations are protected by law. For the last isolated populations are endangered by drying of their restricted habitats and intensive pasturing.

## DISCUSSION

In this study we characterized protected orthopterans living in agro-ecosystems in Hungary. We collect distribution and habitat preference data of species and studied the role of agriculture in the protection of them. There are 121/124 Orthoptera species in Hungary (Nagy, 2003; Nagy and Rácz, 2007) 31 of them are protected (KÖM, 2001). Seven of these species are directly or indirectly affected by the agriculture. In these days neither of them has economical importance. Only Migratory locust (*Locusta migratoria*) can be seen as a pest but in Hungary only some remain soliter type populations live in this time. The near totally extinction of the species caused on the one hand by regulation of the Tisza River and its tributaries and on the other hand by drainage of marshes, bogs and meadows (Nagy, 1995, 2002).

However these species has large natural protection value and we have large responsibility for protect them especially in case of endemic, rare and threatened species. In order to protect these species there is a need for cooperation of conservation biologists, managers, farmers and agronomists.

*Tettigonia caudata* and *Gampsocleis glabra* lives mainly in agro-ecosystems and prefer hedges and fallow lands. The occurrence of these species can be expected mostly in the lowlands. The populations are endangered by habitat fragmentation and habitat loss caused by intensification of land use and intensive use of insecticides (Kenyeres and Bauer, 2001; Nagy, 2002). The larger habitat diversity and the extensive land use generally favours to survival of local populations.

*Polysarcus denticauda* generally lives in hayfields and pastures. Sometimes there are local outbreaks but it has no significant economic importance moreover the intensive land use (pasturing and mowing) endangers these local populations (Harz, 1957; Nagy, 2002).

The other four species hardly ever occur inboard of cultivated lands. They live in hedges and neighbouring natural and semi natural habitats. The intensification of land use generally causes fragmentation and loss of these habitats and the increasing use of pesticides and other chemicals directly endangers the local populations (Nagy, 2002).

Both *Isophya modestior* and *I. modesta* occur in the Villány Hills (Nagy and Nagy, 2000). They live in natural and semi natural grasslands fragmented and isolated by vineyards. The fragmentation and the use of insecticides also endanger these species (Nagy, 2002). Maintaining existing and establish new connections between subpopulations and cautious use of chemicals can help survival of local populations.

*Pholidoptera litoralis* occur only in the surroundings of the Körös River therefore the local organisations (both conservational and agricultural) have large responsibility for protect these populations (Nagy et al., 2000).

Finally *Odontopodisma rubripes* has to be emphasized. This subendemic species listed in international lists of protected species as Annex II and IV of Habitat Directive and NATURA 2000. The Hungarian conservation biology has a large responsibility for this species. It occurs only in the Bereg region and the Szamos-hát and lives in hedges and neighbouring of cultivated land thus the responsibility of farmers and agronomist are also decided.

Generally we can assume that intensive land use and increasing use of chemicals endanger species that live inboard and neighbouring of cultivated lands. The positive effects of traditional (extensive) land use were proved in case of many species (e.g. *Tettigonia caudata*, *Gampsocleis glabra*).

Conservation of these species needs further investigations in order to collect more detailed data on distribution and habitat preferences. In order to detect changes caused by human activity the populations must be monitored. Finally the participation of agricultural organisations, agronomist and farmers is essential both in conservation planning and activities.

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