

**IDENTIFICATION OF BIO-ECOLOGICAL
CHARACTERISTICS OF *SAGA EPHIPIGERA SYRIACA*
(ORTHOPTERA: TETTIGONIIDAE)**

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ABSTRACT: The aim of this study is to identify the bio-ecological characteristics of *Saga ephippigera syriaca* Lucas, 1864 species under Saginae Sub-family of Orthoptera Order. *Cephalaria salicifolia* Post (Dipsacaceae) plant, which is an endemic plant for Kahramanmaraş Province, is the host for *Saga ephippigera syriaca*. The male and female individuals of *Saga ephippigera syriaca* have been collected from *Cephalaria salicifolia* plant from May to late September for a period of 2 years. The male and female individuals have been cultivated in the laboratory and fed with live insects from various families and order collected from the nature. The male and female individuals have been mated and ovulated; and then the eggs have been collected and their lengths and widths have been measured.

KEY WORDS: Saginae, *Saga ephippigera syriaca*, *Cephalaria salicifolia*, bioecology, Kahramanmaraş

Turkey is rather rich in terms of Orthoptera and Tettigoniidae faunas thanks to it topographical and climatic conditions, İyriboz (1938), Erkiş (1945), Bodenheimer (1958), Karabağ (1958), Karabağ et al. (1971, 1974, 1980), Demirsoy (1974), Tutkun (1981), Lodos (1983), Salman (1983), Tutkun & Ünal (1986), Çıplak (2000, 2004), Sevgili & Çıplak (2000), Çıplak et al. (2002, 2009), Demirsoy et al. (2002), Hellerand & Sevgili (2005), Sevgili et al. (2006), Heller et al. (2008) and Ünal (2005, 2006, 2010, 2011a, 2011b) identified many taxons and provided information in connection with Tettigoniidae family of Orthoptera Order in Turkey.

Although some species of Orthoptera are carnivorous, most species are herbivorous and omnivorous. The carnivorous species include *Saga* genus under the sub-family of Saginae. However, detailed study is lacking in Turkey in terms of grasshopper species of *Saga* genus under Saginae sub-family of Tettigoniidae family. The existing studies focus only on identification of the species. On the other hand, Ünal (2014) reports that there are 11 genus under *Saga* species.

Saga species are defined as captive and low populated, undefended and flightless along their distribution zones with low ability to escape from danger. Despite the fact that *Saga* species are unprotected, they live in low populations in isolated zones of warm southern hills of medium heighted mountains like the xerothermic insects (Kaltenbach, 1970). This sub-family consists of 4 species. The three species in Southern and Sub-Saharan Africa and the *Saga* species in Southeastern and Western Palearctic Region display rather different distribution from each other. The *Saga* species containing the greatest grasshoppers of Europe consists of 13 genus (Kaltenbach, 1967). 5 genus within this species live in 5 habitats in Europe continent (adapted in Western Siberia region), and the rest

live in Asia continent (Caucasus, Turkey, Syria, Lebanon, Israel, Iran and Iraq) (Kaltenbach, 1967).

While *Saga* species hide themselves on plant parts during daytime, they become rather active stem hunters during the nighttime (Kaltenbach, 1967; 1990). For this reason, it is rather difficult to find migrant bush-crickets at the said regions. Due to the low number of the observed samples and the similarity between the species, the studies made on collection of an identification key remains uncomprehensive (Krauss, 1878; Saussure, 1888; Werner, 1905). Almost no study has been conducted in connection with *Saga* species until the mid-way through this century (Burr et al., 1923; Ramme, 1951). The first detailed description of the species was made by Ramme; later on an available identification key was published by Kaltenbach (Kaltenbach, 1967).

This study has been conducted due to lack of previous specific studies on *Saga* species or focus of the previous studies only on identification of the species in our country and hence this study provides information on description, existence, ecology and biology of *Saga ephippigera syriaca* Lucas, 1864 species.

MATERIAL AND METHODS

The main material of the study is the *Saga ephippigera syriaca* (Orthoptera: Tettigoniidae: Saginae) species collected from Kandil Highlands of Ahir Mountain at a height of 710 meters in Kahramanmaraş. One side of this region is covered with forests and the other side is covered with *Cephalaria salicifolia* Post (Dipsacaceae), which is an endemic perennial herb for Kahramanmaraş. Field visits have been made to this region as of the end of May. The male and female individuals of *Saga ephippigera syriaca* have been collected from the region and cultivated in the laboratory for a period of 2 years. This type of grasshopper collected from the nature has been morphologically adapted to this endemic plant to a great extent. Ecological and faunistical observations have been made during collection of the male and female individuals from the nature.

The samples brought to the laboratory have been cultivated in ten boxes, which have been filled with soil, at a certain height in such a way to contain 1 male + 1 female individual. These samples, which were observed to have been fed with living materials in the nature, has been fed with insect species of Orthoptera, Coleoptera, Odonata ve Neuroptera orders collected during the field visits (Fig. 1). The individuals, which were mated at different times, have been observed daily. The lengths of the eggs, which were obtained from each culture, have been measured with calipers and counted daily. In addition, morphometric measurements of the male and female individuals and their eggs have been made and the averages have been noted down.

RESULTS

During this study, the mature male and female individuals of *Saga ephippigera syriaca* species have been collected from *Cephaloria salicifolia* Post, which is an endemic plant for Kahramanmaraş and Turkey, from Kandil highlands of Ahir Mountain and cultivated (Fig. 2). Such individuals have been fed with insects from Coleoptera, Orthoptera, Neuroptera and Odonata Orders collected from the nature as Saginea fed with live insects.

Description and Distribution

The lengths of the mature female individuals of *S. ephippigera syriaca* are rather longer than the lengths of mature male individuals (Fig. 3). The antennae are generally filiform and thickened at the proximally and mostly do not outreach the abdomen. All species have strong jaws; the forelegs and mid-legs are rather big; and the lower part of the thorax is covered with strong quills (Fig. 4). The body parts such as mandibula, ovipositor and legs are generally sclerotized clearly (Kaltenbach, 1990).

The wings of female *S. ephippigera syriaca* are shortened and even atrophied. However, a couple of small wings may be observed on the male individuals. The length of these wings is as long as $\frac{1}{4}$ of the length of the pronotum (Fig. 5). The ovipositor of the female individuals shift upward. *S. ephippigera syriaca* are yellow, brown or greenish in color (Fig. 6). Their bodies usually contain at least one these colors. The lower part of the head is reddish brown (Fig. 7). They live in Syria and Turkey (http://www.wikiwand.com/fr/Saga_ephippigera_syriaca).

It has been observed that *S. ephippigera syriaca* live at the outskirts of mountainous areas and forests and within the bushes (Figure 8). *Cephalaria salicifolia* Post, endemic for Kahramanmaraş, is the host for this species (Figure 9). Such plant is a perennial bushy plant with a stem reaching 45 cm upwards; the lowest parts of the leaves are long and thin; the tips of the leaves are oval and bare. The diameter of the flowers vary between 1 and 1,5 cm; and the receptacle is wide. The color of the flower is not known absolutely (Szabó, 1940; Matthews, 1972).

Feeding

S. ephippigere syriaca, which hunts actively at nights, approaches its victim slowly or waits the victim to come to it; and catches its victim quickly when the victim approaches. The forelegs are adapted to hold the caught victim. It also uses bid-legs to hold the victim. It has strong quills at the inner and outer edges of the tibia and femur on the leg (Kaltenbach, 1990). It has been observed that it starts eating its victim from the neck or the hind legs (Fig. 10).

Mating and Oviposition

The male individuals of Saginae are smaller than the female individuals. Former studies revealed that male individuals make ultrasonic sounds through rubbing their wings in order to attract the females (Kolics et al., 2008). The female saga hold on to the abdomen of the male Saga during mating (Fig. 11). Female *S. ephippigera syriaca* lays her eggs during the warmer hours of the day. While ovipositioning, the female controls the ground, where she will lay her eggs, through dipping her ovipositor or with her antennae (Fig. 12). Then she dips her ovipositor 2 or 2,5 cm deep in the soft part of the soil and lays her eggs. It has been observed that the female does not lay her eggs to a single place, but leaves her eggs into several places in such a way to bring several eggs together (Fig. 13).

The female individuals usually die after ovipositioning. As in the case of other insects, the growth process of the laid eggs of *S. ephippigera sriayaca* varies depending on the temperature and humidity of the environment. Despite varying according to the species, the number of eggs of *S. ephippigera sriayaca* varies between 80 and 120 during their life span. The eggs generally hatch after a diapause of 2 to 3 years; and the eggs may remain under the soil for a period of 5 years. No egg parasitoid has been identified until now (Van Helsdingen et al., 1996). The *S. ephippigera syriaca* species, which we have cultivated, has been observed to lay 126 eggs (Figure 14); and the eggs collected after ovipositioning has been measured with calipers (Schedule 1).

DISCUSSION

As a conclusion, it has been identified that *S. ephippigera syriaca* lives on *Cephalaria salicifolia* Post plant, which is endemic to the region and to Kahramanmaraş, as well as at forests. Since the species is very well adapted to *Cephalaria salicifolia* Post plant, it hides itself from its natural enemies and catches its victims easily. It has been observed that male individuals make sounds at nights through rubbing their wings in order to attract the females and find their places. As in the case of other Saga species, it has been determined that *S. ephippigere syriaca* approaches its victim slowly and silently and catches the victim while hunting at nights and that it lays its eggs at the warm hours of the day. It has been detected that the number of eggs is rather high compared to several other saga species (*Saga pedo*) and that it may lay about 120 eggs (Burr et al., 1923; Quiet, 1988; 1991).

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Figure 1. Cultivation of the collected samples and feeding of such samples with the insects collected from the nature.



Figure 2. *Cephaloria salicifolia* Post.



Figure 3. a. *S. ephippigera syriaca* (♂), b. *S. ephippigera syriaca* (♀)

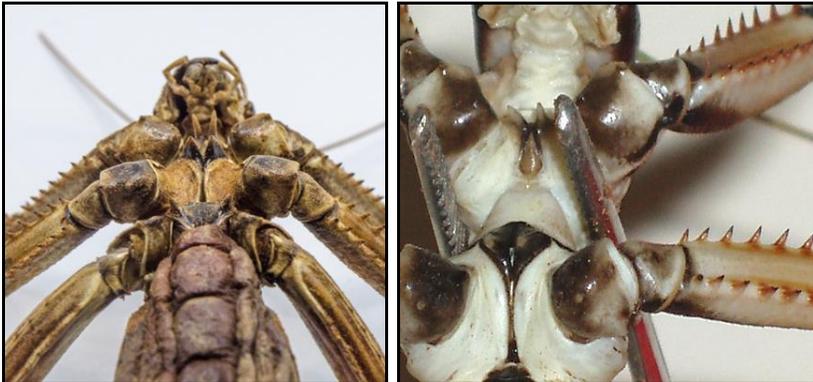


Figure 4. Bottom view of thorax.



Figure 5. View of the wings in male individuals (♂).



Figure 6. Upper view of *S. ephippigera syriaca* (♀)

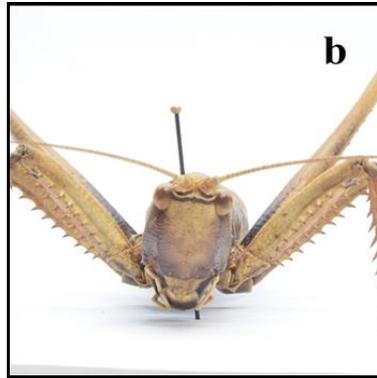


Figure 7. a. Left bottom view of head, b. Frontal view of head.



Figure 8: *Cephaloria salicifolia* zone at the edge of a forest



Figure 9. *S. ephippigera syriaca* (♀) living within *C. salicifolia* Post plant.



Figure 10. Feeding with insects from Melonoidea and Tettigoniidae families

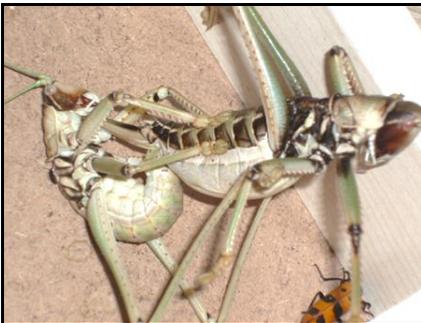


Figure 11. Mating of male and female individuals (male on the left and female on the right)



Figure 12. Dipping the ovipositor in the soil



Figure 13. Laying eggs in the soil

Figure 14. Eggs laid by *S. ephippigera syriaca*

Schedule 1. Length and width measurements of the collected eggs Length and width measurements of the randomly selected eggs. Color: Dark greyish - black

1 st Repetition	Length	Width	2 nd Repetition	Length	Width	3 rd Repetition	Length	Width
1	1,1cm	2mm	1	1,0cm	3mm	1	1,1cm	2mm
2	1,1cm	2mm	2	1,0cm	2mm	2	1,1cm	2mm
3	1,0cm	3mm	3	1,0cm	2mm	3	0,9cm	2mm
4	1,1cm	2mm	4	1,1cm	2mm	4	1,1cm	2mm
5	1,1cm	2mm	5	1,0cm	2mm	5	1,0cm	2mm