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THE OBSERVATION OF *SAGA HELLENICA* KALTENBACH, 1967 (ORTHOPTERA) ON CORFU ISLAND

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Abstract: During two collectional trips to the Northern part of Corfu Island (NW Greece, approx. 39.38N/19.51E) conducted in June 2001 and 2002, the species *Saga hellenica* was observed in its natural habitat as well as in a laboratory. All specimens were observed not in the coastal area of the island but entirely at higher altitude levels around 300 – 500 m above sea within the highest mountain Mt. Pandokratoras massif where they were found strictly locally, on partially grazed aforested banks above the coastal olive plantation level. In total, 5 spp. were observed in 2001 and 12 spp. in 2002. Fourteen spp. from the total recorded number were observed sitting on vegetation at the height of 20 – 150 cm above ground; 3 spec. were found directly on the ground. Only one male was recorded. In 2002, during a detailed survey walk through a 200 m transect along the left side of the path, 7 adults were recorded on bushes. One female held in captivity and fed with insects for 4 weeks oviposited a batch 45 eggs into provided substrate before dying. A second female which died three days following a sudden attack and biting by a male when we attempted to let them mate was dissected and 41 eggs were identified – 20 of which were fully developed and brown, other were lighter and colorless. Eggs of *Saga hellenica* are oblong and 11 x 3 mm in size.

Key words: faunistics, observations, bionomy, ecology, *Saga hellenica*, Orthoptera, Corfu Island (Greece)

INTRODUCTION

Sagas are predatory, flightless, large bush-crickets, which are characteristic for steppe and forest steppe habitats. Their appearance is so distinctive that genera determination causes no difficulties even for amateur biologists. From the genus *Saga* Charp., 1825 the following European species are known (Harz 1969): *Saga natoliae* Serville, 1983; *S. rhodiensis* Salfi, 1929; *S. hellenica* Kaltenbach, 1967; *S. rammei* Kaltenbach, 1965; *S. campbelli* Uvarov, 1921 and *S. pedo* Pallas 1771. With the exception of *S. pedo* all listed species have separate sexes, show marked sexual dimorphism and we predict that oviposition precedes copulation. However, only females have been recorded for *S. pedo* and they are known to lay unfertilized eggs from which only female offspring emerge.

Having no hind wings and thus being flightless, the sagas manifest a low vagility. These bush-crickets are therefore very vulnerable to extinction of anthropogenic nature. There are many causes for the decline of sagas. With their predatory way of life they are correspondingly affected by chemicalization, and even by a double effect. Firstly, they are at risk of direct kill following agrochemical application and afterwards they are exposed to food deficiency. They of course also suffer from the destruction of suitable habitat of various cause. Little is known about the bionomy and ecology of individual species, most of them have not been reared and observed in captivity yet (HROMÁDKA 2000). Concrete and detailed observations from natural conditions are also scarce or they are restricted to mere general data of collectional significance (KALTENBACH 1990). For this reason we would like to present in this paper a number of findings concerning the species *Saga hellenica* which we had the opportunity to observe on Corfu Island.

METHODS

Observations of the sagas in natural conditions, which are described below were conducted on June 15-26, 2001 and June 15-25, 2002 on Corfu Island (Greece). The visited area near Barbati and the massif of the highest mountain Mt. Pandokratos is situated in the North part of the island, its geographical position being approximately 39.38N/19.51E.

Initially, the sagas were found more or less randomly but following the observation of our first specimen, we carefully recorded all general conditions of the findings (sunshine exposure, position, movement, sex, etc). In 2002, on one occurrence site we conducted a transect inspection in order to achieve a random and even distribution of shrubs and vegetation clusters, where the sagas were predicted to be found. During this inspection lasting roughly from 10:30 – 13:30, during a good spell of sunshine we checked a great number of shrublets and vegetation clutches along the left side of the path (heading upward from the sea) between Vinglatouri, Ai Xeria and Paleo Chorio residences. The total abundance and sex of observed specimens was recorded, along with height above ground level within the shrubs (with precision 10 cm).

From all observed spec. we collected 4 to attempt captivity breeding. After trapping, the bush-crickets were transported from natural habitat using 1.5 liter perforated plastic bottles with thick culms and a branch for the animals to hold on and a 6 cm layer of substrate from the site of finding (rocky soil). In such provisional breeding receptacles the bush-crickets survived without harm for a number of days until they were transferred into suitable glass insect breeding cages (insectarias) measuring 20 x 20 x 30 cm (length x width x height) with a lid vent, the lid being secured by a wire netting. Both, in the provisional receptacles and glass insectarias, the animals were fed once a day with larger insects mostly of the same genera (Orthoptera), which was swept from vegetation using a sweep-net. We dewed them once every two days.

The total number of eggs was determined through a detailed inspection of the substrate and a dissection of one dead female. Measuring of the eggs was conducted using a slide caliper, with precision 0,5 mm. Species determination of the observed sagas, which we preliminarily identified as *S. hellenica* (ref. Harz

1969, Willense 1984) on the basis of photographs of live and preparations of perished specimens, was verified by P. A. Kaltenbach.

Specimens for evidence: 2 f: Greece – Corfu Island, Barbati, 39.38N/19.51E, 15.-26.VI.2001, 1 m: Greece – Corfu Island, Ai Xeria NE from Barbati, 39.38N/19.51E, 15.-25.VI.2002, all by Vl. Vrabec lgt. et coll.

RESULTS AND DISCUSSION

Field observations

Sagas were not collected in the coastal area of the island but entirely at higher altitudes around 300 – 500 m above sea within the highest mountain Mt. Pandokratoras massif elevated at 911 meters above sea level. The area consists of extensively grazed banks above the coastal olive plantation level suffering occasionally from local fires. In spite of relatively intensive investigation we found no sagas directly in the plantation between the olive trees. We first encountered the sagas in 2001 during our ascent of Mt. Pandokratos, roughly at half way between Vinglatouri settlement and an abandoned village of Paleo Chorio. While catching butterflies, the attention of the first author was engaged by the movement of some larger creature in a thorny shrub seen from a distance. After careful close-up and control by eye no interesting animal was detected therefore the observer decided to retreat from the site. On his way he accidentally brushed against the mentioned shrub, a branch began to swing and suddenly he literally jumped away from shock after noticing a relatively rapid movement of a giant bush-cricket. The animal immediately squared up to him (Fig. 1) and with head first and front legs upright stood up against the intruder. After the first finding we investigated the shrubs but because no other specimen was discovered the search was terminated. In following days in 2001 we recorded four other specimens, individually in all cases and all females. Two of them were observed walking on the ground but it always was in the proximity to some shrub or higher culmy vegetation. As a result of struggling through the undergrowth we should not exclude the possibility of random fall down from the leaves.

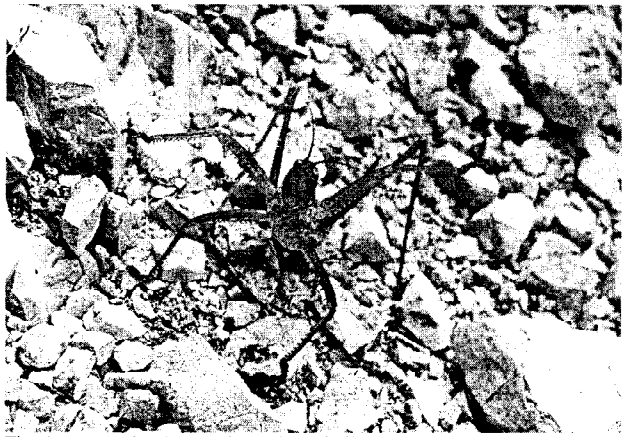

Fig. 1: A squaring bush-cricket *Saga hellenica*. Photo by V. Vrabec

Five more bush-crickets, 4 females and 1 male, were discovered by a similar random search during a walk through the locality in the same area in 2002. From these 5 spec. only one female was observed directly on the ground. After their detection the first of the authors decided to conduct a detailed investigation of the site in order to record at least general information of the sagas' distribution in the field. All larger shrubs and vegetation clusters were carefully explored through a transect along the left side of the path. During this search lasting roughly 3 hours 7 spec. were found – all females with a fully developed ovipositor corresponding in size to that of sexually mature adults. Detailed distribution of these specimens on this concrete transect is depicted in Fig. 2. As the transect intentionally was situated to have an even distribution of shrubs and vegetation with same sunlight exposure, our results suggest that the presence of sagas is also influenced by other factors because there are two spots of higher bush-cricket density within the transect. Figure 3 represents the spatial distribution of found specimens above the height of surrounding field in 2001 and 2002. Though higher vegetation was available on the transect no specimen was observed at more than 150 cm above ground level.

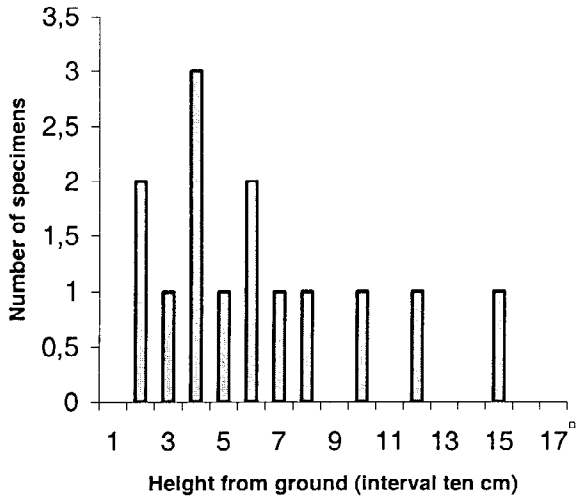

Fig. 2: A schematical picture of *Saga hellenica* distribution within a 200 m transect. Horizontal axis represents transect, vertical shows individual saga specimens.

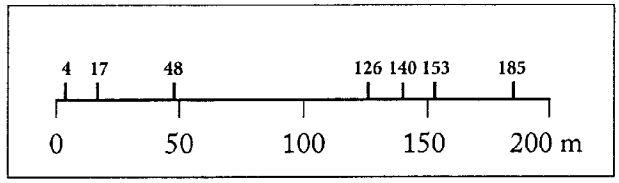

Fig. 3: The localization of 14 *Saga hellenica* specimens collected in 2001 and 2002 above the height of surrounding field with accuracy 10 cm. X axis represents height of terrain, Y axis shows number of specimens.

Observations in captivity

In 2001, we transferred from nature 2 individual females in order to conduct observations in captivity. Afterwards, in 2002, a male also was collected. We attempted to experimentally place one of the females in the same transport bottle with the male. The female was roughly 1/3 larger than the male. We intended to transfer the pair to our base camp and record mating eventually. However, the male directly reacted by attacking and

biting the female in the sternal part of her foreabdomen. His mandibles perforated the abdomen but nearly immediately he let go, ignoring the attacked female further on. The injured female was left in the box with the male afterwards, being mobile but without feeding for the next three days. She died eventually and was found in the morning being consumed by another locust, which was originally added to the breeding box to serve as feed.

All sagas were kept in transport vessels at first and were transferred into glass insectarias eventually (see Methods). They were fed daily with adequate amounts of locusts, smaller grasshopper species or crickets *Gryllus asimilis* later on, which were swept from vegetation using a sweep-net. At first, larger locusts and grasshoppers served as feed were immobilized by breaking off one or two legs used for jumping, however, further on we found out that this is not necessary in such restricted breeding space. Sufficient humidity and drinking water was enabled to the sagas by dewing, which was performed on the walls of the breeding box and branches arranged inside once every two days. In 2001, one of the encaged females oviposited into the transport bottle substrate in an interval of approximately one week to 11 days after field collection. Actual ovipositing was not recorded but through careful investigation, we observed and collected a total of 45 eggs sized 11 x 3 mm in the substrate, which initially contained no eggs at all. Following counting and examination we returned the eggs into the substrate and left them there at room temperature (fluctuating from 16 - 30°C, 22°C in average) until summer 2002, however without hatching. During the same year the first of the authors ensured himself that the eggs did not dry out and separated part of the egg batch to put in other boxes, which were exposed to lower temperatures – one in a refrigerator and the second in outdoor natural conditions of the Czech Republic. Still remaining moist, the eggs did not hatch even in 2003. By August 2004 most of the eggs have cooped in and therefore they were removed from the substrate and placed into a collection. The second female, which was caught in 2001, did not oviposit at all. From the day of collection in 2001 until the recorded death, the first female lived for 25 days, the second one lived a shorter period of 17 days. The male trapped in 2002 lived in captivity 22 days, after which he perished as a result of breeding box overheating.

Through dissection of the female from 2002, which most likely died after the male attacked her, we obtained 41 eggs, from which 20 were already fully developed and colored (dark brown) while the remaining 21 eggs were lighter in color and poorly sclerotized. The eggs are depicted in Fig. 4.

SOUHRN

Během dvou sběratelských cest na severní část ostrova Korfu (SZ Řecko, přibližně 39°38´N/19°51´E) realizovaných v červnu 2001 a 2002 byl v přírodě a v zajetí pozorován druh *Saga hellenica*. Ságy nebyly nalezeny v příbřežní části ostrova, ale výhradně výše okolo 300 – 500 m v masivu nejvyšší hory ostrova Mt. Pandokratoras na částečně vypásaných bezlesých stráních nad hranicí příbřežních olivových sadů a to velmi lokálně. Celkem bylo v roce 2001 pozorováno 5 jedinců, v roce 2002 12 jedinců. 14 z celkového počtu nalezených exemplářů sedělo na vegetaci ve výšce od 20 do 150 cm od země, 3 jedinci byli zaznamenáni na zemi. Pouze jediný nalezený exemplář byl samec. Při podrobné prohlídce 200 m transektu podél levé strany cesty v jednom místě výskytu v roce 2002 bylo na tomto úseku v keřích zaznamenáno 7 adultních jedinců. Jedna samice držená v zajetí a krmená hmyzem po dobu 4 týdnů než uhynula, vykladla do substrátu po jediné snůšce o 45 vejcích. Druhá samice, která uhynula za tři dny po náhlém útoku a kousnutí samcem při pokusu o její připuštění byla vypitvána a pitvou bylo zjištěno 41 vajec z nichž 20 bylo plně vyvinutých a hnědě vybarvených, ostatní byla světlá a nevybarvená. Vajíčka jsou podlouhlá o rozměrech 11 x 3 mm.

Fig. 4: *Saga hellenica* eggs. Photo by V. Vrabec

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