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ORIGINAL ARTICLE

DESCRIPTION OF THE PREDATOR BUSH CRICKET, *SAGA EPHIPPIGERA* FISCHER VON WALDHEIM, 1846 (ORTHOPTERA, TETTIGONIIDAE) FROM ERBIL PROVINCE, KURDISTAN REGION- IRAQ

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ABSTRACT

The predatory bush crickets *Saga ephippigera* Fischer Von Waldheim, 1846 is the largest Iraqi orthopterans and one of the most active and successful predators in the Kurdistan region. The nymphs and adults prey on all the stages of various species of insects. Twelve adult specimens were collected from Erbil Province during May 2018 and June 2021. Morphological structures of the adult insects were described and illustrated in details; important taxonomic characteristics of body regions with their appendages were chosen; and the results indicated the importance of morphological characteristics which confirmed the identification of this species correctly.

Keywords: Description, Erbil, Iraq, Kurdistan region, Morphology, *Saga ephippigera*.

INTRODUCTION

Tettigoniidae Krauss, 1902 is a family of the suborder Ensifera includes 17 subfamilies, which contains almost 6,000 species, in 1070 genera and in the Palearctic region, it is represented by six subfamilies (Çıplak, 2003; Mahasneh and Katbeh- Bader, 2004; Krištín and Kanuch, 2007; Sevgili *et al*., 2011; Taylan *et al*., 2019). One of them is the subfamily Saginae in which the predatory bush crickets genus *Saga* Charpentier, 1825 represent one of the largest Palearctic Orthoptera, with 16 species, ten inhabit Asia (Azerbaijan, Armenia, Caucasus, Turkey, Syria, Palestine, Lebanon, Jordan, Israel, Iran and Iraq), the rest occur in Europe (Uvarov, 1938; Rentz and Colless, 1990).

Ecologically, most species of grasshoppers are ground inhabitants except the individuals of Tettigoniini and Onconotini which they live on shrubs and bushes. Some species oviposit in the soil even if they are not ground dwellers while some species inserted their eggs into plant tissues (Karabağ *et al*., 1974).

Some species of Saginae are carnivorous while others feed on plant substances and achieve pest status; they survive winter in the egg stage (Kaltenbach, 1990); among the non-European *Saga* species, *S. ephippigera* has the broadest geographic range (Vrabec and Kocarek, 2005; Hochkirch *et al*., 2016). In 1934, Uvarov during his journey in Iraq collected *S. ephippigera* Fischer de Waldheim, 1846 between Sulaymaniyah and Penjwin in the Kurdistan Region. Since then detailed studies were very rare until recently Khudhur and Ahmed (2020) were published a paper considering the presence and distribution of the two recorded species *S. ephippigera* and *S. syriaca* Lucas, 1864 with precise localities after a gap of more than fifty years in documented observations and collections from Iraq. Therefore, the aim is to describe the cricket *S. ephippigera* in detail alongside clarifying all its important diagnostic characters as a contribution to fill the gap mentioned above.

MATERIALS AND METHODS

Specimens' collection

In the present study, 12 specimens were collected from an oak tree which is located in the north of Erbil Province, Kurdistan region-Iraq, during a period of time between May 2018 and June, 2021. The specimens were killed by freezing for 48 hours, and then preserved after placing their information in the insect box, which treated with 85% of Seven and Naphthalene balls.

Identification of specimens

For identifying the specimens, several keys were used (Kaltenbach, 1967; Bei- Bienko, 1964; Ragge, 1964; Kaltenbach, 1990; Çıplak, 2003; Mahasneh and Katbeh- Bader, 2004; Şirin *et al*., 2019; Khudhur and Ahmed, 2020). Then insects were deposited in the Insect Museum- Plant Protection Department, Directorate of Agriculture Researches, Ministry of Agriculture and Water Resources, Erbil, Iraq.

Morphological study

The adults were dissected under a dissecting microscope, after selecting the diagnostic characteristics they were prepared and studied directly. The selected parts were put in warmed water and then transferred to a petri dish to soften the tissues and break avoidance. Finally, to measure the dimensions of the selected parts, the ruler, ocular micrometer, linear micrometer, stage micrometer and a digital computerized microscope were used, and the photos were taken by a camera of iPhone 5s.

RESULTS

Morphological study

Saga ephippigera Fischer von Waldheim, 1846

Saga ephippigera Fischer von Waldheim. 1846. Nouv. mem. Soc. Imp. natur. Moscou 8: i-iv, 1- 443, pls 1- 37.

Synonyms: *Saga ephippigera* subsp. *ephippigera* Fischer von Waldheim, 1846
S. ephippiger
S. epippigera

S. monstrosa Krauss, 1879
S. uvarovi Ramme, 1951

Body: (Pls.1 A, B, C, D) large, elongate with cylindrical shaped and robust; pronotum with two stripes of anterior and posterior pale brown colored margins except for head. Male about 65-69 mm long and 8-10 mm wide. Female about 76-79 mm long (without the ovipositor) and 17-19 mm wide. Male and female with strong armature of fore and middle legs, antennae filiform and longer than the body, tergites larger than sternites (Pls. 1, E, F).

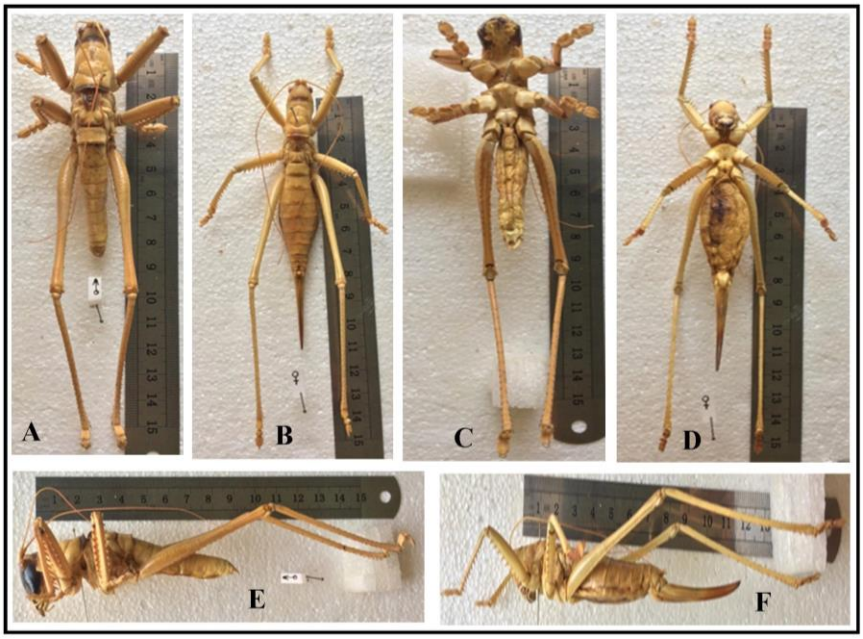

Plate (1): Body of *Saga ephippigera*, male and female; (A) ♂ Dorsal view, (B) ♀ Dorsal view, (C) ♂ Ventral view, (D) ♀ Ventral view, (E) ♂ Lateral view, (F) ♀ Lateral view.

Head: (Pls. 2 A, B) large, nearly oval shaped with hypognathous mouthpart (Pls. 2 C, D), its length about 6-7 mm, and width about10-11 mm, mostly black colored except for vertex, clypeus, proximal halve of labrum, labium and maxillae pale brown colored in male but they brown in female, vertex flat, not differentiated as fastigium, frons wide, and nearly rectangular, strongly sloping backwards. Antennae (Pl. 2 E), filiform, pale brown colored, length, about 96-98 mm and longer than the body, scape big, cylindrical, robust and inserted vertically between compound eyes, pedicel semi slender than the scape and as long as it, directed side-wards, antennal sockets contiguous, with hardly produced margins, compound eyes large, prominent, and oval, located on the top of lateral sides of head, distance between them about 4-5 mm. Brown colored, mouthparts

chewing and biting type. Clypeus, semi-rectangular shaped, pale brown colored with prominent distal margin. Labrum almost circular shaped, pale brown colored and sclerotized (Pl. 2 F). Mandibles, (Pl. 2 G) triangular, strongly sclerotized and brown color, incisor region with four black long robust teeth, molar region with two black short robust teeth. Maxillae (Pl. 2 H) moderately sclerotized, robust and elongate, pale brown colored except for galea and lacinia which brown colored, cardo small and ovoid shape; stipe big, galea tongue-like, lacinia ended with three teeth, maxillary palp provided with five segmented, and pale brown colored. Labium, (Pl. 2 I) with two small; yellow tubular structures fused glossa and two big brown un-fused pad-like paraglossa which inclosing the glossa has three segmented and pale brown colored. Hypopharynx (Pl. 2 J), tongue-like, brown and elongated, except for its lateral margins that have pale brown color.

Thorax (Pls. 3 A, B, C, D): Pronotum, large, strongly developed, longer than meso- and metathorax collectively, overhanging laterally, about 17-19 mm long, with convex dorsum and flat downward directed lateral lobes, posterior groove "V" shaped and well-marked, prosternum with two contiguous long and pale brown spine-like processes between forelegs; wings (Pls. 3 E, F) in male, absent and modified to vestigial as a pair of two dark brown small parallel processes, but completely absent in female. Legs, fore legs (Pl. 3 G) with fore and middle femora and have numerous strong ventral black-tipped spines which adapted for holding the pray, hind femora long, slender, without saltatorial, and apical spines on tarsi; mid legs (Pl. 3 H) similar with fore legs in structure and morphology, but ventrally depressed. Hind leg (Pls. 3 I, J) long and modified for jumping, basal part of femur thick; second segments longitudinally grooved laterally, and second segment of tarsus heart-shape, first and, apical tarsus curved tube-like, ended with two black-tipped claws, without arolium; auditory pits (tympanal organ) covered partly by an ear-like extension of chitinous edge which covers them and narrows aperture to curved slit on base of fore-tibiae (Pls. 3 K, L).

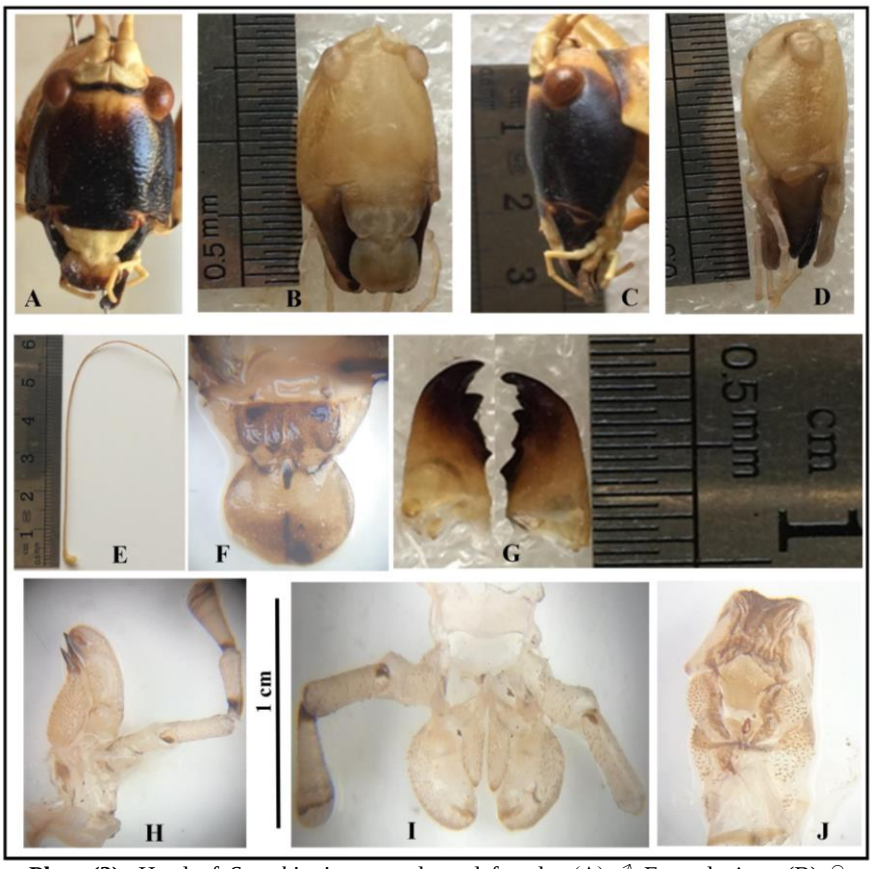

Plate (2): Head of *S. ephippigera*, male and female; (A) ♂ Frontal view, (B) ♀ Frontal view, (C) ♂ Lateral view, (D) ♀ Lateral view, (E) Antenna, (F) Clypeus and Labrum, (G) Mandible, (H) Maxilla, (I) Labium, (J) Hypopharynx.

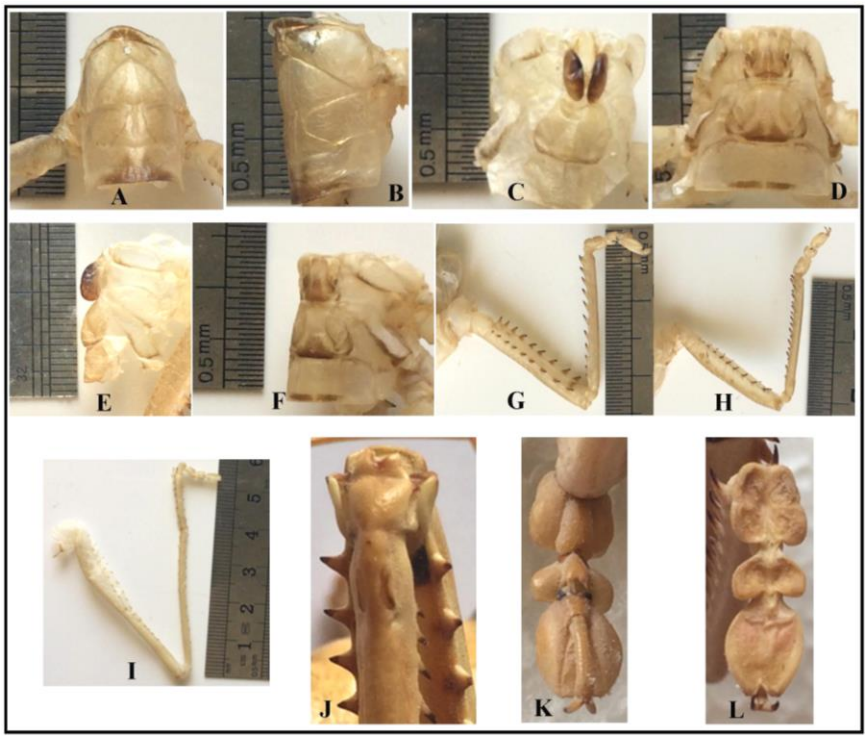

Plate (3): Thorax and its' appendages of *S. ephippigera*, male and female; (A) ♂ Pronotum (Dorsal view), (B) ♂ Pronotum (Lateral view); (C) ♂ Meso-metanotum (Dorsal view); (D) ♀ Meso- metanotum (Dorsal view), (E) ♂ Meso- metanotum (Lateral view), (F) ♀ Meso- metanotum (Lateral view), (G) Fore leg, (H) Midleg, (I) Hind leg, (J) Tympanal organ on the base of fore leg, (K) Tarsi (Dorsal view), (L) Tarsi (Ventral view).

Abdomen (Pls. 4 A, B): Elongate, cylindrical, pale brown colored, with ten terga and nine sterna in male, and nine terga and eight sterna in female, abdominal segments well developed, and gradually narrowed and made inverse triangular shape toward end of body; this form more obvious in females (Pls. 4 C, D). Abdominal folds noticeable from ventral view and well developed. Anal sclerite present and located at posterior of last tergum, last sternum (9th segment in male, and 8th segment in female) modified to sub-genital plate; distal margin of last tergum of male incurved, paraprocts well developed and obvious as two lobes (Pls. 4 E, F); and last abdominal segment in female provided with cerci and ovipositor. Male genitalia (Pl. 4 G) consisted of triangular anal plate which provided with two closely rounded apically, pale brown colored; sub-genital plate parallel-sided with two evenly tapered processes, cerci pale brown colored, stout, long, un-segmented, incurved, an extended inwards. Female genitalia (Pl. 4 H): Anal plate as in male but smaller in size, triangular shaped, pale brown colored, sub-genital plate triangular shaped (Pls. 4 I, J), it has two round angles at basal part, but distal angle v-shaped, and covering with ovipositor. Ovipositor (Pls. 4 K, L, M) long, and laterally

compressed, dorsally curved, sword shaped, dorsally comprised a pair of cerci as in male but more fine and shorter than it; dorsal and ventral margins of ovipositor serrate, pale brown colored, about 31-32 mm long (Pl. 4 N).

Material Examined: Rawanduz, high mountain, 28.v.2000, 2♂♂, 3♀♀; Shiwemasi, steppes 22.vi.2004, 1♂: 2♀♀; Sarkandkhailan, steppes, 16.vi.2004, 1 ♂; Harir, 10.vi.2018, 1♀; and Mergasur, steppes, 9.vi.2021, 1♂1♀.

Plate (4): Abdomen and its' appendages of *S. ephippigera*; (A) Male abdomen (Dorsal view), (B) Male abdomen (Ventral view), (C) Female abdomen (Dorsal view), (D) Female abdomen (Ventral view), (E) End (apex) of male abdomen (Dorsal view), (F) End (apex) of male abdomen (Ventral view), (G) End (apex) of male abdomen (Lateral view), (H) End (apex) of female abdomen (Dorsal view), (I) End (apex) of female abdomen (Ventral view), (J) End (apex) of female abdomen (Lateral view), (K) Ovipositor (Dorsal view), (L) Ovipositor (Ventral view), (M) Ovipositor (Lateral view), (N) Toothed end of ovipositor (Dorsal view).

DISCUSSION

The present study focused on the morphological features of the species *Saga ephippigera*, which considered the entire description of the diagnostic characteristics which wasn't studied in the Iraqi literature for a long time. Kaltenbach (1967) selected *Saga syriaca* as synonym of *S. ephippigera* and Considered *S. syriaca* as a subspecies of *S. ephippigera*. Hence, *S. ephippigera* included two subspecies *S. ephippigera ephippigera* and *S. ephippigera syriaca*. While some references considered that *S. syriac* as an isolated species (Kirby, 1906; Bader and Massa, 2001; Şirin *et al*., 2019; Aslan and Candan, 2019). The adult specimens were chosen among the collected specimens for description and identification. Some morphological characteristics were selected for describing such as color, size and sclerotization of taxonomic parts that were renowned in the literature (Massa and Fontana, 1998; Şirin *et al*., 2019).

S. ephippigera reflects a broader range of coloration and from light tan, light brown to dark brown with variable darker bands, rings and patterns on the body segments, head and leg edges. Thus, the description of the studied species wasn't reliable on the colour factor because the reflection of color change is variable due to geographical and seasonal distribution while the size factor was more depended in identifying the species (Bader and Massa, 2001; Khudhur and Ahmed, 2020). In this study most of the diagnostic characters were described and illustrated clearly which helped to confirm the determination of this species correctly. This study represented the implication of morphological description of the predatory bush crickets *Saga ephippigera* and identifying the important diagnostic characteristics and taxonomic relationships among Iraqi Orthopterans as an effective predator across agriculture fields from Erbil Province, Kurdistan region- Iraq.

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CONFLICT OF INTEREST STATEMENT

"The authors have no conflicts of interest to declare".

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وصف جراد الاحراش المفترس
Saga ephippigera (Fischer von Waldheim, 1846)
(Orthoptera, Tettigoniidae)
في محافظة أربيل، اقليم كردستان العراق

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الخلاصة

يعد نوع جراد الاحراش المفترس *Saga ephippigera* Fischer von Waldheim, 1846من أكبر افراد رتبة مستقيمة الأجنحة في العراق، وهو من المفترسات الناجحة والنشطة في أقليم كوردستان؛ حيث ان الحوريات والحشرات الكاملة تفترس الادوار المختلفة للحشرات. جمعت 12 عينة من الحشرات الكاملة من محافظة أربيل خلال فترة ايار2018 وحزيران 2021؛ اذ وصف المظهر الخارجي للكاملات و توضيحها بالتفصيل.

أختيرت الصفات التصنيفية الهامة لمناطق الجسم مع ملحقاتها، ودلت النتيجة على أهمية الصفات المظهرية التي تؤكد تشخيص هذا النوع بشكل صحيح.