A taxonomic study on the long-horned grasshoppers of Jordan (Orthoptera: Tettigoniidae)

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Abstract: A total of 1380 specimens of Tettigoniidae were collected from 98 localities in Jordan during the period from October 2001 to February 2004. Specimens in the University of Jordan Insects Museum as well as other Jordanian collections were examined. A total of 27 species belonging to 17 genera and four subfamilies are recorded. The Tettigoniinae contained 14 species in nine genera. The Phaneropterinae contained nine species in five genera. The Conocephalinae contained three species in two genera. The subfamily Saginae contained one species. In our study seven species are new records for Jordan: *Phaneroptera jordanica*, *Tylopsis peneri*, *Tylopsis* sp., *Platycleis* (*Tessellana*) *tesellata holoptera*, *Parapholidoptera syriaca*, *Conocephalus conocephalus*, and *Conocephalus maculatus*. The *Tylopsis* species collected from Dana Reserve is believed to be new to science. Keys for the identification of subfamilies, genera, subgenera and species recorded in Jordan were constructed and provided with the necessary illustrations. For each species, the valid name, distribution in the world, collecting sites and dates in Jordan, and colored photographs were provided.

Key words: Orthoptera, Tettigoniidae, Jordan, taxonomy, Insecta.

Introduction

Data on the distribution and systematics of Middle Eastern Orthoptera are scattered. The Orthopterofauna of Syria, Lebanon, Iraq, Iran and Jordan are still incompletly or scarcely known (Massa & Fontana 1998).

The long-horned grasshoppers belong to the family Tettigoniidae, suborder Ensifera, order Orthoptera. This family includes 17 subfamilies worldwide, which contains almost 6,000 species, in 1070 genera (Gwynne & Morris 2002). In the Palearctic region, the family Tettigoniidae is represented by six subfamilies and no species counts for the Palearctic are available (Çiplak et al. 2002).

Satar & Özbay (2003) reported that species of *Platycleis* (*Platycleis*) *intermedia* migrated to Turkey from Iraq between 1939-1942 and caused important damage to cultivated plants, *Decticus albifrons* caused loss of wheat yield in 1939 in Turkey, *Platycleis* (*Platycleis*) *escaleria escaleria* is known as harmful to many cultivated plants.

Several studies were conducted on the Tettigoniidae of the Middle East. Steinmann (1966) described *Phaneroptera jordanica* as new species from Jordan. Bader & Massa (2000) described *Anadrymadusa jordanica* as new species from AL Mujeb Nature Reserve. In addition, Bader & Massa (2001) recorded 19 species, 13 of them were new to the country and two species of them were new to science, *Parapholidoptera willemsei* and *Uvarovistia rammei*. More publications are found on the Tettigoniidae of Palestine. Uvarov (1927) described *Metrioptera bodenheimeri* as new species, later Uvarov (1939) recorded five species. Kaltenbach (1969) recorded 11 species and described *Eupholidoptera peneri* as new species, and later Kaltenbach (1974) recorded 13 species. Harz (1970) described *Conocephalus raggei*, C. *meadowsae* and *Leptophyes peneri* as new species, and C. *concolor peneri* as new subspecies. Karabag (1972) described *Anadrymadusa* (?) *danensis* as new species. *Phaneroptera cleomis* described as new species by Ayal et al. (1973). Later, Ayal et al. (1999) recorded 42 species belonging to

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Tab. 1: Collecting Sites and Coordinates.

Collecting sites	Coordinates	Collecting sites	Coordinates
Abu Nusayr	32°03'N-35°52'E	Dibbin	32°14'N-35°48'E
Abu Az Zighan	32°12'N-35°38'E	Disah	29°37'N-35°33'E
Al Az Zraq	31°55'N-36°50'E	Eastern Bayudah	32°08'N-35°45'E
Al Hummar	32°01'N-35°49'E	Fuqu'a	31°23'N-35°40'E
Al Jazzazeh	32°14'N-35°49'E	Ghawr As Safi	31°02'N-35°28'E
Aqaba	29°31'N-35°00'E	Husban	31°48'N-35°48'E
Ar Ramtha	32°34'N-36°00'E	Hummrit As Sahin	32°05'N-35°39'E
Ar Riyashah	32°15'N-35°56'E	Ira	31°59'N-35°41'E
As Subayhi	32°09'N-35°42'E	Iraq Al Amir	31°55'N-35°45'E
Az Zara	31°10'N-35°42'E	Irbid	32°33'N-35°51'E
Azraq Wetlands Reserve	29°31'N-35°00'E	Jarash	32°17'N-35°54'E
Ajlun	32°18'N-35°43'E	Judayta	32°24'N-35°42'E
Al Aridah	32°07'N-35°39'E	Jordan University	32°00'N-35°52'E
Al Badhiyah	31°26'N-35°41'E	Kafr Huda	32°04'N-35°42'E
Al Bahhath	31°53'N-35°46'E	Kafr Khal	32°22'N-35°55'E
Al Baqa'a	32°04'N-35°51'E	King Talal Dam	32°12'N-35°36'E
Al Baqurah	32°38'N-35°43'E	Kufrinjah	32°18'N-35°42'E
Al Bayt University	29°19'N-35°59'E	Ma'ain	31°41'N-35°42'E
Al Buqei'wiya	32°03'N-37°08'E	Madaba	31°43'N-35°48'E
Al Fuhays	32°01'N-35°46'E	Mahis	31°59'N-35°45'E
Al Husson	32°29'N-35°52'E	Mu'addi	32°10'N-35°37'E
Al Jubayhah	32°01'N-35°52'E	Muzyrib	32°39'N-35°48'E
Al Karak	32°12'N-35°41'E	Na'or	31°52'N-35°50'E
Al Mukhaybah al Fawqa	32°42'N-35°41'E	Qafqafa	32°21'N-35°56'E
Al Mukhaybah at Tahta	32°39'N-35°40'E	Qumaym	32°34'N-35°44'E
Al Mushaqqar	31°48'N-35°47'E	Ruwehat al Ghawr	32°11'N-35°37'E
Al Muwaqqar	31°46'N-36°13'E	Rum	29°35'N-35°26'E
Al Wala	31°39'N-35°43'E	Sama As Sarhan	32°27'N-36°14'E
Ar Rabbah	31°16'N-35°40'E	Sayl Az Zarqa	31°59'N-35°59'E
Ar Ramtha	32°30'N-36°04'E	Suf	32°19'N-35°50'E
Ar Rumaymin	32°06'N-35°47'E	Suwaymah	31°46'N-35°36'E
Ar Rumman	32°09'N-35°49'E	Um eldananir	32°05'N-35°49'E
Ar Rummanah	30°41'N-35°34'E	Um Qays	32°39'N-35°40'E
As Safawi	32°11'N-37°06'E	Wadi al Hashad	32°30'N-37°17'E
As Sahin	32°05'N-35°39'E	Wadi al Majar	32°15'N-35°56'E
As Salt	32°03'N-35°44'E	Wadi ar Ratam	31°51'N-36°48'E
Ash Shajarah	32°35'N-35°59'E	Wadi al Yabis	32°23'N-35°35'E
Ash Shawbak	30°30'N-35°31'E	Wadi as Sir	31°57'N-35°49'E
Ash Shumary Reserve	31°50'N-36°49'E	Wadi Faynan	31°48'N-35°48'E
Ash Shunah	31°54'N-35°38'E	Wadi Shu'ayb	32°01'N-35°35'E
Ayn Aqraba	32°43'N-35°47'E	Wadi Shuqayq	31°24'N- 35°43'E
Ayn esh Shallaleh	32°35'N-35°57'E	Western Bayudah	32°10'N-35°43'E
Badhan	31°12'N-35°40'E	Yajuz	32°01'N-36°00'E
Balila	32°23'N-35°56'E	Yarqa	31°59'N-35°42'E
Dana	30°41'N-35°37'E	Zabdah	32°31'N-35°50'E
Dayr al Kahf	32°15'N-36°49'E	Zahr	32°33'N-35°48'E
Dayr Alla	32°05'N-35°36'E	Zai	32°06'N-35°45'E
Dead Sea	31°36'N-35°33'E	Zubiya	32°26'N-35°46'E

22 genera. RAGGE (1973) described another new species. From Saudi Arabia, POPOV (1981) recorded 26 species in 15 genera; he also provided keys to subfamilies, genera and species. From Syria and Iraq UVAROV (1934) recorded two genera and 36 species. And from Iraq only, UVAROV (1938) recorded 8 species.

The present study aims to conduct a taxonomic study on the long-horned grasshoppers of Jordan and construct identification key for this group.

Materials and methods

Field Trips and Collecting Sites

Weekly field trips were conducted to different locations in Jordan from October 2001 to February 2004. An effort was made to collect species from all seven-phytoecological zones mentioned by LARSEN & NAKAMURA (1983). These are the North Mediterranean zone, the Southern Mediterranean zone, and the Irano Turanian belt surrounding the Mediterranean zone, the North Jordan Valley, the southern Jordan Valley, the Eastern Desert, and the southern Desert. The site names and coordinates are given in Table 1. Names of sites were according to Gazetteer of Jordan (ANONYMOUS 1990).

Collecting Methods and Source of Specimens

The adult of Long-horned Grasshoppers were collected by sweeping net (33 cm diameter, 1 m handle) with fine mesh, or by using large forceps, or by hand. The immature grasshoppers were reared at room temperature in small cages and fed with available grasses or plants such as *Lactuca sativa*, *Vitis vinifera*, *Sorghum halepense* (Gramineae), *Malva parviflora* (Malvaceae), *Papaver rhoeas* (Papaveraceae), *Anthemis palaestina*, *Chrysanthemum coronarium* and *Chrysanthemum segetum* (Compositae), till they become adults. Collected specimens were killed in a Potassium Cyanide or Ethyl Acetate killing jars. Samples were taken from plants on which adults were seen to feed or to hide and identified according to AL-EISAWI (1998) and ABU-IRMAILEH (2000).

In addition to the collected grasshoppers, specimens of Tettigoniidae were examined from four Jordanian collections: Al Al-Bayt University Collection, Natural History Museum at Al Yarmouk University, Mutah University Collection and Jarash Private University.

Storing and Preservation of Specimens

All collected specimens were pinned and then left to dry. A small label was attached to each specimen containing collecting date, location and coordinates, habitat and identification. All the collected specimens were kept in the University of Jordan Insect Museum (UJIM).

The copulation organs of some males were removed, cleaned, placed in 10 % KOH solution as described by ÇIPLAK (1999) and washed with 70 % alcohol and then kept in small plastic capsule containing glycerin for later identification.

Identification of Speciemens

Specimens were identified using several keys (BEI-BIENKO 1954, 1964; RAMME 1951; CHOPARD 1951; KARABAG 1961; RAGGE 1960, 1964; HARZ 1969; 1970, RENTZ & COLLESS 1990; POPOV 1981; WILLEMSE 1985; KALTENBACH 1990; ÇIPLAK 2000 a, b; WILLEMSE & HELLER 2001; ÇIPLAK et al. 2002; DEMIRSOY et al. 2002; ÜNAL & NASKRECKI 2002).

Results

The identified specimens were found to belong to 27 species belonging to four subfamilies, seven species and one genus is recorded for the first time. The majority were of identified species belong to Tettigoniinae, which contains 14 species in nine genera. The Phaneropterinae contains nine species in five genera. The Conocephalinae contains three species in two genera. The subfamily Saginae contains one species.

Key to the Subfamilies of Tettigoniidae of Jordan

1 Robust, powerful species with stout teeth on the lower side of the fore and mid legs, adapted for predation; Body very elongate 45-90 mm ..... Saginae
– Less robust species; teeth of the fore and mid legs less stout 2
2 Head globose, not markedly inclined or flattened; fore tibia in section approximately square in distal portion, dorsal surface flat, or slightly concave, not convex; ovipositor short and upturned, strongly flattened laterally, margins crenulated; prosternum unarmed ..... Phaneropterinae
– Not with the above combination of characters 3
3 Hind basitarsus with plantulae equal to about half the length of basitarsus ..... Tettigoniinae
– Plantulae scarcely developed or absent ..... Conocephalinae

Key to the Subfamily Phaneropterinae

Nine species of this subfamily occur in Jordan. It has 5 tribes. However, one species is placed in unknown tribe.

Key to the Genera of Phaneropterinae of Jordan

1 Tibial tympana open 2
– Tibial tympana closed 3
2 Tegmina fully developed; wings long, reaching beyond tegmina; lateral lobes of pronotum with posterior shoulder like notch; fore coxae with small, short spinule ..... *Phaneroptera*
– Tegmina shorted; forewing stridulatory organ in male as long as or shorter than pronotum; lateral lobes of pronotum without posterior shoulder like notch, fore coxae without spinule ..... *Isophya*
3 Antennae thick; fore femora cylindrical, with fine spinules, with no groove on lower side or with very slight one; eyes circular; length of the fore wing 22-40 mm, overall color green ..... *Acrometopa*
– Not fitting the above character combinations 4
4 Very slender insects, with fine non-dilated lobiform spines on the legs; non-contrasting coloration ..... *Tylopsis*
– Robust insects, with dilated labiform spines on the legs; contrasting green and white coloration ..... *Diogena*

Key to species of *Phaneroptera* of Jordan

1 Lateral pronotal lobes deeper than long ..... *Phaneroptera nana*
– Lateral pronotal lobes about as long as deep 2
2 Forewing length, hind femur length ratio more than 1:1 *Phaneroptera jordanica*
– Forewing length, hind femur length ratio less than 1:1 ... *Phaneroptera sparsa*

Key to species of *Tylopsis* of Jordan

1 Lateral pronotal lobes with well developed median spin like process presented on the hind margin of pronotal disc. . . . . *Tylopsis lilifolia*
– Lateral pronotal lobes without median spin like process 2
2 Lateral side of tergum with almost whitish strip; general coloration green to yellowish- brown . . . . . *Tylopsis peneri*
– Lateral side of tergum with whitish black spots and two black stripes on tergum sides; general coloration dark brown to blackish . . . . . *Tylopsis* sp.

Key to the Subfamily Tettigoniinae

This subfamily represents by two tribes, Platycleidini with 8 species and Tettigoniini with 6 species.

Key to the Genera of Tettigoniinae of Jordan

1 Plantula of hind tarsus very well developed, fastigium of vertex broad, in most species at least as broad as antennal scapus. 2
– Plantula of hind tarsus knob-like, scarcely more developed than adjacent pulvillus, fastigium of vertex broad or narrow 5
2 Fastigium broad about 3 times as wide as scapus and protrude; pronotum cylindrical; prosternum unarmed, hind tibia with 4 apical spurs ventrally and plantulae much longer than metatarsus; ovipositor up-curved . . . . . *Festella*
– Not fitting the above character combinations 3
3 Metazona of pronotum with distinct keel in the middle; if hypopterous; then apical part of tegmina always with distinct longitudinal veins towards the apex . . . . . *Platycleis*
– Metazona of pronotum without or with only a very indistinct keel in the middle; always hypopterous; apical part of male tegmina strongly reduced; female tegmina with only a network of vienlets 4
4 All terga unicolored . . *Parapholidoptera*
– At least 10th tergum black or brownish black or partly light spotted . . . . . *Eupholidoptera*
5 Fastigium much narrower than 1st antennal segment; body green; tegmina and wings fully developed . . . *Tettigonia*
– Fastigium wider than or as wide as 1st antennal segment; body not green; tegmina developed to a varying extent. . . . 6
6 Pronotum dorsally flat, with well-marked median carina . . . . . *Decticus*
– Pronotum dorsally convex, without a trace of median longitudinal carina . . . . . *Medicticus*
7 Fastigium not wider or less than twice as wide as 1st antennal segment . . . . . *Scotodrymadusa*
– Fastigium of vertex broad, prominent forwards, as large as 1st antennal segment. . . . . *Anadrymadusa*

Key to species of *Tettigonia* of Jordan

1 Ventral spines of the hind femur, each with a distinct basal black spot; male cerci straight, not reaching beyond styli; ovipositor usually extending far beyond apex of tegmina. . . . . *Tettigonia caudata*
– Ventral spines of the hind femur with no distinct black spot, only the top of the spine are black; male cerci slightly curved dorsally, much longer than styli; ovipositor usually not reaching apex of tegmina . . . . . *Tettigonia viridissimia*

Key to Subgenera of *Platycleis* of Jordan

1 Tegmina usually shortened, not dark in middle and without light spots, cross veins almost of the same color as the rest of the tegmina . . . . . *Decorana*

– Tegmina fully developed, dark in middle with distinct light spots on cross veins. 2

2 Tegmina without contrasting light and dark coloration, broad; female genital plate with distinct longitudinal groove; male cerci with a denticle in the middle. . . . . *Platycleis*

– Tegmina with contrasting light and dark coloration, very narrow; female genital plate and male cerci of different form. . . . . *Tessellana*

Key to species of *Platycleis* (*Platycleis*) of Jordan

1 VII female abdominal sternum much inflated forming a tubercle, epiphallus strongly bent at an obtuse angle apically with almost strong denticles ..... *Platycleis escaleria*

– VII female abdominal sternum with obtuse tubercle posteriorly and usually with little developed transverse ridge anterior to middle; apical half of epiphallus almost straight or slightly bent at the end, with weak denticles..... *Platycleis intermedia*

Key to the Subfamily Conocephalinae

This subfamily contains 2 tribes, Copiphorini with 1 species, and Conocephalini with 2 species.

Key to the Genera of Conocephalinae of Jordan

1 Small species, antennae two times as long as body or more, fore and middle femora unarmed, fastigium of vertex broad, obtuse; ventral portion not produced or forming a hook ..... *Conocephalus*

– Large species, fore and middle femora armed, fastigium of vertex conical often forming an elongate cone with a tubercle at base ..... *Ruspolia*

Key to species of *Conocephalus* Jordan:

1 Prosternum without spines; male cerci tapering toward apex with an internal pointed tooth ..... *conocephalus*

– Prosternum with two spines; male cerci with broad tooth little pointed at apex ..... *maculatus*

Subfamily Phaneropterinae

The name Phaneropterinae based upon the typical old worlds genus *Phaneropterina* SERV. meaning "visible wing". The members of this family are characterized by: frons vertical, antennae sometimes 2-3 times as long as body, pronotum without sharp longitudinal median carina on upper side, tegmina fully developed and in that case usually shorter than the wings, or both pairs are markedly shortened or even undeveloped, tympanal organ on for tibiae in form of exposed opening covered by membrane, or opening masked from one or two sides by swelling which opens in wide slit, ovipositor turned upward, often strongly compressed laterally and in that case short, lamellar and usually with very finely serrate margins, or nonlamellar and in that case strongly serrate along margins (BEI-BIENKO 1954).

Phaneroptera nana FIEBER 1853 (Fig. 1a, b)

Distribution: Jordan, Palestine, Syria, Middle East, N. Africa, and widespread in Europe.

Material examined: (39 specimens) Al Bahhath 11.XI.92 (4♀♀); Al Baqa'a 21.X.99 (1♀); Al Bunayyat 27.XII.96 (1♂); Al Jubayhah VIII.93 (1♀); 19.X.96 (1♂); 22.IV.98 (1♀); As Salt XII.98 (1♂); 12.X.2001 (1♂); 31.XII.2001 (1♂); Danna Reserve 27.IX.2002 (1♂); Dayr Alla 16.V.2002 (4♀♀); 20.V.2002 (1♂); Eastern Bayudah 26.VIII.2002 (3♂♂, 4♀♀); Ghawr Kabid 23.X.97 (1♂); Jarash 3.IV.2003 (2♀♀); 15.IX.2003 (1♂ nymph, reared, ad. 28.IX.2003); 29.IX.2003 (3♂♂); 21.X.2003 (1♂, 3♀♀ nymph, reared, ad. 27.X.2003); Jordan Valley 20.XI.96 (1♂); Madaba 9.X.84 (1♂); Ssafout 18.XI.2003 (1♂); Wadi as Sir 14.X.93 (1♂); Wadi Shu'ayb 11.X.2000 (1♀).

Remarks: This species can be collected easily by hand or by using a small tube. It almost appears from February to the end of the year. The reared species at the laboratory seem to stay alive without food for one week or more; it hides under plant leaves, or found at the top of the shrub or flower like to take a sun bath. It was collected from flowers or grasses such as: *Carlina hispanica*, *Chrysanthemum coronarium*, *Chrysanthemum segetum*, *Onopordum alexandrinum*, *Centaurea iberica*, *Ononis antiquorum*, *Carthamus te-*

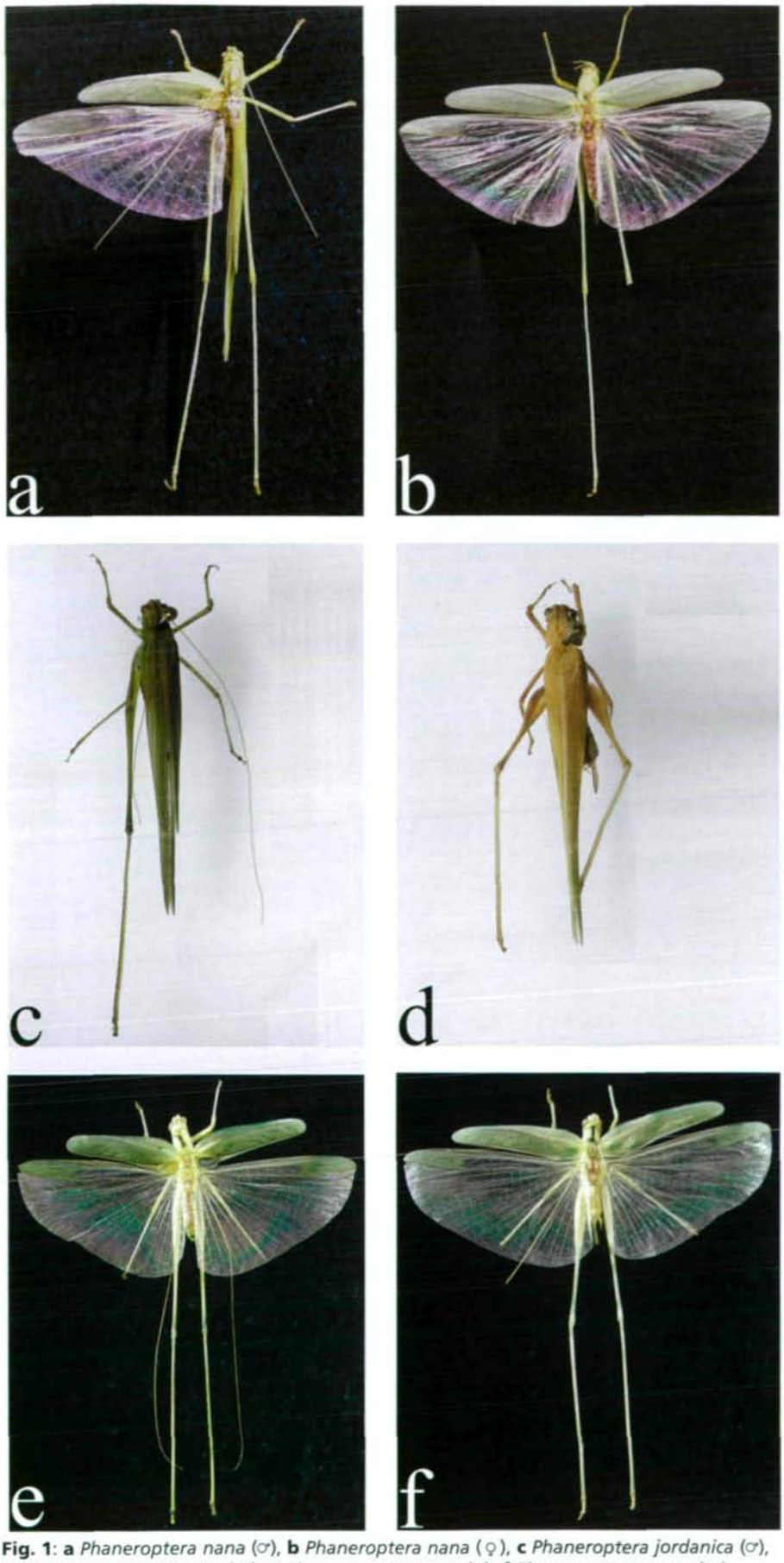

Fig. 1: **a** *Phaneroptera nana* (♂), **b** *Phaneroptera nana* (♀), **c** *Phaneroptera jordanica* (♂), **d** *Phaneroptera jordanica* (♀), **e** *Phaneroptera sparsa* (♂), **f** *Phaneroptera sparsa* (♀).

nuis, *Dittrichia viscose* (Compositae), *Avena sterilis* (Gramineae) and *Medicago sativa* (Fabaceae).

Phaneroptera jordanica STEINMANN 1966 (Fig. 1c, d)

Distribution: Jordan.

Material examined: (2 specimens) Paratypes at Natural History Museum, Budapest (Examined) labeled as: Jordantal Jericho (Agricult. State. In Citrus) 30.XII.1957 (1♂); O. Jordania 7.IX.1957 (1♀).

Remarks: This species was described by STEINMANN (1966) from Jordan as new species. Two Paratypes (male & female) were examined after receiving it from the collection of the Natural History Museum, Budapest. Since the time of describing this species it was not collected again either in Jordan or in Palestine which was studied intensively. Therefore, this species should be investigated in a revision covering the *Phaneroptera* of the area to verify its status.

Phaneroptera sparsa STÅL 1857 (Fig. 1e, f)

Distribution: Covers Africa south of the Sahara Desert, western and southern Saudi Arabia, and extends northwards through the Levant, probably to eastern and central Turkey.

Material examined: (11 specimens) As Salt 10.X.1995 (1♂); As Subayhi 28.X.2003 (1♂); Jarash 15.IX.2003 (6♂♂, 3♀♀ nymphs), one male and one female nymphs reared, became adults on 28.IX.2003.

Remarks: The availability of this name is under question, but some authors separate it from *Phaneroptera nana nana* by indicating the fore wing-length, hind femur-length ratio. RAGGE (1956) mentioned that it is not always easy and occasionally impossible to separate the two subspecies (*P. n. nana* and *P. n. sparsa*), later, RAGGE (1980), raised it as (*Paneroptera sparsa* STÅL 1857), but OTTE & NASKRECKI (1997), at their database website (Orthoptera Species File Online version 2.2), still dealing with it as *Phaneroptera nana sparsa*.

It appears from February to the end of the year, usually found on the flowers or grasses. It was collected from *Carlina hispanica*, *Centaurea iberica*, *Carthamus tenuis*, *Dit-*

trichia viscose, *Chrysanthemum coronarium*, *Chrysanthemum segetum*, *Onopordum alexandrinum* (Compositae), *Ononis antiquorum* (Papilionaceae) and *Avena sterilis* (Graminaceae).

Isophya savignyi Brunner von Wattenwyl 1878 (Fig. 2a, b)

Distribution: Jordan, Palestine, Lebanon and Turkey.

Material examined: (163 specimens) Ajloun 7.V.1987 (2♀♀), 24.IV.2003 (2♂♂); Al Al Jubayhah 6.IV.1994 (1♂); Al Aridah 3.IV.1979 (2♂♂, 1♀), 3.IV.1995 (1♂), 4.III.2002 (9♂♂, 10♀♀), 21.IV.2003 (6♂♂, 4♀♀); Al Jubayhah 6.V.1996 (1♀); Al Mukhaybah al Tahta 11.III.2002 (2♂♂); Al Yazidyh 3.III.1993 (2♂♂); A'qraba 25.III.2002 (8♂♂), 29.IV.2002 (6♂♂, 5♀♀); As Salt 22.III.1998, 22.IV.2001 (1♂); Birayn 1.V.1993 (1♂); Fuhays 19.IV.1989 (1♂, 1♀); Homrat As Sahin 21.III.2001 (3♂♂), 27.II.2002 (8♂♂, 2♀♀ nymphs), 1.III.2002 (3♂♂), 22.IV.2002 (1♂, 6♀♀); Husban 27.3.2004 (2♂♂, 1♀); Jarash 14.IV.1994 (2♂♂), Jarash 5.IV.1998 (1♂, 2♀♀), Jarash 2.IV.2001 (2♂♂, 2♀♀), Jarash 15.III.2002 (3♂♂, 1♀), Jarash 19.IV.2002 (10♂♂, 8♀♀); Jarash University 3.V.2002 (4♂♂); Jordan Valley 12.I.1996 (1♂); Kufr Asad 9.IV.2001 (4♂♂); Muzayrib 25.IV.1994 (1♀♀); Muzyrib 11.III.2002 (3♂♂, 3♀♀); Qumm 16.IV.2003 (6♂♂, 4♀♀); Sad Wadi Al-'Arab 16.IV.2001 (2♂♂); University Campus 3.III.2002 (3♂♂, 4♀♀ nymphs); Zabdah 11.IV.1995 (3♂♂, 2♀♀);

Remarks: This species can be recognized by sound of male and it is easily collected by hand. Bei-Bienko (1954), reported that Bodenheimer (1935) mentioned that this species appears from the coast of Palestine to the mountains and the Jordan Valley. It inhabits the maquis zone (evergreen Mediterranean shrubs), also, its often observed in spring on rest-harrow (*Ononis* sp., fam. Leguminosae).

This species appears between January and May. It is common among low vegetation and is often observed in spring on *Malva nicaeensis*, *Malva parviflora* (malvaceae) *Alhagi maurorum* (Papilionaceae), *Anthemis palaestina*, *Carthamus nitidus*, *Chrysanthemum coronarium*, *Chrysanthemum segetum*, *Onopordum alexandrinum* (Compositae), and *Papaver rhoeas* (Papaveraceae).

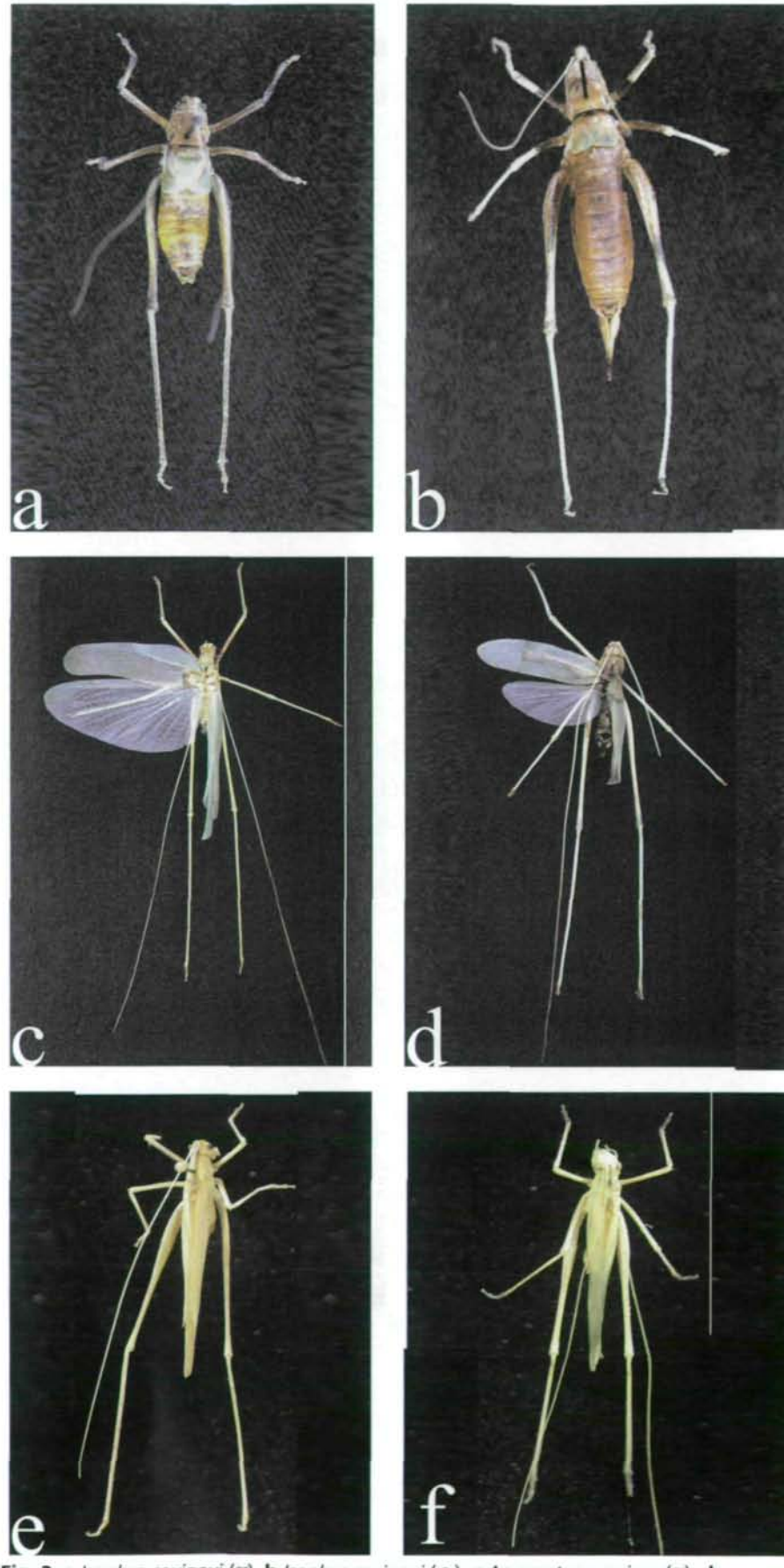

Fig. 2: **a** *Isophya savignyi* (♂), **b** *Isophya savignyi* (♀), **c** *Acrometopa syriaca* (♂), **d** *Acrometopa syriaca* (♀), **e** *Tylopsis lilifolia* (♂), **f** *Tylopsis lilifolia* (♀).

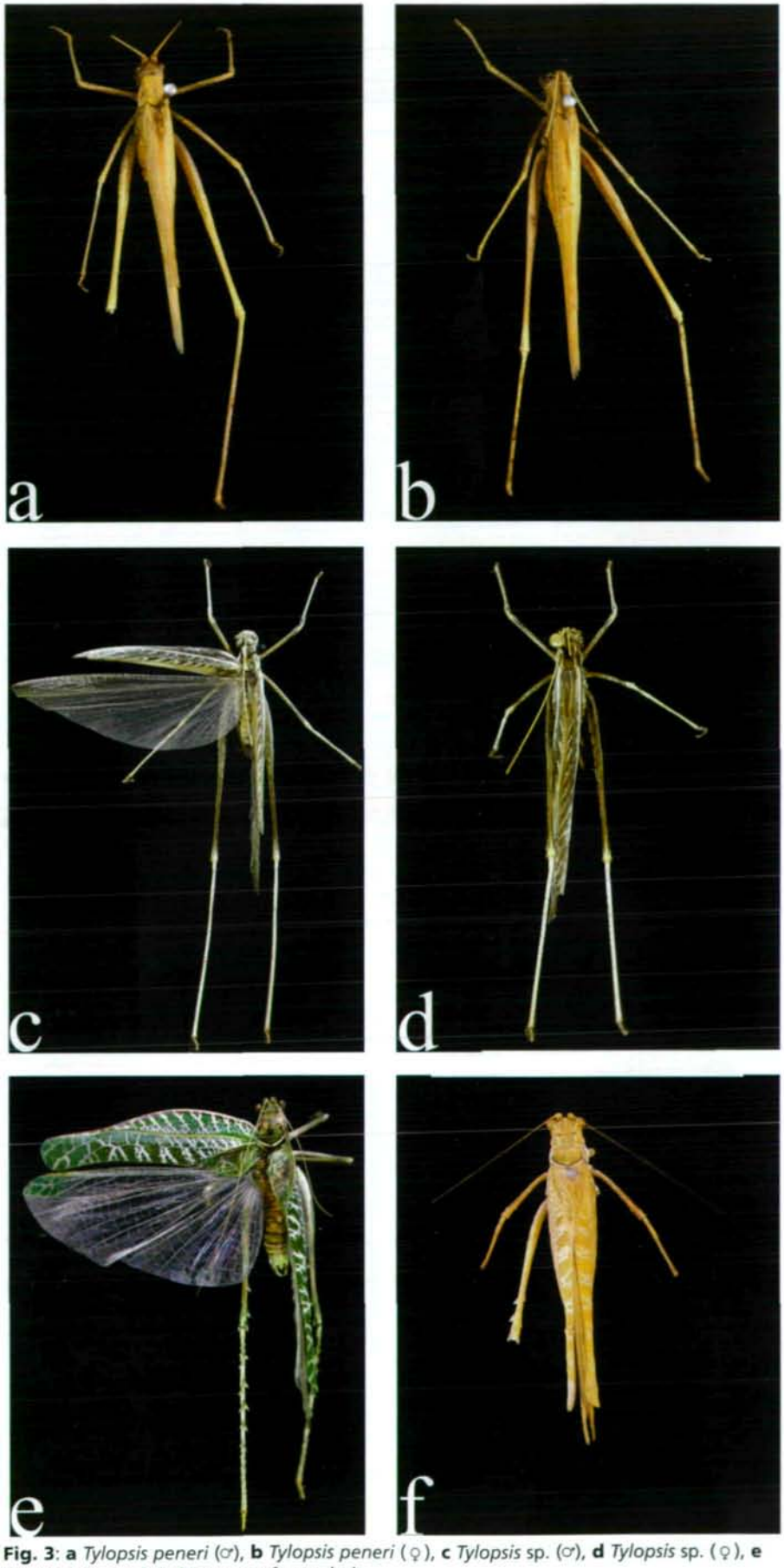

Fig. 3: **a** *Tylopsis peneri* (♂), **b** *Tylopsis peneri* (♀), **c** *Tylopsis* sp. (♂), **d** *Tylopsis* sp. (♀), **e** *Diogena fausta* (♂), **f** *Diogena fausta* (♀).

Acrometopa syriaca Brunner von Wattenwyl 1878 (Fig. 2c, d)

Distribution: From Greece through Turkey and Cyprus to Iraq, Syria, Lebanon, Palestine, Jordan and Egypt.

Material examined: (49 specimens) Abu Rawwa' 12.V.2003 (9♂♂, 7♀♀); Jarash 28.V.2002 (2♂♂); Al Aridah 28.IV.2002 (1♂); Al Aridah 4.V.1981 (9♂♂, 3♀♀); Amman (1♂, 1♀); Ar Rumman 4.VI.1988 (1♂); Dayr Alla 2.IV.2002 (1♂ nymph), 28.IV.2002 (1♀); Homrat As Sahin 22.IV.2002 (1♂, 1♀ nymphs); Jarash 22.V.2003 (4♂♂), 3.VI.2002 (2♂♂); Kumm 27.V.2003 (1♂,4♀♀).

Remarks: According to Bei-Bienko (1954), in Jordan and Palestine, it occurs from the seashore to the mountain plateau and the Jordan Valley and here it inhabits the maquis zone. This species appears in spring, the nymph appears almost in April on grasses and shrubs. The earliest adults are encountered in mid-July. It is common among the low vegetation and flowers such as: *Malva parviflora*, *Alhagi maurorum* (Malvaceae), *Anthemis palaestina* and *Carthamus nitidus* (Compositae).

Tylopsis lilifolia (Fabricius 1793) (Fig. 2e, f)

Distribution: It has a southern Mediterranean distribution, in S. Europe, N. Africa, and W Asia. In the Middle East, it has been recorded from Palestine, Jordan, Lebanon, Syria, Turkey, Iran, and Arabia.

Material examined: (122 specimens) Abu Az Zighan 28.IV.2003 (4♂♂, 1♀); Abu Rawwa' 12.V.2003 (2♂♂, 1♀); Al Bahhath 11.XI.1992 (1♂, 1♀); Al Balqa 27.XII.1996 (1♂); Al Jazzazeh 29.VI.2002 (2♂♂, 1♀); Al Jubayhah 10.VI-II.1993 (1♀); Al Majar 16.VI.2003 (6♂♂, 5♀♀ nymphs, adult 20.VII, 3.VIII); Al Mukhaybah Alfoqa 29.VII.2003 (1♂, 1♀); Ar Riyashah 7.VII.2003 (1♂, 6♀♀); Ar Rumaymin 1.VII.2003 (1♂, 1♀); Ar Rummanah 28.IX.2002 (3♀♀); As Salt 24.V.1993 (1♀); 8.VIII.1993 (2♂♂, 3♀♀); As Shawbak 15.VII.2003 (1♀), 16.VII.2003 (1♂, 1♀), 17.VII.2003 (1♀ nymph); Prince Hasmza Reserve 21.VII.2003 (3♂♂, 2♀♀); Balila 15.IX.2003 (1♀); Dana 25.VI.2003 (3♀♀); Dayr Alla 17.X.1991 (1♀), 27.III.1994 (1♂), 23.X.1997 (1♂), 28.IV.2003 (2♂♂, 1♀), 10.V.2004 (1♂); Homrat As Sahin 22.IV.2002 (1♀ nymph, adult 14.5); 3.VI.2002 (1♂, 1♀); Humrat As Sahin 12.V.2000 (1♂); Iraq Al Amir 14.X.1993 (1♂); Irbid 19.VII.1975 (1♀); Jarash

1.VI.2002 (1♂); 13.VI.2002 (1♂), 29.IV.2003 (1♂); Jarash-Ajlun Road 19.VIII.2003 (3♂♂, 11♀♀); Jordan University 22.IV.1998 (1♀); Jordan Valley 20.XI.1996 (1♂); Judayta 2.X.2003 (1♀); Kufr Khal 22.VII.2002 (2♂♂, 8♀♀), 15.IX.2003 (3♂♂, 12♀♀); Kufrinjah 6.V.2003 (1♀); Qum 27.V.2003 (1♂, 6♀♀); Um eldananir 1.VII.2003 (1♂); Wadi Shu'ayb 11.VII.2003 (1♂, 2♀♀); Zobia 8.VII.2002 (2♂♂, 2♀♀);

Remarks: Specimens from Jordan belong to the deserticolous form. The favorite habitats are sunlight grassy places, or dry mountain slopes overgrown with grass or shrubs, and it prefers the young seedling leaves. It can be found in almost all months of the year but most common in the spring. It was often observed on: *Carlina hispanica*, *Centaurea iberica*, *Ononis antiquorum*, *Carthamus tenuis*, *Chrysanthemum coronarium*, *Chrysanthemum segetum*, *Onopordum alexandrinum*, *Carthamus nitidus*, *Dittrichia viscose* (Compositae) *Avena sterilis* (Gramineae) and *Papaver rhoeas* (Papaveraceae).

Tylopsis peneri Ragge 1973 (Fig. 3a, b)

Distribution: Jordan and Palestine.

Material examined: (8 specimens) As Shawbak 15.VII.2003 (2♂♂,1♀); Dayr Alla 28.IV.2003 (1♂, 2♀♀); Prince Hamza Reserve 21.VII.2003 (2♂♂).

Remarks: This species may be collected easily by hand. It was taken from Composite flowers between April and July. Also it was usually found on *Artemisia herba-alba*, *Verthemia iphionoides*, *Carlina hispanica* and *Centaurea iberica* (Compositae).

Tylopsis sp. (Fig. 3c, d)

Distribution: Jordan (Wadi An Nawatif: Dana Naturae Reserve).

Material examined: (5 specimens) Dana 27.IX.2002 (2♀♀); Wadi An Nawatif 25.VI.2003 (1♂, 2♀♀).

Remarks: It is easy collected by hand but difficult to see because of its color which greatly resembles the bush which was found on it (*Artemisia herba-alba*). Also it was collected from *Varthemia iphionoides* (Compositae).

Diogena fausta (Burmeister 1838) (Fig. 3e, f)

Distribution: Jordan, Palestine, Sahelian and Sudanian belts of Africa, from Morocco to Arabia.

Material examined: (8 specimens) Dayer Alla 12.V.02 (1♂ nymph); Ghawr Kabid 27.IV.92 (1♂), 20.XI.92 (1♀), 6.X.97 (1♀), 23.X.94 (1♂); Shunit Nimrin (near Dead Sea) 12.VII.94 (1♀), 4.IX.94 (1♀); South Shuna 19.XI.02 (1♂).

Remarks: This is striking species that has dilated lobiform spines on the hind legs. It resembles closely the foliage which lives on it by its contrasting, patterned, green and white coloration. When the tegmen is folded, it has almost a deep red stripe along the upper side. Specimens was collected mainly from fields of grapes and citrus, and dominated with *Varthemia iphionoides* and *Dittrichia viscose* (Compositae).

Subfamily Tettigoniinae

Tettigoniinae range in size from among the smallest of tettigoniids to those rivaling the largest. The majority of species are brachypterous or micropterous, but many are fully winged. Most stridulate at night, but many such nocturnal species perform various other activities during day. Similarly, diurnal species can be found actively moving about, feeding, ovipositing and even intermittently stridulating at night. Most species are found on or near the ground. Some are associated with grasses and their long legs enable them to successfully straddle the grass stems in high winds. Many of the long-winged species are associated with bushes and trees. Most species are probably opportunistic scavengers. Several species are strictly predacious, others facultatively so, but the great majority feed on foliage, flowers, seeds, dead animal matter and insects as the situation provide. They appear to be omnivorous in their choice of food and when kept in captivity, even cannibalistic. There is usually coloration range from green, dull grayish or yellowish-brown, which are corresponding closely with the dead leaves and other herbage of their abiding places (Renth & Colless 1990).

Tettigonia caudata (Charpentier 1845) (Fig. 4a, b)

Distribution: Jordan, Palestine, Syria, Iraq, Iran, Turkey, Cyprus, Caucasus, and from C. Europe to the Balcans.

Material examined: (40 specimens) Abu Rawwa' 12.V.2003 (1♂, 7♀♀); Al Aridah 21.IV.2003 (4♂♂, 3♀♀); Al Mukhaybah Al Fawqa

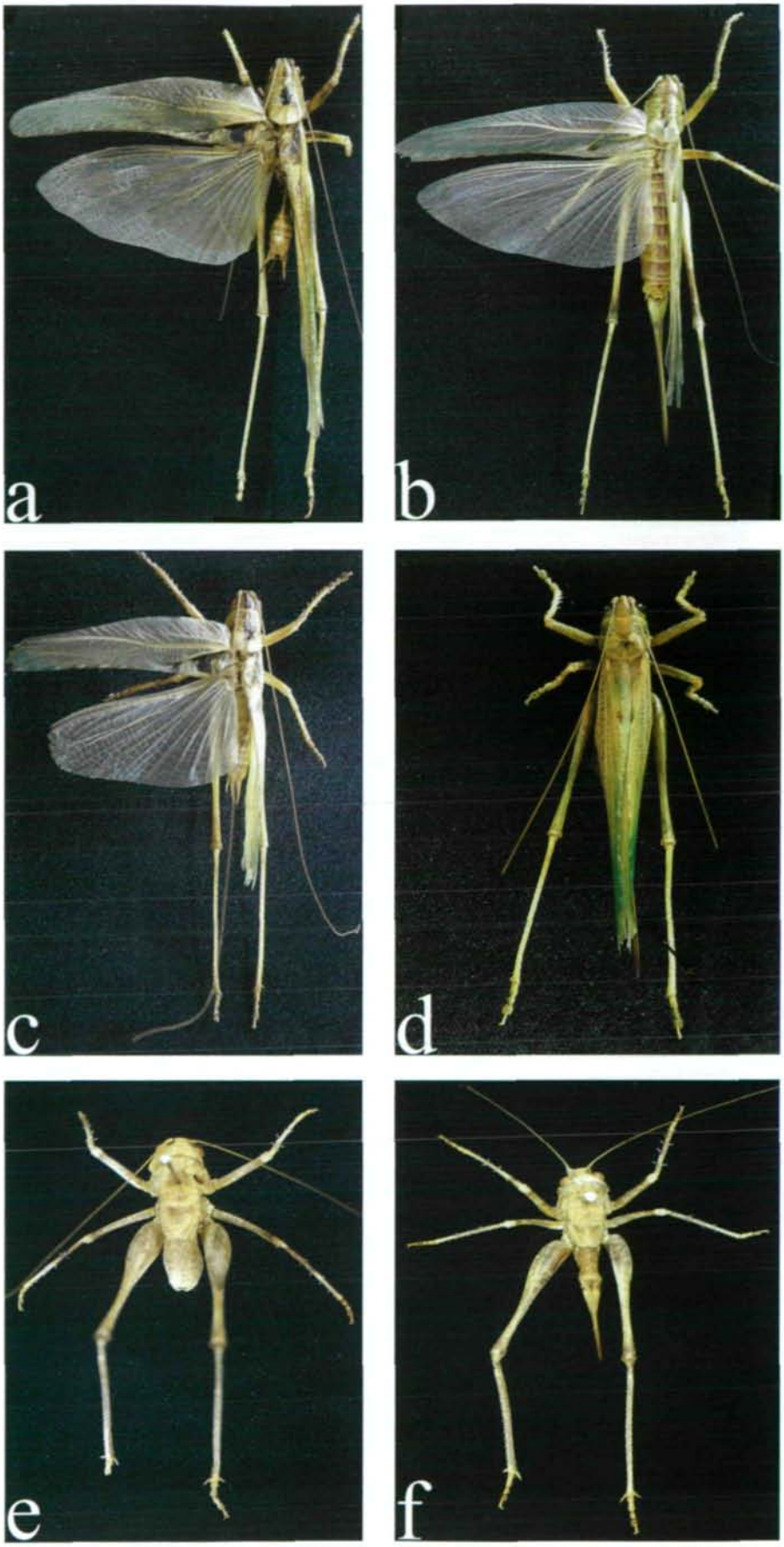

Fig. 4: **a** *Tettigonia caudata* (♂), **b** *Tettigonia caudata* (♀), **c** *Tettigonia viridissimia* (♂), **d** *Tettigonia viridissimia* (♀), **e** *Scotodrymadusa philbyi* (♂), **f** *Scotodrymadusa philbyi* (♀).

13.III.2002 (1♀); Amman 12.VI.1980 (2♂♂, 1♀); Ayn Aqraba 25.III.2002 (1♂ nymph), 29.IV.2002 (1♂, 1♀), 8.IV.2003 (2♀♀); Jarash 18.IV.2003 (1♀ nymph); Kufr Khal 23.V.2003 (4♂♂, 6♀♀); Kufrinjah 6.V.2003 (1♀); Marw 18.V.1987 (1♀); Qum 27.V.2003 (1♀); Um Eldananir 24.V.2003 (1♀); Zahr 27.V.2003 (1♀).

Remarks: This species has a good flying ability but for short distances. Its color greatly resembles its background making it hard to see in the field. It may become predacious on small insects, and also may be cannibalistic in captivity. It appears from March to July. It is usually found on green bushes, grasses or flowers. It was collected from *Avena sterilis* (Gramineae), *Carthamus tenuis*, *Vicia ervilia* (Papilionaceae), *Notobasis syriaca*, *Carlina hispanica* and *Centaurea iberica* (Compositae).

Tettigonia viridissima Linnaeus 1758 (Fig. 4c, d)

Distribution: Whole Palearctic region. In the Middle East, it was recorded from Palestine by Bodenheimer (1935), from Iraq by Uvarov (1938), and from Turkey by Naskrecki & Ünal (1995).

Material examined: (30 specimens) Abu Rawwa' 12.V.2003 (3♀♀); Al Aridah 28.IV.2003 (2♂♂, 1♀); Al Badhiyah 13.III.2003 (1♂); Al Mukhaybah Al Fawqa 13.III.2002 (1♀ nymph); Ar Rumman 12.V.2003 (1♂); Ayn Aqraba Dayr Alla 12.V.2002 (1♂); 8.IV.2003 (1♂, 1♀); Dayr Alla 21.IV.2003 (1♂ nymph); Jarash 18.IV.2002 (1♀ nymph), 5.VI.2002 (1♂); Jordan Valley 12.VI.1987 (1♀); Kufr Khal 10.V.2003 (1♂), 16.V.2003 (1♀ nymph, adult 18.V), 23.V.2003 (2♂♂, 2♀♀); Kufrinjah 6.V.2003 (1♀); Unknown Data (2♂♂, 4♀♀); Zabdah 11.IV.1995 (1♂).

Remarks: This species as the previous one has a good flying ability but for short distances and its color greatly resembles its background making it hard to see in the field. This species is carnivorous and attacks many insect species such as flies, acridiens, butterflies, caterpillars. It also may become cannibalistic in captivity. *T. caudata* and *T. viridissima* are very similar species but can be separated from each other by the morphology of the ovipositor, the hind femur spines, and male cerci. For *T. caudata*, the ovipositor reaches beyond apex of tegmina, but for *T. viridissima*, the ovipositor usually does not reach the apex of tegmina; male cerci for *T.*

caudata almost not reaching the styli, while in *T. viridissima* cerci are longer than styli. This species appears from March to July. It was found on *Avena sterilis*, (Gramineae) *Carthamus tenuis*, *Notobasis syriaca*, *Carlina hispanica*, *Centaurea iberica* (Compositae) and *Vicia ervilia* (Papilionaceae).

Scotodrymadusa philbyi (Uvarov 1927) (Fig. 4e, f)

Distribution: Jordan and Palestine.

Material examined: (16 specimens) Amman VI-II.1999 (1♂); As Salt 29.VII.2000 (1♀); Ira 7.XI.2002 (1♂, 1♀); Jarash 7.VIII.2000 (1♂); unknown data (1♂, 10♀♀).

Remarks: This brachypterous grasshopper is an active and fast moving species. It was collected from *Avena sterilis* (Gramineae), *Carthamus tenuis*, *Notobasis syriaca*, *Carlina hispanica* and *Centaurea iberica* (Compositae).

Anadrymadusa jordanica Katbeh Bader & Massa 2000 (Fig. 5a)

Distribution: Jordan, Al Mujeb Nature Reserve, Fagua, Wadi Shgeig

Material examined: (1 specimen) Wadi Shuqayq (Fagua) 10.II.1998 (1♀).

Remarks: this species was described from one female by Katbeh Bader & Massa (2000) as new species. It was collected from Al Mujeb Nature Reserve (Fagua, Wadi Shgeig). The male is still unknown.

Decticus albifrons (Fabricius 1775) (Fig. 5b, c)

Distribution: Mediterranean region including Jordan, Palestine, Syria and Lebanon, also SW. Asia.

Material examined: (21 specimens) Abu Az Zeghan 28.IV.2003 (1♀ nymph, reared in laboratory; ad.: 27.V.2003); Abu Rawa' (Kufrinjah) 12.V.2003 (6♂♂); Ar Ryashi 7.VII.2003 (5♂♂, 1♀); Dyer alla 20.V.2003 (1♂, 1♀); Jarash 30.VI.2002 (1♀); Kumm 27.V.2003 (2♂♂, 3♀♀, 1 nymph reared in laboratory ad: 20.6.2003).

Remarks: This species is never of green color. Popov (1981) mentioned records of swarming and occurrence of serious damage to wheat by this species in parts of Algeria. *Decticus albifrons* is a stout and active species which is hard to collect, even by using sweeping net. It has a good ability for jumping and it flies quickly. It usually appears bet-

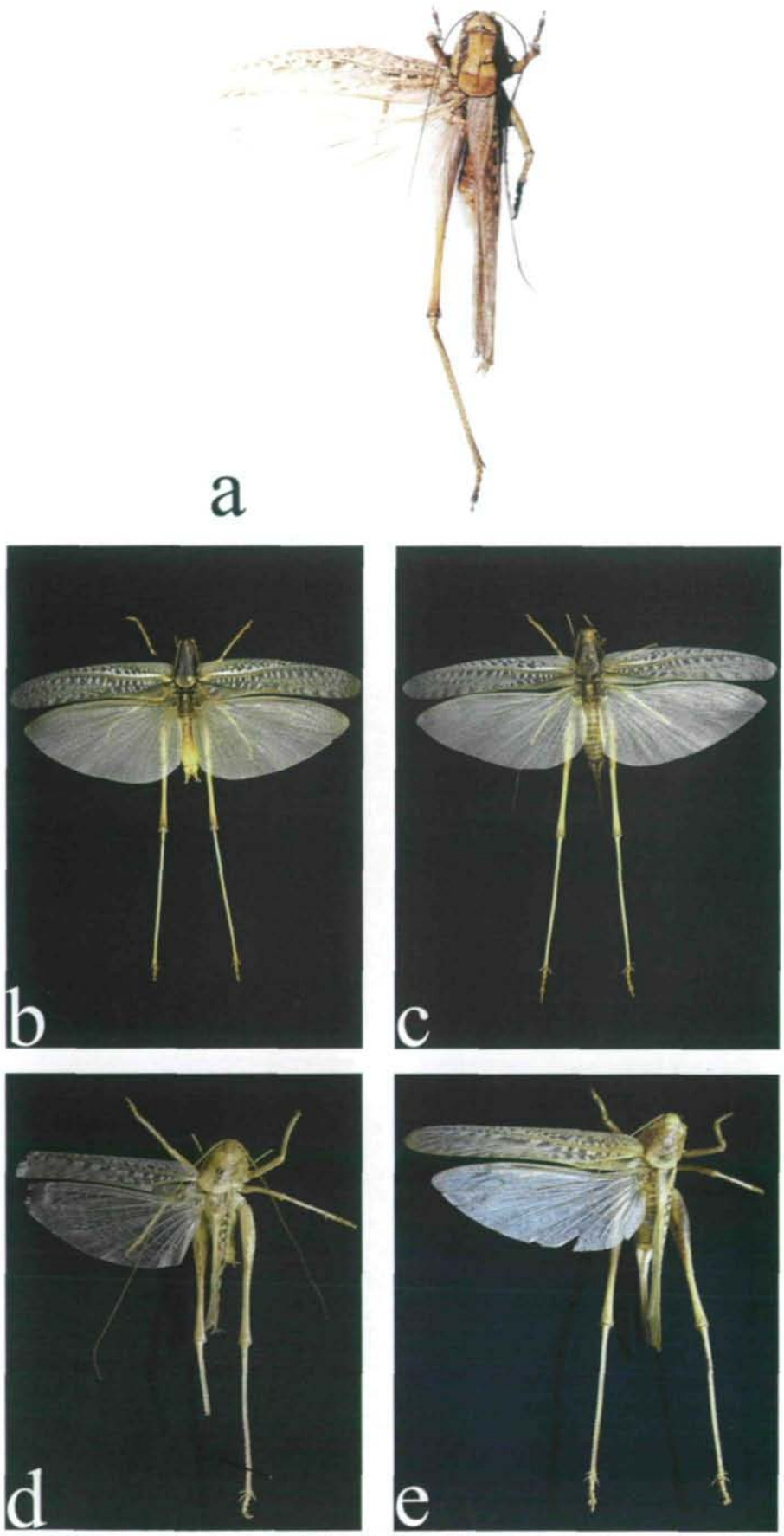

Fig. 5: **a** *Anadrymadusa jordanica* (♀), **b** *Decticus albifrons* (♂), **c** *Decticus albifrons* (♀), **d** *Medecticus assimilis* (♂), **e** *Medecticus assimilis* (♀).

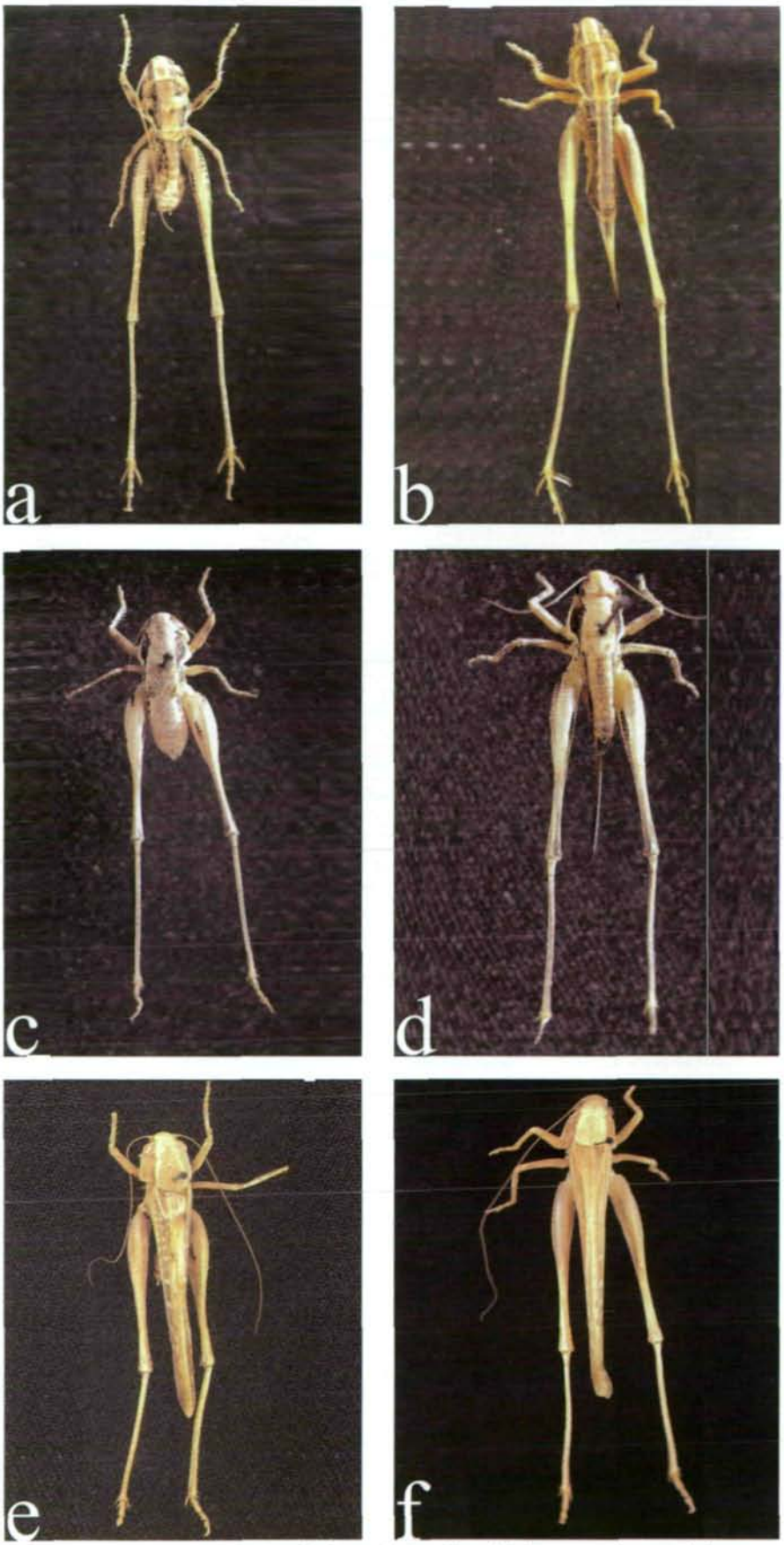

Fig. 6: **a** *Festella festae* (♂), **b** *Festella festae* (♀), **c** *Platycleis* (*Decorana*) *erecta* (♂), **d** *Platycleis* (*Decorana*) *erecta* (♀), **e** *Platycleis* (*Platycleis*) *escaleria* (♂), **f** *Platycleis* (*Platycleis*) *escaleria* (♀).

ween April and August, on ground, in grasses, in areas with low patchy vegetation. It was collected on *Centaurea iberica*, *Notobasis syriaca*, *Gundelia tournefortii*, *Carthamus tenuis*, *Carlina hispanica*, (Compositae), *Salvia syriaca* (Labiatae) and *Ononis antiquorum* (Papilionaceae).

Medecticus assimilis (Fieber 1853) (Fig. 5d, e)

Distribution: Known from Middle East, including Palestine, Syria, Lebanon, Iran, Iraq and Turkey, also known from Caucasus and neighboring countries.

Material examined: (4 specimens) Abu Rawa' (Kufrinjah) 12.V.2003 (1♂); Kumm 27.V.2003 (1♀); Sama As Sarhan 29.VII.2002 (2♀♀).

Remarks: This species is hard to collected, even by using sweeping net because of its good ability for jumping and flying. Its color resembles the background making it hard to see. It appears from April to July. The usual habitat is open ground with low patchy vegetation. It was collected from *Ononis antiquorum* (Papilionaceae), *Notobasis syriaca*, *Centaurea iberica* and *Carlina hispanica* (Compositae).

Festella festae (Giglio-Tos 1893) (Fig. 6a, b)

Distribution:
Jordan, Palestine and Syria.

Material examined: (47 specimens) Abu Rawa' 26.VIII.2003 (1♀); Aj Jazazeh 20.V.2003 (1♀); Al Mukhaybah al Fawqa 29.VII.2003 (1♂, 1♀); Ar Rumman 5.VIII.2003 (4♀♀); As Subayhi 28.X.2003 (2♂♂, 4♀♀); Ayn esh Shallaleh 24.VI.2002 (1♂, 1♀); Jarash 2.IX.2003 (5♀♀); Judayta 2.X.2003 (1♂, 1♀); Mahis 8.VII.2002 (2♂♂, 1♀), 15.VII.2002 (1♀); Qum 2.IX.2003 (1♂, 2♀♀), 7.X.2003 (1♀); Um eldananir 1.VII.2003 (5♀♀); Wadi Shu'ayb 11.VIII.2003 (8♀♀); Zahr 16.VI.2002 (1♀), 19.VII.2002 (1♂, 1♀).

Remarks: This is an active species. It is common between May and October. It was collected from *Centuria iberica*, *Echinops spinosa* (Compositae), and *Avena sterilis* (Gramineae).

Platycleis (Decorana) erecta (Uvarov 1939) (Fig. 6c, d)

Distribution: Jordan, Palestine.

Material examined: (13 specimens) Al Majar 16.VI.2003 (3♀♀); Bergish Reserve 14.V.2001 (1♂); Homrat As Sahin 15.IV.2001 (1♀), 3.VI.2002 (2♂♂); Umm Nuwarh 25.V.2002 (1♀); Yarqa 3.VI.2003 (1♀); Zay 3.VII.2002 (2♂♂); Ira 3.VI.2003 (1♂, 1♀).

Remarks: Usually appears between April and July, inhabit bushes or grasses. It was collected on *Avena sterilis* (Gramineae), *Carthamus tenuis*, *Carlina hispanica* and *Centaurea iberica* (Compositae).

Platycleis (Platycleis) escaleria Bolivar 1899 (Fig. 6e, f)

Distribution: Throughout SE. Europe and W. Asia to Jordan and Palestine.

Material examined: (6 specimens) Al Muwaqqar 7.X.2002 (1♂, 1♀); Ash Shumary Reserve 26.VI-II.2002 (3♀♀); unknown (1♀).

Remarks: Beside its feeding on plants, this species may be insectivorous. It is hard to collect, even with sweeping net. A great effort is needed, and several trials to catch it after disturbing the surrounding are usually needed. Usually, it will quickly move down and hide in the bush or grass, or it may fly away. A long forceps is useful to pick it up from the spiny bushes they live on. It was collected from *Avena sterilis* (Gramineae), *Carthamus tenuis*, *Carlina hispanica*, *Centaurea iberica*, and *Sarcopterium spinosium* (Compositae) and *Sarcopterium spinosium* (Rosaceae).

Platycleis (Platycleis) intermedia (Serville 1839) (Fig. 7a, b)

Distribution: It is widespread and common all over the Mediterranean region, Central Europe, and as far as China to the East.

Material examined: (144 specimens) Al Badhiyah 9.VI.2003 (6♂♂, 1♀); Al Jubayhhah 9.VIII.1989 (1♀); Al Muwaqqar 22.VII.1995 (1♀), 26.VIII.1995 (2♂♂), 7.X.2002 (2♂♂, 21♀); Amman 26.V.2003 (1♂), 4.VIII.2003 (1♂), 22.VIII.2003 (1♀); Ar Rumman 18.V.2000 (1♀); Ar Ryashi 7.VII.2003; (1♂, 3♀♀); As Salt 9.VI.2002 (1♀); Ash Shawbak 14.VII.2003 (2♂♂, 1♀), 15.VII.2003 (8♂♂, 9♀♀), 16.VII.2003 (2♂♂, 7♀♀); Ash Shumary Reserve 17.V.2002 (1♂), 26.VIII.2002 (1♂); Ash Shunah

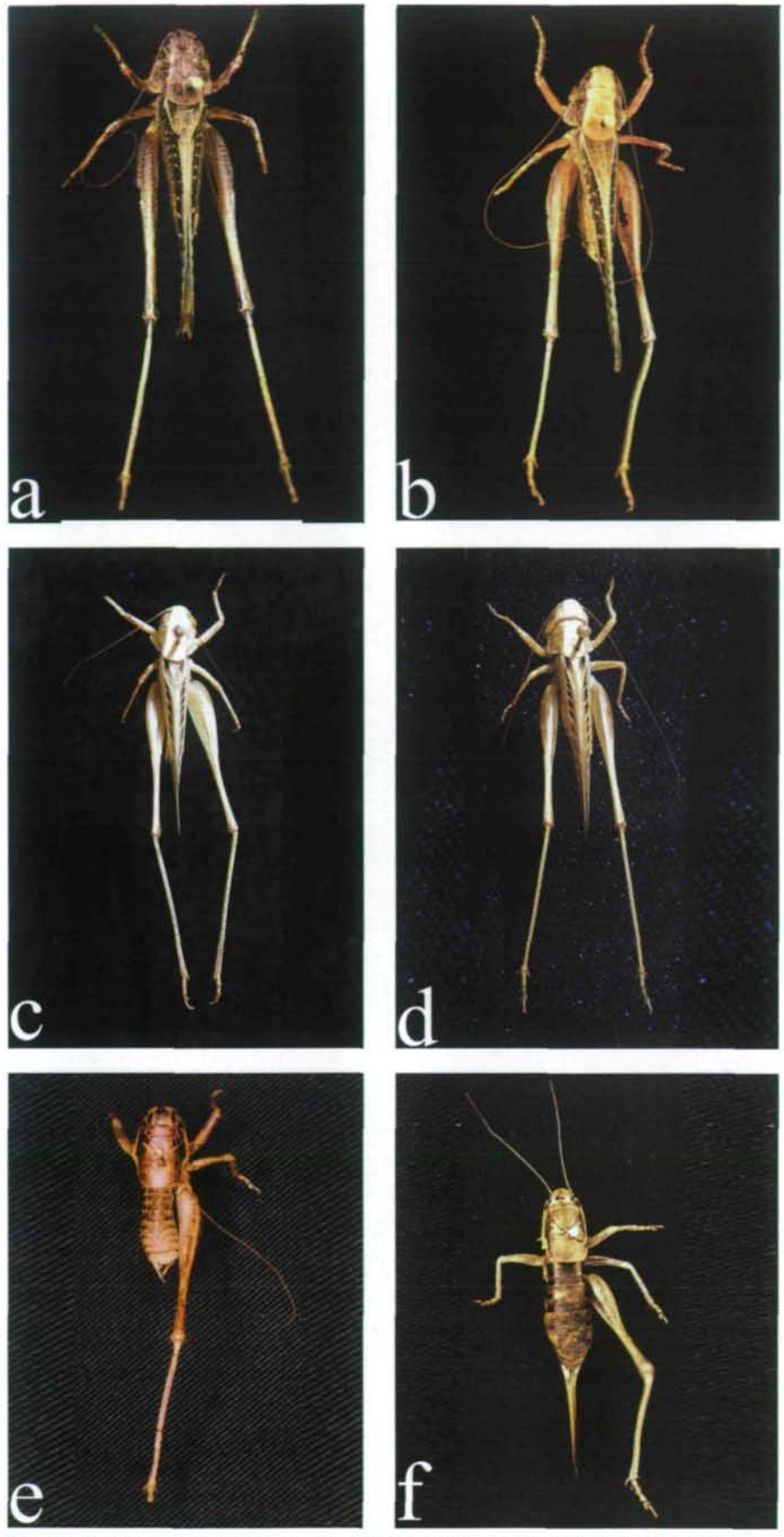

Fig. 7: **a** *Platycleis (Platycleis) intermedia* (♂), **b** *Platycleis (Platycleis) intermedia* (♀), **c** *Platycleis (Tessellana) tesellata holoptera* (♂), **d** *Platycleis (Tessellana) tesellata holoptera* (♀), **e** *Parapholidoptera willemsei* (♂), **f** *Parapholidoptera syriaca* (♀).

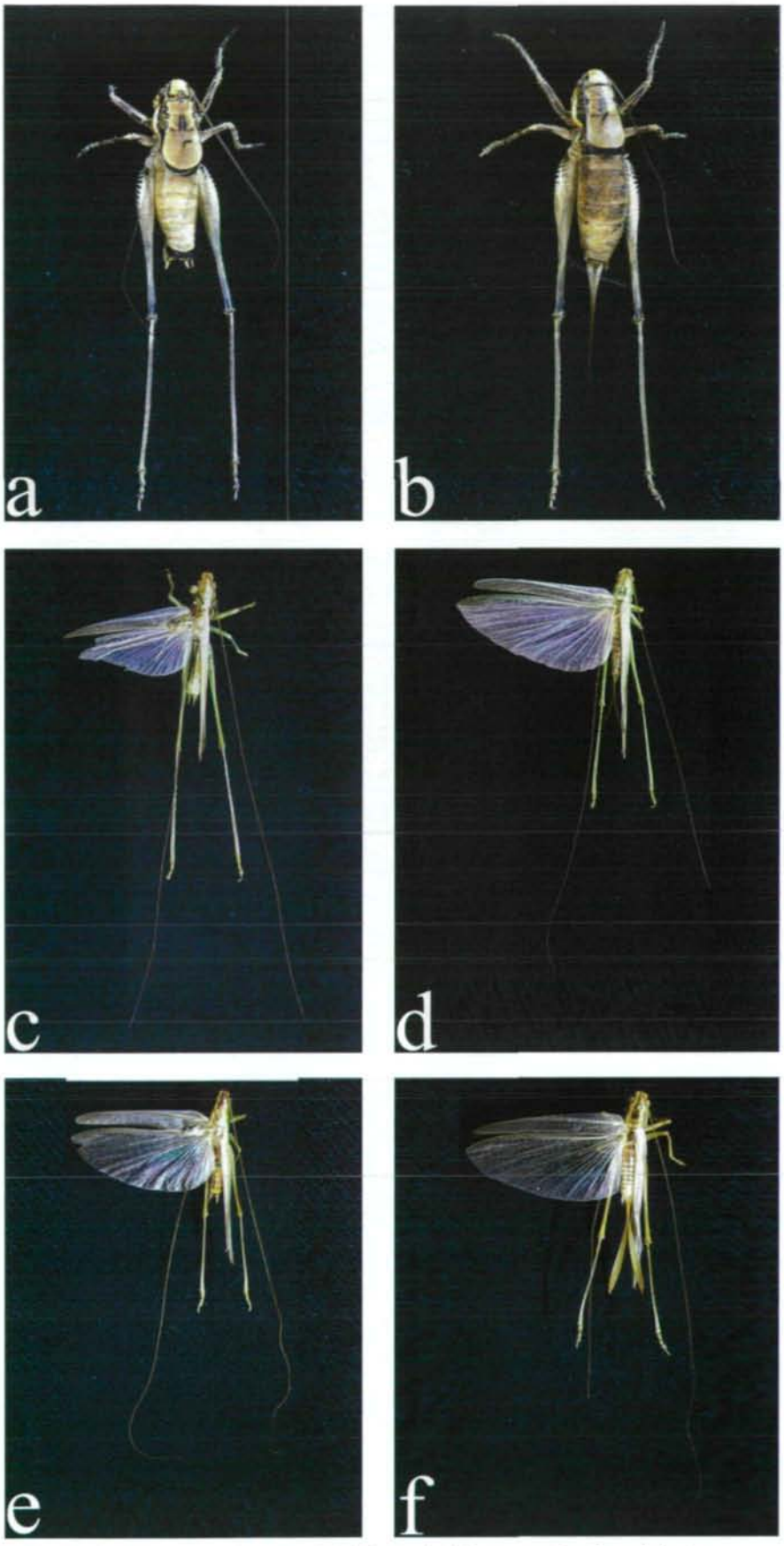

Fig. 8: **a** *Eupholidoptera palaestinensis* (♂), **b** *Eupholidoptera palaestinensis* (♀), **c** *Conocephalus conocephalus* (♂), **d** *Conocephalus conocephalus* (♀), **e** *Conocephalus maculatus* (♂), **f** *Conocephalus maculatus* (♀).

16.VII.2000 (1♀); Ayn Esh Shallaleh 24.VI.2002 (1♂); Dayr Alla 30.VII.1992 (2♂♂), 20.V.2002 (1♂), 2.V.2003 (1♀), 5.V.2003 (7♀♀), 28.IV.2003 (1♂, 2♀♀); Hummrit As Sahin 1.V.2000 (1♀), 22.IV.2001 (1♀), 22.IV.2002 (3♂♂), 3.V.2002 (3♀♀) 3.VI.2002 (2♂♂, 2♀♀); 13.IV.2004 (1♂, 1♀); Husban 2.IV.2004 (1♀); Ira 3.VI.2003 (2♂♂, 2♀♀); Jarash 20.V.2003 (7♂♂, 5♀♀), 16.VI.2003 (4♂♂, 4♀♀); Jordan University 22.VIII.2002 (1♂); Kafr Khal 6.V.2003 (1♀), 26.V.2003 (1♂); Ma'ain 5.VIII.2002 (1♂); Mahis 16.V5.2003 (1♀); Na'or 5.VIII.2002 (2♀♀); Um eldananir 20.VI.2000 (1♀), 1.VII.2003 (1♀); Unknown data (12♂♂, 8♀♀); Wadi As Sir 3.X.1985 (1♀); Wadi Shu'ayb 20.X.1998 (1♀), 16.V.2003 (1♂); Yarqa 29.III.2003 (1♂), 3.VI.2003 (1♀).

Remarks: This species is common in the uncultivated places and in areas cultivated with cereals. As the previous species, it is hard see and collected, even with sweeping net. Nymphs may be found it in aggregate or singles usually found among dense grasses and bushes It was collected on *Avena sterilis* (Gramineae), *Vicia ervilia* (Papilionaceae), *Carthamus tenuis*, *Carlina hispanica*, *Centaurea iberica* (Compositae), and *Sarcopterium spinosium* (Rosaceae).

Platycleis (*Tessellana*) *tessellata holoptera* (Ramme 1951) (Fig. 7c, d)

Distribution: Jordan, Palestine, Algeria, Tunis, Iran and Anatolia.

Material examined: (15 specimens) Aj Jazazeh 20.V.2003 (4♂♂, 3♀♀); Al Majar 16.VI.2003 (1♂); Al Muwaqqar 22.VII.1995 (1♂); Dayer Alla 12.V.2002 (1♂); Jarash 1.VI.2002 (2♂♂); Prince Hamza Reserve. 21.VII.2003 (2♂♂); Wadi Shu'ayeb 11.VIII.2003 (1♂).

Remarks: This species is recorded from Jordan for the first time. It is an active species, it jumps and flies quickly. It appears between May and August. It was collected from *Centuria iberica*, *Echinops spinosa* (Compositae), *Vicia ervilia* (Papilionaceae), and *Avena sterilis* (Gramineae).

Parapholidoptera willemsei Katbeh Bader & Massa 2001 (Fig. 7e)

Distribution: Jordan.

Material examined: (1 specimen) Kufranjah 12.V.2002 (1♂).

Remarks: movable species, it was collected from a field dominated by *Carthamus tenuis* and *Carlina hispanica* (Compositae).

Parapholidoptera syriaca (Ramme 1930) (Fig. 7f)

Distribution: Jordan, Syria and eastern Mediterranean area of Turkey.

Material examined: (1 specimen) Amman 30.V.2003 (1♀).

Remarks: This species was on *Carlina hispanica* (Compositae).

Eupholidoptera palaestinesis (Ramme 1939) (Fig. 8a, b)

Distribution: Jordan and Palestine.

Material examined: (33 specimens) Abu Rawa' 12.V.2003 (4♂♂, 2♀♀); Al Aridah 21.IV.2003 (2♂♂, 4♀♀), 28.IV.2003 (3♂♂, 1♀); Ar Rumman 20.V.2003 (2♂♂, 2♀♀); Ayn Aqraba 25.III.2002 (1♂), 29.IV.2002 (3♂♂, 1♀); Dayr Alla 21.IV.2003 (1♀); Jarash 18.IV.2003 (1♀), 12.IV.2004 (1♂, 1♀); Kufr Assad 9.IV.2001 (1♀); Kufrinjah 27.V.2002 (2♂♂); Qumm 27.V.2003 (1♂).

Remarks: Specimens were located in colonies in areas cultivated with leguminous plants, especially after harvesting of the crop. It is an active species collected from *Centuria iberica*, *Notobasis syriaca*, *Gundelia tournefortii* (Compositae), *sarcopterium spinosum* (Rosaceae), and *Avena sterilis* (Gramineae).

Subfamily Conocephalinae

Species of small to large size, fastigium of vertex broad or conical, if broad, then obtuse, projected in the form a blunt rounded tubercle, while if conical, then forming cone with a tubercle at its base, eyes rather large subglobose; antennae very slender, tapering, often of excessive length; pronotum with no more than one transverse sulcus; prosternum with two slender spines or without, tegmina usually well developed, their color usually green, rarely pale brown, the color of their bodies corresponds closely with that of the stems and leaves of the grasses among which they dwell. posterior tibiae with 4 apical spurs.

Conocephalus conocephalus (Linné 1767) (Fig. 8c, d)

Distribution: Whole Afrotropical region, in Palaearctic from Egypt and SW. Asia, including several localities in the Arabian Peninsula.

Material examined: (3 specimens) Al Mukhaybah alfawqa 21.V.2002 (2♂♂, 1♀).

Remarks: This species is recorded from Jordan for the first time, also the genera is recorded for the first time. It is a small and slender species. *Conocephalus conocephalus* was found associated with tall green grasses of *Elusin indica* and *Sorghum halepense* (Gramineae). Usually it appears in June.

Conocephalus maculatus (Le Guillou 1841) (Fig. 8e, f)

Distribution: Jordan (Al Karak), Saudi Arabia, Afro-Asian tropics, Australia and the Pacific, Indo-Malaysia, West Malaysia.

Material examined: (10 Specimens) Al Bathyh (Al Karak) 25.IV.2002 (2♂♂, 2♀♀); Al Mukhaybah alfawqa 21.V.2002 (6♀♀).

Remarks: *Conocephalus maculatus* is recorded for the first time from Jordan, also the genera is recorded for the first time. It is small, hygrophilous grasshopper. It is associated with marshy habitats with tall grasses. Usually appears from April to July. It was collected from *Elusin indica* and *Sorghum halepense* (Gramineae).

Ruspolia nitidula (Scopoli 1786) (Fig. 9a, b)

Distribution: Middle East, N Africa and Macaronesian and Saudi Arabia.

Material examined: (35 specimens) Al Jubayhah 20.IV.98 (1♂); 25.XI.92 (1 nymph); Al Masharī'a 4.X.95 (1♂ nymph); Al Ryashi 13.IV.2003 (5♂♂, 1♀ nymphs reared to become an adults. molt: 18.IV, 19.IV.2003); Al Ryashi 13.V.2003 (2♂♂, 2♀♀), 29.IV.2003 (4♂♂, 7♀♀, nymphs reared to become an adults. molt: 6.V, 7.V, 9.V, 2.VI.2002); Ash Shawbak 1.X.1997 (1♀); Dayr Alla 5.X.95 (1♀); Ghor Al Mazra'ah 20.X.1969 (2♂♂); Jordan Valley 1.V.98 (1♀), 20.XI.96 (1♀); Kurayyimah 21.X.95 (1♂), 22.X.95 (1♂ nymph); Waqqas 23.X.95 (1♂ nymph); Yarqa 22.IV.03 (1♀).

Remarks: Green, fully winged, it appears usually from April to June. It is common on the grasses of *Elusin indica* and *Sorghum halepense* (Gramineae).

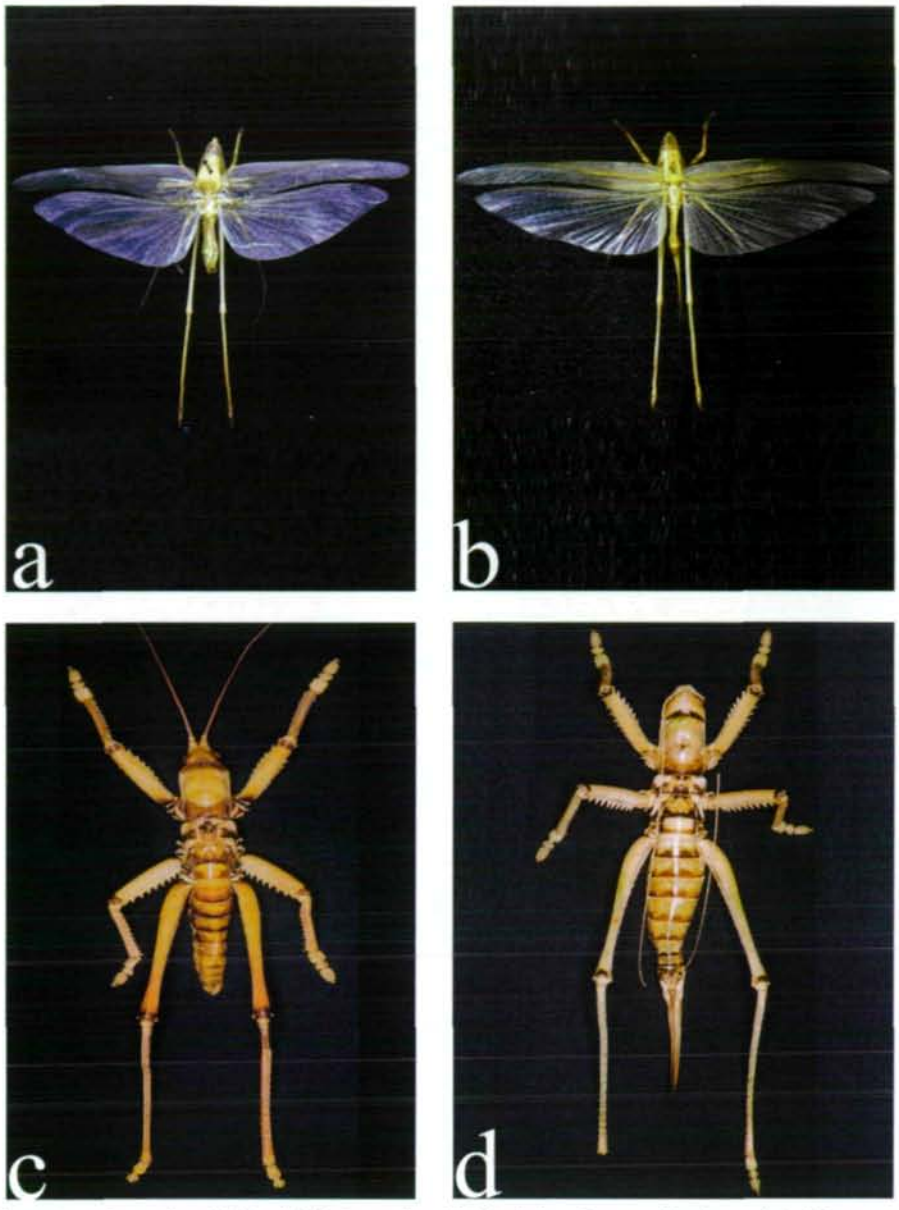

Plate 9: **a**. *Ruspolia nitidula* (♂), **b** *Ruspolia nitidula* (♀), **c** *Saga ephippigera* (♂), **d** *Saga ephippigera* (♀).

Subfamily Saginae

The saginae are medium-sized to very large saltatoria with a body shape ranging from slender to very bulky, the antennae are usually filiform and thickend proximally and do not extend much beyond the tip of abdomen, the fastigium of the vertex is not elongate as in some families and the eyes are large and prominent, all species have powerful jaws; the fore and middle legs are long and robust in more bulky species, and the ventral surfaces are equipped with strong spines. In most sagines, the wings are abbreviated or even vestigial, the incurved male cerci are hooked apically, but without a distinct internal tooth; the dorsal and ventral margins of the ovipositor are serrate.

Saga ephippigera Fischer-Waldheim 1846 (Fig. 9c, d)

Distribution: Jordan, Palestine, Turkey, Syria, Armenia, Caucasus, Iran and Iraq.

Material examined: (55 specimens) Abu Az Zeghan 28.IV.2003 (1♀); Al Aridah 4.III.2002 (1♂ nymph), 28.IV.2003 (3♂♂); Al Jubayhah 1.VII.1979 (1♂), 20.V.82 (1♀), 14.VIII.1985 (1♀), 20.VI.1986 (1♀), 2.VII.1992 (1♀), Al Walah 20.VI.1999 (1♀); Al Mukhaybah al Fawqa 29.VII.2003 (2♀♀); Amman 8.VI.1976 (1♂), 3.V.1979 (1♂); Ar Rumman 4.VI.1988 (1♀); As Salt 23.VII.1974 (1♂); 17.VII.1995 (1♀); 22.IV.2000 (1♂ nymph); Ash Shawbak 12.VII.2003 (1♀); Dayer Alla 4.IV.2004 (1♂, 1♀, nymphs), 19.VI.2003 (1♂); Ghawr Kabid 3.XII.?? (1♀); Jarash 1.VI.1980 (1♂), 6.IX.1992 (1♀), 18.V.1998 (1♂), 29.V.1998 (1♂), 31.V.1998 (1♂), 19.V.2002 (3♀♀), 18.IV.2003 (1♂ nymph), 10.V.2003 (1♂ nymph reared: ad.18.6.2003), 18.VI.2003 (1♂), 11.VII.2003 (2♀♀); Judayta (Ajloun) 29.IV.00 (4♀♀ nymphs, one reared in laboratory; ad: 10.VI.00); Nahlah 8.VII.74 (1♂); Kumm 16.IV.2003 (1♂, 2♀♀), 27.V.2003 (3♂♂ nymphs, reared, ad. 30.V.2003); Rajib 18.IV.00 (1♂ nymph); Tila' Al Ali 11.V.92 (1♂ nymph); unlabeled (1♂, 3♀♀); Wadi Shu'ayb 4.V.90 (1♂).

Remarks: Robust predacious species. Forelegs adapted for holding the prey; rows of strong spines along inside and outside lower edges of femur and tibia. They attack every living animal they can subdue up to their own size. In field, it sits motionless in dense grasses or bushes, or moves a little in order to have a prey, once it notices any walk or jump for an insect, suddenly *Saga* catch and clasp it by the long forelegs that adapted for prey with robust spines, and compress it hardly, then bite the prey starting from its throat. This species consume their prey almost completely, they generally reject the heavily sclerotized parts such as mandibles, ovipositor, legs and wings. Feeding occur in a strange form, *Saga* overcome the victim by clasping it with their spined fore legs, in addition, they often use their mid legs for holding the prey, and sometimes it may climbs up a twig holding its victim in its mandible, then it clinging only by the hind legs. It shows a clear preference for grasshoppers, locusts and tettigoniids. *Saga* usually does not feed on dead animals and they never accept plant food, the water requirements of *Saga* are low if sufficient food is available.

The green, tawny, brown or grayish coloration of *Saga* demonstrates a remarkable resemblance to the surrounding plants of the habitat (KALTENBACH 1990). In Jordan, our data shows that it appears from March to November in areas dominated by: *Carthamus tenuis*, *Carlina hispanica*, *Echinops spinosa*, *Centaurea iberica*, *Ononis antiquorum* (Compositae), *Vicia ervilia* (Papilionaceae) and *Avena sterilis* (Gramineae).

Rearing of Tettigoniidae under laboratory conditions

Some of Tettigoniidae nymphs were reared in cages (35 x 30 x 37 cm and 20 x 20 x 17 cm), untill they became adults. The majority of the Tettigoniidae showed cannibalistic behavior especially among the Saginae and the Tettigoniinae. Less cannibalistic behavior appeared among the Phaneropterinae especially between *Tylopsis* species, while members of Conocephalinae did not show any cannibalistic behavior. Among the reared specimens, species of subfamily Saginae were always predators. Long-horned grasshoppers were fed with grasses (*Anthemis palaestina*, *Chrysanthemum coronarium*, *Malva nicaeensis*, *Papaver rhoeas*, *Dittrichia viscose*) and sometimes provided with lettuce, grapes and apples. *Saga ephippigera* was provided with insects such as Tettigoniid species from other subfamilies and some Acrididae species such as *Tmethis pulchripennis asiaticus*, *Anacridium aegyptium aegyptium*, *Eyprepocnemis plorans*, *Sphingonotus savignyi* and *Truxalis exima*. Most reared nymphs became adults within one week to one month at room temperature.

Tylopsis lilifolia, *Tylopsis peneri*, *Phaneroptera nana* and *Phaneroptera sparsa* were easily kept alive in captivity for long periods. Some of them stayed alive for 6-10 days without food. In Addition, *Saga ephippigera* has a good ability to stay alive at captivity for about 20 days.

Most of Jordanian species occur in the Mediterranean phyto-ecological zones of Jordan, they were quite common on ground among the luxuriant annual plant found between scattered trees. Plant families from which Jordanian Tettigoniidae are listed in Table 2. Compositae contained 14 plant species on which the long horned-grasshoppers were observed to feed, hide or rest. Papilionaceae and Gramineae contained three species for each, Malvaceae have two species, while Papaveraceae, Labiatae and Rosaceae, and each was represented with one species.

Tab. 2: Plant families from which Jordanian Tettigoniidae were collected. Papi.= Papilionaceae, Com.= Compositae, Gra.= Gramineae, Mal.= Malvaceae, Papa.= Papaveraceae, Lab.= Labiatae, Fab.= Fabaceae, Ros.= Rosaceae.

Species	Papi.	Com.	Gra.	Mal.	Papa.	Lab.	Fab.	Ros.
Phaneroptera nana		*	*				*	
Phaneroptera jordanica								
Phaneroptera sparsa	*	*						*
Isophya savignyi		*		*	*			
Acrometopa syriaca		*		*				
Tylopsis lilifolia		*	*		*			
Tylopsis peneri		*						
Tylopsis sp.		*						
Diogena fausta		*						
Tettigonia caudata	*	*	*					
Tettigonia viridissima	*	*	*					
Scotodrymadusa philbyi		*	*					
Anadrymadusa jordanica								*
Decticus albifrons	*	*				*		
Medicticus assimilis	*	*						
Festella festae		*	*					
Platycleis (Decorana) erecta		*	*					
Platycleis (Platycleis) escaleria		*	*					*
Platycleis (P.) intermedia	*	*	*					*
Platycleis (Tessellana) tessellate holoptera	*	*	*					
Parapholidoptera willemsei		*						
Parapholidoptera syriaca		*						
Eupholidoptera palaestinensis		*	*					*
Conocephalus conocephalus			*					
Conocephalus maculatus			*					
Ruspolia nitidula			*					
Saga ephippigera	*	*	*					

All members of the Tettigoniidae resemble plant foliage, park twigs, lichens and most commonly leaves, and they exhibit cryptic behavior. Most species were collected from the plants since the Tettigoniidae spent most of the time within grasses and bushes for feeding, oviposition or resting and sunbathing.

Dense vegetation is preferred by several species of *Tettigonia*, *Medicticus*, *Platycleis*, *Decticus*, *Eupholidoptera* and others. Species of *Conocephalus* are hygrophilous and are restricted to the dense vegetation on the borders of springs and swamps, other species live on meadows and among herbs.

Discussion

The Tettigoniidae of Jordan are divided to three groups; 16 and 10 species are of Mediterranean and Irano-Turanian distribution respectively and 1 species of Ethiopian distribution. So far, there are four endemic in the Levant: *Tylopsis peneri*, *Eupholidoptera palaestinensis*, *Scotodrymadusa philbyi* and *Festella festae*. However, there are several common species in Jordan such as: *Tylopsis lilifolia*, *Phaneroptra nana*, *Isophya savignyi* and *Platycleis* (*Platycleis*) *intermedia*. Other rare species are *Parapholidoptera willemsei* and *Parapholidoptera syriaca* whereas a single specimen of each was collected, Also *Conocephalus conocephalus* is known only from three specimens. *Phaneroptera jordanica* was not collected since it was described by STEINMANN (1966), and should be investigated in a revision covering the genus *Phaneroptera* in the area to verify its status. *Anadrymadusa jordanica* is a new species that has been described by BADER & MASSA (2000) from one female specimen, whereas the male is still unknown and further collection may clarify its status.

Considering the relatively small area of Jordan, this family is well presented. A total of 42 species were recorded from Palestine (AYAL et al. 1999), where as 28 species were recorded from Saudi Arabia (POPOV 1981).

This study is considered as base line for further studies on the Tettigoniidae of Jordan. Studies on the distribution, biology and ecology of most species need to be done.

Zusammenfassung

Eine taxonomische Studie über die Laubheuschrecken Jordaniens (Orthoptera: Tettigoniidae). Zwischen Oktober 2001 und Februar 2004 wurden 1380 Tettigoniidae an 98 verschiedenen Orten Jordaniens gesammelt. Exemplare der University of Jordan Insects Museum sowie andere jordanische Sammlungen wurden in die vorliegende Studie eingebunden. 26 Arten aus 16 Gattungen und 4 Unterfamilien wurden nachgewiesen. Den Unterfamilien wurden folgende Artenzahlen zugeordnet: Tettigoniinae (13 aus 8 Gattungen), Phaneropterinae (9 aus 5 Gattungen), Conocephalinae (3 aus 2 Gattungen) und Saginae (1). 7 Arten erwiesen sich als neu für Jordanien: *Phaneroptera jordanica*, *Tylopsis peneri*, *Tylopsis* sp., *Platycleis* (*Tessellana*) *tesellata holoptera*, *Parapholidoptera syriaca*, *Conocephalus conocephalus* und *Conocephalus maculatus*.Die *Tylopsis*-Art aus Dana Reserve dürfte bisher noch unbeschrieben sein. Bestimmungsschlüssel für die Unterfamilien, Gattungen, Untergattungen und Arten der in Jordanien nachgewiesenen Arten wurden erstellt und illustriert. Für die einzelnen Arten wurde phänologische Angaben oder Hinweise zu Futterpflanzen gegeben.

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