

First record of *Saga pedo* (Orthoptera, Tettigoniidae) in Suceava County with notes on its distribution in Eastern Romania

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Abstract. The predatory bush-cricket *Saga pedo* Pallas, 1771 is mentioned for the first time from "Fânețele Seculare Ponoare" Bosanci Natural Reserve, located few kilometers south of Suceava city, Suceava county (Romania). The general distribution of this species in eastern Romania is also discussed in this paper.

Key Words: *Saga pedo*, first record, Suceava county, distribution.

Introduction. Genus *Saga* Charpentier comprises 13 species distributed in Central and Southern Europe, Asia Minor and Western Asia (Eades et al 2012). The species *Saga pedo* Pallas, 1771 is considered to be one of the biggest predatory insects in Europe. The species is xero-thermophilous and praticolous, with a Ponto-Mediterranean distribution of paleogeic origin (Krištín & Kaňuch 2007).

This is the first record of the species *S. pedo* in "Fânețele Seculare Ponoare" Bosanci Natural Reserve, near Suceava city, Suceava county (Romania). This is the northern most known point of species distribution in Romania. In this paper, in addition to habitus images and the natural habitat where the species was found, we also present the regional distribution in Eastern Romania. No more than a modest contribution to the knowledge of this rare and protected species. The importance of "Fânețele Seculare Ponoare" Bosanci Natural Reserve (47 033'N 26 016'E, 300-400m altitude, surface 24ha) is also due to the presence of three endangered plant species, at the European level: *Crambe tataria*, *Echium russicum* and *Ligularia sibirica* (Sârbu et al 2007). Several of the present plant species are included on the Romanian red list: *Adonis volgensis*, *Carex diandra*, *Centaurea marschalliana*, *Cimicifuga europea*, *Cirsium decussatum*, *Dactylorrhiza incarnata*, *Dianthus capitatus*, *Dictamnus albus*, *Gymnadenia conopsea*, *Gymnadenia odoratissima*, *Iris aphylla* ssp. *hungarica*, *Lathyrus pannonicus*, *Menyanthes trifoliata*, *Orchis laxiflora* ssp. *elegans*, *O. ustulata*, *Pulsatilla grandis*, *P. patens*, *Salix rosmarinifolia*, *Serratula wolfii*, *Trolius europaeus*, *Veratrum nigrum*. Plant communities are edified mainly by *Festuca* spp., typical for the steppic vegetation.

Material and Method. A female specimen of *S. pedo* has been collected by the first author in august 2010 with an entomological net on the steppic vegetation from Fanetele Seculare Ponoare-Bosanci Reserve. The species was accidentally collected during a fieldtrip in order to collect and study parasitic micro-hymenoptera, especially Mymaridae (Hymenoptera, Chalcidoidea).

The other analyzed specimens have been collected with an entomological sweep-net. Others were observed on the vegetation from some areas in Moldova and Dobrogea (Romania), in the summer time, in the period 2001 to 2011. Apart from the female

collected by the first author at Ponoare-Bosanci Reserve and some individuals earlier collected by last author, all the other specimens captured were photographed and released into the wild. Specimens are in authors' personal collections.

Results and Discussion. The species *S. pedo* is part of: Order Orthoptera, Suborder Ensifera, Family Tettigoniidae, Subfamily Saginae, *Saga pedo* Pallas, 1771 (syn. *Gryllus pedo* Pallas, 1771; *Locusta serrata* Fabricius, 1798; *Saga serrata* Charpentier, 1825).

Material: 1 ♀, 17.08.2010, Ponoare Bosanci, Suceava county (leg. E. Pricop & B. M. Negrea).

Additional material: 2 ♀♀, 27.06.2001, Valea lui David, Iași county (leg. I. Ș. Iorgu); 16 ♀♀, 05.06.2003, Valea lui David, Iași county (observation I. Ș. Iorgu, not collected); 3 ♀♀, 22.07.2004, Valea lui David, Iași county (leg. I. Ș. Iorgu); 1 ♀, 25.08.2004, Pașcani, Iași county (observation I. Ș. Iorgu, not collected); 1 ♀, 11.06.2005, Valea lui David, Iași county (leg. E. Pricop); 1 ♀, 22.06.2005, Oancea, Galați county (observation I. Ș. Iorgu, not collected); 3 ♀♀, 10.08.2005, Hagieni, Constanța county (observation I. Ș. Iorgu, not collected); 2 ♀, 07.09.2005, Cheile Dobrogei, Constanța county (observation I. Ș. Iorgu, not collected); 11 ♀♀, 28.07.2006, Valea lui David, Iași county (leg. I. Ș. Iorgu); 1 ♀, 31.07.2006, Măcin, Tulcea county (leg. I. Ș. Iorgu); 1 ♀, 01.08.2006, Greci, Tulcea county (observation I. Ș. Iorgu, not collected); 4 ♀♀, 11.05.2007, Gura Dobrogei, Constanța county (observation I. Ș. Iorgu, not collected); 1 ♀, 27.07.2007, Codru, Tulcea county (observation I. Ș. Iorgu, not collected); 1 ♀, 13.05.2008, Codru, Tulcea county (observation I. Ș. Iorgu, not collected); 7 ♀♀, 14.05.2008, Gura Dobrogei, Constanța county (observation I. Ș. Iorgu, not collected); 1 ♀, 16.05.2008, Dumbrăveni, Constanța county (observation I. Ș. Iorgu, not collected); 1 ♀, 28.06.2008, Bârnova, Iași county (observation I. Ș. Iorgu, not collected); 5 ♀♀, 27.07.2008, Valea lui David, Iași county (observation I. Ș. Iorgu, not collected); 1 ♀♀, 12.08.2008, Hagieni, Constanța county (observation I. Ș. Iorgu, not collected); 1 ♀, 13.08.2008, Babadag, Tulcea county (observation I. Ș. Iorgu, not collected); 1 ♀, 13.08.2008, Visterna, Tulcea county (observation I. Ș. Iorgu, not collected); 2 ♀♀, 13.08.2008, Codru, Tulcea county (observation I. Ș. Iorgu, not collected); 1 ♀, 14.08.2008, Tulcea, Tulcea county (observation I. Ș. Iorgu, not collected); 1 ♀, 14.08.2008, Atmagea, Tulcea county (observation I. Ș. Iorgu, not collected); 1 ♀, 14.08.2008, Horia, Tulcea county (observation I. Ș. Iorgu, not collected); 1 ♀, 15.08.2008, Hanu Conachi, Galați county (observation I. Ș. Iorgu, not collected); 2 ♀♀, 04.09.2008, Valea lui David, Iași county (observation I. Ș. Iorgu, not collected); 1 ♀, 30.09.2008, Mârzești, Iași county (observation I. Ș. Iorgu, not collected); 1 ♀, 30.09.2008, Horlești, Iași county (observation I. Ș. Iorgu, not collected); 2 ♀♀, 01.05.2009, Gura Dobrogei, Constanța county (observation I. Ș. Iorgu, not collected); 15 ♀♀, 09.06.2009, Gura Dobrogei, Constanța county (observation I. Ș. Iorgu, not collected); 9 ♀♀, 02.06.2010, Gura Dobrogei, Constanța county (observation I. Ș. Iorgu, not collected); 2 ♀♀, 05.06.2010, Agigea, Constanța county (observation E. Pricop, not collected); 3 ♀♀, Valea lui David, coll. Laboratory of Entomology, Faculty of Biology, "Al. I. Cuza" University of Iași; 1 ♀, Valea lui David, coll. Natural History Museum of Iași.

Description: ♀ body: 59-112 mm. The specimen collected from Ponoare Bosanci measures 9.7 cm, the ovipositor from base to tip is about 3.7 cm (Figure 1). Subgenital plate in the female triangular with a small incision in the apex. Tegminae of the males very short, reduced to stridulatory organs. In contrast, the females do not have tegminae. Very long ovipositor, denticulate in the apical region. Anterior and median tibiae and femurs with spurs on the ventral parts. Few males are known.

The species is xerothermophilous–pratinicolous, with a Pontomediterranean distribution of paleogeic origin; in Europe it is critically endangered (Nagy et al 1983; Berg & Zuna-Kratky 1997; Krištín 2001; Kenyeres et al 2002).

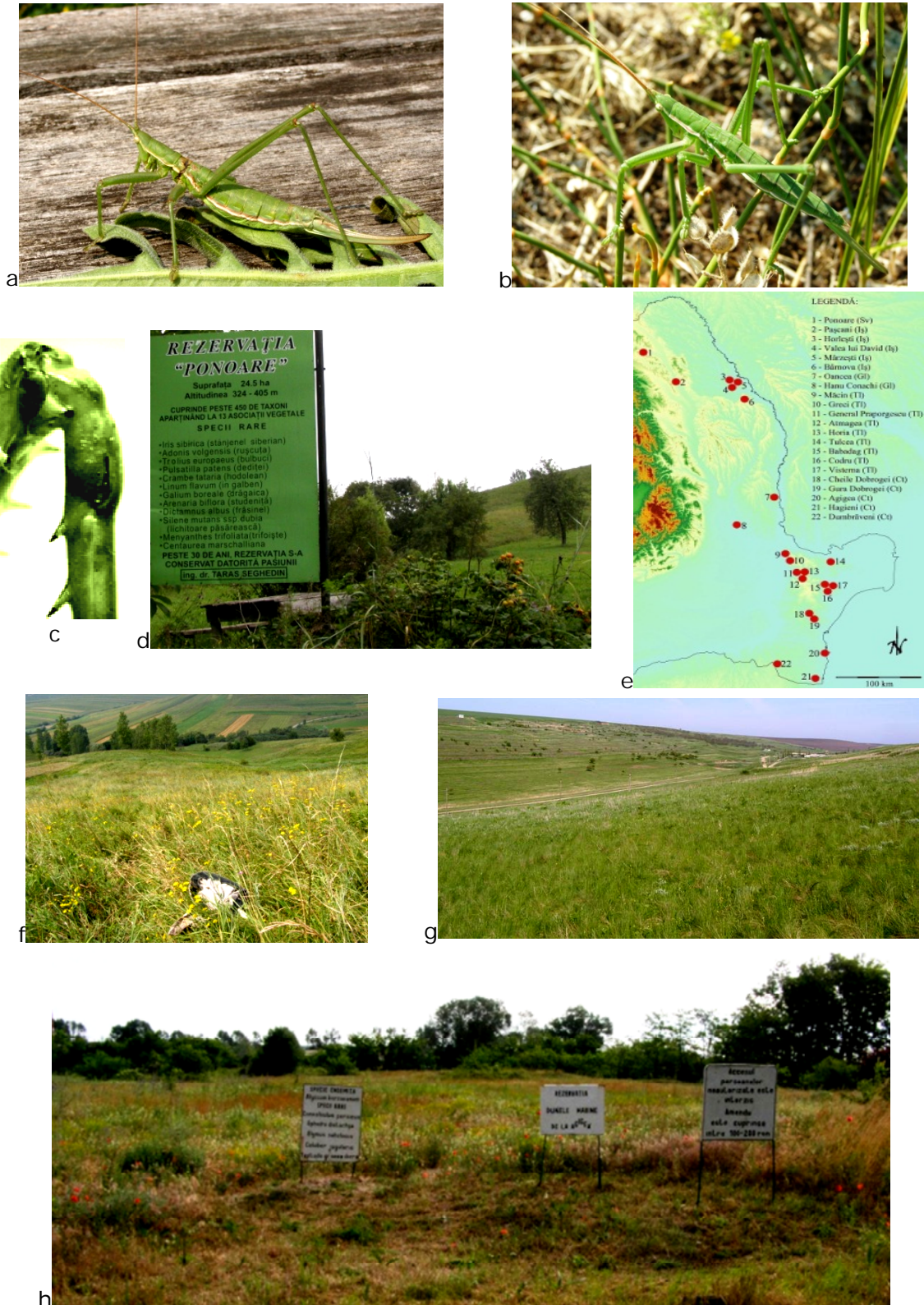


Figure 1. *Saga pedo* and some specific natural habitats in Moldavia and Dobrogea: a, c - adult specimen captured from Ponoare - Bosanci Reserve, with the taxonomic feature of fore-tibia; b - larva on *Ephedra distachya* in Agigea Reserve; d, f - "Fanetele Seculare Ponoare" – Bosanci; e - distribution map of the species in Eastern Romania (by I. Iorgu); g - "Fanetele seculare Valea lui David" - Iași; h - sand dunes reserve from Agigea (original photos E. Pricop).

All *Saga* species are completely carnivorous, preferring to eat bush-cricket and grasshoppers. The legs are adapted for holding prey, being fitted with rows of strong spines along inside and outside lower edges of femur and tibia. It is a matriarchal species reproducing parthenogenetically. Eggs are laid in late summer, planted deep in the soil using the long sabre-like ovipositor. Female spawns only a few eggs in soil and fixes them at different depth; the spawn is diurnal and will end in autumn. The hatched larvae transit 9 phases of evolution. Males are known but quotations are extremely rare: recently one male was found in Switzerland (Baur et al 2006). Rare cases of hybridization between *S. pedo* and *S. rammei* Kaltenbach have been recently discussed (Lemonnier-Darcemont & Darcemont 2007). Several parasitoids are reported to attack Orthoptera eggs (Pricop 2009).

S. pedo reaches maturity before other orthopteroids, preying extensively on them. In the Eastern part of Romania we found adults from early July up to September. This species is usually at the top of trophic pyramids and its abundance is limited by the availability of suitable prey and well-preserved, natural or semi-natural habitats. *S. pedo* is endangered certainly by insecticides and habitat destruction by intensified agriculture. Few species are its natural enemies.

In Romania it is very rare and localized. It prefers steppic xerophilous and meso-xerophilous lawns, with tall herbaceous vegetation; sometimes it can be seen on bushes (Iorgu & Iorgu 2008). Olmo i Vidal (2002) mentions it also in siliceous rockrose scrub, heath and brambles. It has been found from 5-7 m a.s.l. at Agigea (Constanța county, Romania) up to 1065 m a.s.l. at El Mascar (Tortos, Spain) (Olmo i Vidal 2002) but it can go higher. This species points out the good condition of the steppic habitat (Báldi & Kisbenedek 1997). We consider that the habitat loss is an important limitation factor for *S. pedo*, most steppe habitats are cultivated: the agricultural land represents nowadays 62% of the total surface of Romania (Petrescu & Petrescu-Mag 2010).

S. pedo is protected, located on the Annex IV of the E. C. Habitats Directive and Annex II of Bern Convention (1993), considered vulnerable by IUCN commission which included it in the protected species list since 2000 (IUCN, <http://www.iucnredlist.org>) and DCE: 92/43/EEC from 21.05.1992 (<http://eur-lex.europa.eu/>) (Baillie et al 2004; Török et al 2006; Lupu 2007).

General distribution. Palaearctica (Europe and Asia) and Nearctica (introduced only in Michigan, USA): Armenia, Austria, Azerbaijan, Bulgaria, China, The Czech Republic, France, Georgia, Germany, Hungary, Italy, Kazakhstan, Kyrgyzstan, Portugal, Republic of Moldova, Romania, Russia, Serbia and Montenegro, Slovakia, Spain, Switzerland, Tajikistan, Turkey, Turkmenistan, Ukraine, Uzbekistan and SUA - Michigan (Nagy et al 1983; Cantrall 1972; Eades et al 2011).

In the past, *Saga pedo* was reported in Romania by various researchers. Lupu (2009) summarizes some of the data available from literature: Knechtel & Popovici-Biznoșanu (1959) recorded this species near Turda, Zalău (Cluj county), Horoslar, Murfatlar, Techirghiol (Constanța county), Pricopan (Măcin Mountains, Tulcea county) and Racosu de Jos (Brasov county); Kis found it in Danube Delta (1993); Rákósy & Wieser (2000) in Măcin Mountains; Kiss et al (2004) in Tulcea zone. Mîndru (1980) mentions this species from Fânețele Seculare de la Valea lui David, Iași. Recently, the species is also nominated in the Red List of plants and animals from the Danube Delta Biosphere Reserve (Lupu 2003) and in the Red list of wild species of flora and fauna from Măcin Mountains National Park (Rákósy & Wieser 2000). Lupu (2009) also mentions this species from Dealurile Tulcei - Dobrogea.

In the Eastern part of Romania, *S. pedo* is commoner in Dobrogea than in Moldavia according to recent knowledge of distribution: Pașcani, Valea lui David (Zamfirescu et al 2007), Horlești, Mârzești, Bârnova (Iasi county), Oancea, Hanul Conachi (Galati county) (Iorgu & Iorgu 2008; Iorgu 2009); from the border area Romania – Republic of Moldova (Popescu & Davideanu 2009); from Dealul lui Dumnezeu - Iași (Zamfirescu et al 2009); Ponoare-Bosanci (Suceava county) (this paper); General Praporgescu (Tulcea county) (Lupu 2007), Măcin, Greci, Tulcea, Horia, Atmagea, Codru,

Babadag, Visterna (Tulcea county), Hagieni, Dumbrăveni, Gura Dobrogei, Cheile Dobrogei (Constanta county) (Iorgu 2009), Agigea (Constanta county) (this paper).

Rarer than *S. pedo*, in Romania also lives *S. campbelligracilis* Kis, known only from the surroundings of Histria (Iorgu et al 2008; Iorgu 2009; Lupu 2009; Păiș, 2010). The main difference between these two species is the prominent tympanal area on the fore-tibiae in females of *S. pedo*, wider compared with *S. campbelli*.

Conclusions. The presence of *Saga pedo* in "Fânețele Seculare Ponoare" Bosanci area is due to the good state of this natural reserve, no major threats were detected; it will be a good future refuge for this species.

Due to environmental change of recent years, we can say that *S. pedo* species is expanding its areal. It is advantaged by a hot and dry climate, specific to Sarmatic and Ponto-sarmatic steppes. In the last 2-3 years precipitation regime in Suceava plateau dropped under the multiannual average of the last 30 years (characteristical to bioclimatic regionalization of northern Moldavia), fact that advantages this species. *S. pedo* is considered to be a vulnerable species.

Acknowledgements. This study was supported by the following projects: POSDRU/88/1.5/S/47646, POSDRU/88/1.5/S/52946 and POSDRU/89/1.5/S/63663 co-funded by the European Social Fund through the Sectoral Operational Programme - Human Resources and Development 2007-2013.

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Received: 06 December 2012. Accepted: 10 December 2012. Published online: 15 December 2012.

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How to cite this article:

Pricop E., Negrea B. M., Popescu I. E., Iorgu I. S., 2012 First record of *Saga pedo* (Orthoptera, Tettigoniidae) in Suceava County with notes on its distribution in eastern Romania. AES Bioflux 4(3):171-177.