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Records of Tridactylidae and Tetrigidae from Jordan

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Abstract

Collections of Pygmy grasshoppers (Tetrigidae) and Tridactylidae were made on expeditions to Jordan in 2008, 2009, 2010 and 2012. This country is predominated in great parts by arid and semi-arid habitats, mostly stony deserts. The collections contain a single Tridactylidae species (*Xya pfaendleri*) and three Tetrigidae species (*Paratettix meridionalis, Tetrix bolivari*), including the recently described new species *T. monnerati* Lehmann, 2014. All four species are restricted to wet habitats, mostly near wadis, and might be used as biological indicators in a water restricted country as Jordan.

Zusammenfassung

Bei libellenkundlichen Untersuchungen in Jordanien 2008, 2009, 2010 und 2012 konnten begleitend Dornschrecken (Tetrigidae) und Grabschrecken (Tridactylidae) gesammelt werden. Das gesammelte Material beinhaltet eine einzelne Grabschreckenart (Tridactylidae: *Xya pfaendleri*) und drei Arten von Dornschrecken (Tetrigidae). Neben den weit verbreiteten Tetrigidae *Paratettix meridionalis* und *Tetrix bolivari* fanden wir auch eine separat beschriebene, neue Art *T. monnerati* Lehmann, 2014. Alle vier Arten kommen nur in Feuchtgebieten vor, besonders im Bereich der Wadis. Jordanien hat ein trockenes Klima, in weiten Teilen geprägt von Halbwüsten und Steinwüsten. Deswegen sind die vier Arten gute Bio-Indikatoren in einem Land mit akutem Wasserstress, der sich in den letzten Jahrzehnten noch drastisch erhöht hat.

Introduction

Jordan occupies a surface area of about 89.000 km^2 and comprises a high diversity of landscapes and a sharp gradient from north to south, respectively west to east. Elevation variation is from Dead Sea 411 m below sea level (lowest point on earth) and 1727 m above sea level in the mountain range in the southwest (WAITZBAUER & PETUTSCHNIG 2004a). Jordan is an arid country and the climate is affected by altitude and latitude. The hills in the north and west have a Mediterranean climate with a mean annual rainfall of 550 mm and moderate temperatures; the vegetation is well developed with oak macchia and pine forests. Southern and eastern parts of Jordan are dry and hot, with mean annual precipitation of 50 mm or less in desert areas (WAITZBAUER & PETUTSCHNIG 2004c). The rain falls mainly during winter from November to March, but the precipitation regime has a high variability all over the country (TARAWNEH & KADIOĞLU 2002). Perennial rivers are restricted to the West and flow from the mountain range in the Jordan Valley or in the Dead Sea where most wadis are supplied by thermal

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springs. In the southwest wadis are drying in summer, but springs are locally present. In the eastern part water is very scarce and without any perennial water. One notable exception is the famous Azraq Oasis in the eastern desert (WAITZBAUER & PETUTSCHNIG 2004b).

In such an arid country the occurrence of Tetrigidae and Tridactyliidae might be naturally limited, as humidity of the substrate is predominant for oviposition and the development of eggs and larvae of both groups. According to the hydrological and climatic situation in Jordan, the species of these two families are primary limited to a small number of favourable habitats. In this aspect, threats on aquatic habitats are concrete due to over exploitation of water resource and acute dependence on precipitation. The degradation of Azraq Oasis due to water overpumping since the 1960' became critical in 1993 (ZORNIG & WEISSENBACHER 2004). Actually, ponds have to be maintained by pumping. The Azraq Wetland Reserve was the first reserve in the country created in 1977 by the Royal Society for the Conservation of Nature (RSCN) with the support of the government of Jordan. At present seven reserves are distributed in the country representing different habitats (AMR et al. 2004).

Given this climatic restrictions it is less surprising that only few records of both groups exist for the country. The presence of a single Tridactyliidae is well established; however the first Tetrigidae is reported quite recently by KATBEH-BADER (2001).

Collection sites

We were able to study material from 21 localities (Table 1). Most sample sites with records of Tetrigidae and Tridactylidae are situated in the western part of Jordan, predominantly in wadis leading to the Jordan valley and the Dead Sea. Sample sites are distributed from the Syrian border in the north to Wadi Musa close to the Gulf of Aqaba in the south. Just one record is from the wetlands of the famous Azraq Oasis, located in the stony desert of Eastern Jordan (Figure 1).

Records including taxonomic remarks

67 Tetrigidae and 50 Tridactylidae individuals were collected and identified by the second author. They are placed in his private Collectio in Neuchâtel (CM, dry pinned specimens or nymphs stored in collecting tube in alcohol all with GBIFCH labels numbered and barcoding), but generously several were donated to the private Collectio AW Lehmann (CL, specimens individually numbered from 12001 to 12018). A subset of dry pinned specimens was identified by the first author using BEY-BIENKO & MISHCHENKO (1951=1963), HARZ (1975) and DEVRIESE (1996) for the Tetrigidae and HARZ (1975) and GÜNTHER (1990) for Tridactylidae. The keys of HARZ (1975) have been proven to be reliable and well pictured. Nonetheless the steadily enlarging Collectio Lehmann incorporating material and whole collections send in over the years and the collection from the Museum für Naturkunde Berlin (ZMHB) were used for comparison.

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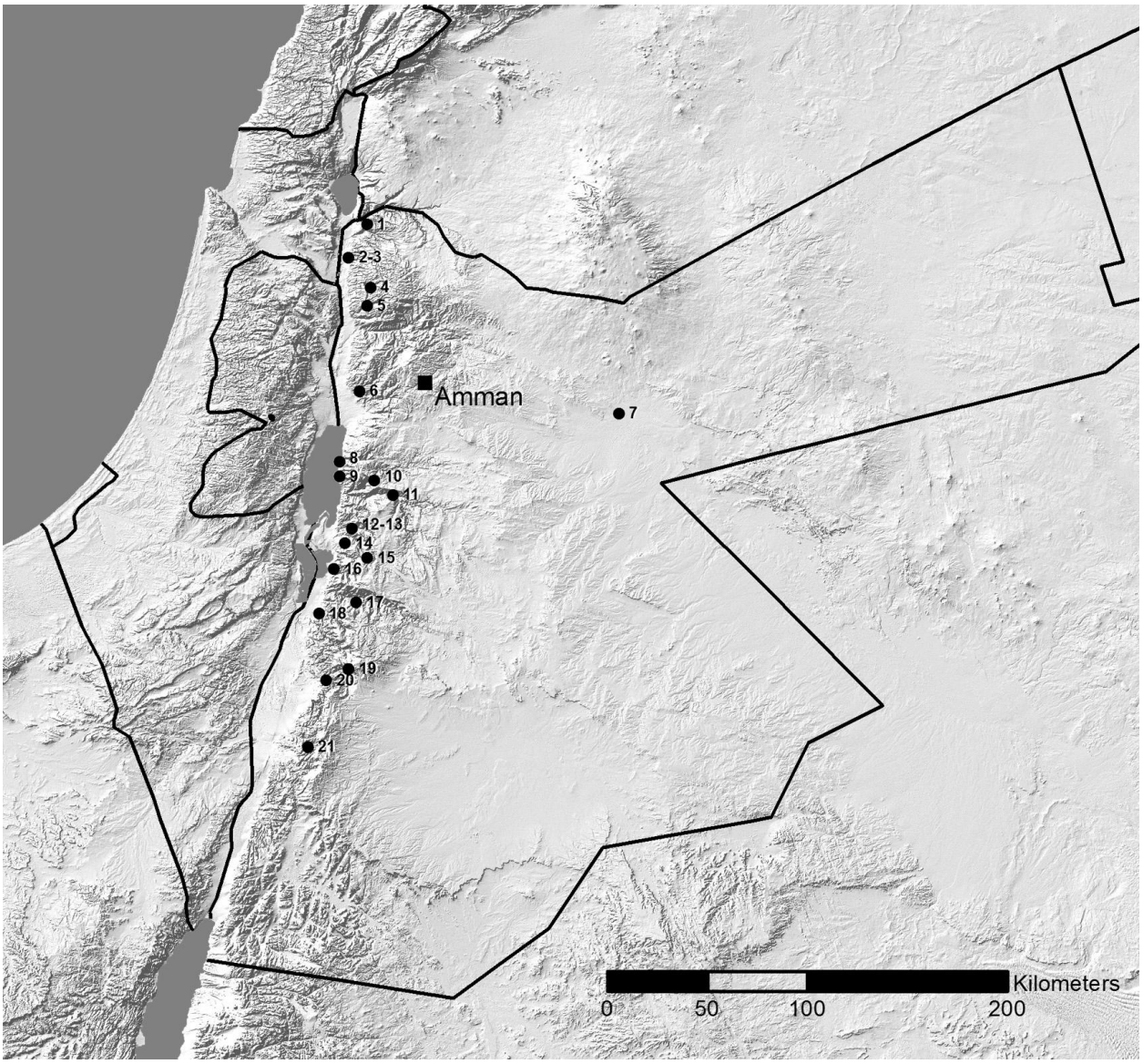

Fig. 1: Map of Jordan with collecting sites.

Tetrigidae

Morphological polymorphism

It is well known that Tetrigidae can occur in distinct morphological forms regarding the length of their wings and the pronotum (STEENMAN et al. 2013, 2014). However, all specimens from Jordan belong to the morphs with long hindwings (=Alae) and elongated pronota, both extending beyond the hind knees. These morphs are named forma macropronotal or preferentially forma macroptera (LEHMANN and LANDECK 2007). It should be noted that this forms are developmental reaction norms without taxonomic status according to the International Code of Zoological Nomenclature.

Table 1: Collecting sites in Jordan with date of visit, name, geographic coordinates altitude and description, sorted from North to South.

No.	Locality	Geographic coordinates	Altitude	Date	Description of collecting site
1	Um Qais	N 32°40' / E 35°41'	15 m asl	14.04.2008	Little pond supplied by a brook and used for pumping water. Mud with pioneer vegetation (*Apium nodiflorum*, *Veronica beccabunga*).
2	Wadi Ziglab	N 32°31' / E 35°37'	-120 m bsl	10.08.2009, 08.11.2009	Silty place near the mouth of the wadi into the lake dam and a sandy bank further upsteram.
3	Al Qulai'at	N 32°31' / E 35°36'	-200 m bsl	16.04.2008	Wadi bed under dam with a trickle of water, sandy wet place.
4	Wadi Yabis	N 32°23' / E 35°42'	450 m asl	23.04.2008, 09.08.2009	Green valley with trees (*Salix*, *Populus*, *Platanus*) and *Mentha longifolia*. Gravel bank in the wadi bed and upstream sand wet place at a waterfall.
5	Wadi Kufrinja	N 32°18' / E 35°41'	410 m asl	07.08.2009	Wadi bank, gravel and silty places with grasses, *Cyperus papyrus* and *Salix*, surrounded by orchards of olive trees.
6	Wadi Shu'yab	N 31°55' / E 35°39'	-105 m bsl	12.08.2009	Wadi banks of gravel and sand. Covered by short vegetation dominated by grasses, higher vegetation with reed (*Typha*, *Arundo*).
7	Al Azraq, Wetland Reserve	N 31°49' / E 36°49'	510 m asl	19.04.2008, 05.06.2012	Wetland reserve including many ponds with fluctuating water level, sandy edge partly with grass, buffalo pasture.
8	Zara Hot Springs	N 31°36' / E 35°33'	-340 m bsl	09.04.2009, 04.06.2012	Hang mire with hot springs, sandy paths near mire, very popular site for bathing.
9	7.2 km south Zara Hot Springs	N 31°32' / E 35°33'	-340 to -325 m bsl	16.04.2008, 09.04.2009	Hang mire with a temporary pond in a ditch along the road.
10	Wadi Wala	N 31°31' / E 35°43'	235 m asl	17.04.2009	Rocky bank with wet sand, covered by grasses, herbs and *Nerium oleander*.
11	Wadi Mujib	N 31°27' / E 35°48'	120 m asl	13.08.2009	Gravel with sand on wadi bank, downstream the lake dam. Vegetation grazed by goats.
12	Wadi Ibn Hammad (upstream hammam)	N 31°18' / E 35°38'	100 m asl	08.04.2009	Tributary of the wadi near a narrow, little gorge. Sandy place, broken *Phragmites* stems and *Nerium oleander* bushes.
13	Wadi Ibn Hammad (downstr. hammam)	N 31°18' / E 35°37'	20 m asl	04.04.2010	Sandy wet Wadi bed without vegetation due to recent floods.

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No.	Locality	Geographic coordinates	Altitude	Date	Description of collecting site
14	Wadi Weida'a	N 31°14' / E 35°35'	75 m asl	09.04.2009	Hang mire and little brook in the wadi, some places remain open by donkey grazing or burning.
15	Wadi Karak	N 31°10' / E 35°41'	770 m asl	17.04.2008, 07.04.2009	Little pond and brook in the wadi, supplied by the overflow of a water tank.
16	Wadi Hudeira	N 31°07' / E 35°32'	-220 m bsl	10.04.2009	In a high narrow siq, sandy deposit on a rocky place at the edge of wadi at a little tributary (*Tamarix*, *Typha*, *Saccharum*).
17	Wadi Afra	N 30°58' / E 35°38'	285 m asl	17.08.2009	Vegetation free area with wet sand below a spring, near hang mire with *Juncus*.
18	Wadi Feifa	N 30°55' / E 35°28'	-265 to -250 m bsl	14.08.2009	River gravel bank with sandy places. Scarce vegetation with short grasses.
19	Dana village	N 30°40' / E 35°36'	1220 m asl	23.04.2008, 05.04.2009	Gardens and olive orchards near the village. Flowing water on a path with gravel near a spring and wet soil under irrigated trees.
20	Wadi Ghuweir	N 30°37' / E 35°30'	335 m asl	30.05.2012	Edge of flowing water of the wadi and little brook, sandy areas without vegetation or reed (*Cyperus laevigatus*, *Juncus*, *Typha*) and bushes (*Nerium oleander*).
21	Wadi Musa (Petra)	N 30°19' / E 35°25'	865 m asl	16.08.2009	Wadi with large sandy and wet area, covered with *Mentha longifolia*, *Typha domingensis*, *Phragmites australis* and *Nerium oleander*.

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Paratettix meridionalis (RAMBUR, [1838])

Material studied: 43 individuals from 10 localities, all individuals were f. macroptera.

Records: 14.04.2008 Um Qais, 1♂ (GBIFCH00170535) – 16.04.2008 Al Qulai'at 1♂ (GBIFCH00170536) – 10.08.2009 Wadi Ziglab, 2♂♂, 2♀♀ (GBIFCH00170545-48) – 09.11.2009 Wadi Ziglab, 8♂♂, 2♀♀, 1Nymph (GBIFCH00170521-31) – 12.08.2009 Wadi Shu'yab, 6♂♂, 1♀ (GBIFCH00170549-54, CL12002 1♂), 1Nymph (GBIFCH-00170555) – 19.04.2008 Azraq Wetland Reserve 4♂♂, 1♀ (GBIFCH00170539-42, CL12001 1♂) – 05.06.2012 Azraq Wetland Reserve 1♂, 1♀ (GBIFCH00170559-60) – 09.04.2009 Zara Hot Springs, 1♀ GBIFCH00170544) – 04.06.2012 Zara Hot Springs, 1♂, 1♀ (GBIFCH00170557-58) – 16.04.2008 7.2 km south Zara Hot Springs, 2Nymphs (GBIFCH00170537-38) – 13.08.2009 Wadi Mujib, 1♂ (GBIFCH00170556) – 09.04.2009 Wadi Weida'a 2♀♀ (GBIFCH00170543 1♀, CL12003 1♀), – 14.08.2009 Wadi Feifa, 2♂♂, 2♀♀ (GBIFCH00170532-34/561)

Given its restricted occurrence at wet habitats, *P. meridionalis* is a reasonable widespread species in this dry country. Half of the records (five out of 10) are below sea level, the lowest at -340 m bsl. In western Jordan, the highest locality was in the Wadi Mujib at 120 m asl, only the record from the eastern plateau at the Azraq Wetland Reserve is higher (510 m asl). This species occurs only at low altitudes in Jordan and does not co-exist with *T. bolivari*, which inhabits only the higher elevations in this country. However, *P. meridionalis* is found together with the widespread Tridactylidae species *X. pfaendleri,* which spans a high range of altitudes in Jordan.

This species was the only Tetrigidae species reported previously from Jordan (KATBEH 2001). It also occurs in the neighbouring countries, with reliable records from Lebanon (MASSA & FONTANA 1998) and Israel (BUXTON & UVAROV 1923, BODENHEIMER 1935, FISHELSON 1985). Records from Egypt (KRAUSS 1890) seem to be restricted to the Mediterranean North of this country (WILLEMSE 2009; Lehmann unpublished data).

Taxonomic remarks: There are a few *Paratettix* taxa recorded from the Near and Middle East (BEY-BIENKO & MISHCHENKO 1951=1963; own data). However, at the moment only the Mediterranean species *P. meridionalis* is present in the material from Jordan. We compared the collected specimens with series covering the whole known distribution from the Canary Islands towards Turkey. The Jordan material in front of us falls within the morphological range and clearly belongs to *P. meridionalis*. Nonetheless, the *Paratettix* species from the Middle East, the Arabian Peninsula and Middle Asia are in need of revision, which is currently under way by the first author. The record from the Oasis Azraq is the easternmost record on the Arabian Peninsula at the moment. It is unclear whether this species extends from Jordan to the East; any citations from Saudi Arabia are in need of revision.

Further remarks: The year of publication of the original description by RAMBUR is most likely 1838 (CORAY & LEHMANN 1998).

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Tetrix bolivari SAULCY, 1901 in Azam

Material studied: 20 individuals from 4 localities, all individuals were f. macroptera.

Records: 09.08.2009 Wadi Yabis, 3♀♀ (GBIFCH00170575-77) – 07.08.2009 Wadi Kufrinja, 2♀♀ (GBIFCH00170573-74) – 17.04.2008 Wadi Karak, 2♂♂ (GBIFCH00170562-63) – 07.04.2009 Wadi Karak, 3♂♂, 1♀ (GBIFCH00170570-72, CL12004 1♂) – 05.04.2008 Dana village, 1♂, 1♀ (GBIFCH 170568-69) – 23.04.2008 Dana village, 2♂♂, 5♀♀ (GBIFCH00170564-67, CL12005-07 1♂, 2♀♀)

Widespread at higher altitudes, the records are from colline to montane levels of 400 to 1200 m asl. In Jordan *T. bolivari* is altitudinal segregated from the widespread *P. meridionalis*, which is restricted to lower altitudes. This species is widespread in the region, including most neighbouring countries to the North. All records from the region reported as *T. subulata* needs re-examination, as this temperate zone species has its nearest verified records in northern Turkey (LEHMANN & LANDECK 2007). From the western neighbouring country Israel, this species is not listed in the Fauna Palaestina (FISHELSON 1985). However, based on the description given in this book, a record from the Golan Heights given as *Paratettix ocellatus* obviously not belong to the genus *Paratettix*, and might be tentatively placed under *T. bolivari*. Records from Israel originally published as *Tetrix subulata* (BUXTON & UVAROV 1923, BODENHEIMER 1935) and as such listed in the book of FISHELSON (1985) were re-examined and transferred to *T. bolivari* by UVAROV (1942).

Taxonomic remarks: KARAMAN (1965) has separated three subspecies based on the head profile. However, DEVRIESE (1996) has synonymized these names and we also cannot justify a separation, based on the variation found in our material.

Tetrix monnerati LEHMANN, 2014

Material studied: 4 individuals from 2 localities, all individuals were f. macroptera.

Records: 09.04.2009 7.2 km south Zara Hot Springs, 1♂ (CL12008 1♂) – 09.04.2009 Wadi Weida'a, 2♂♂, 1♀ (CL12009-11: 2♂♂, 1♀)

Quite unexpected we found a hitherto undescribed species under the material from Jordan. The full description of the new species is given in LEHMANN (2014). Both records are from low elevations (-325 m bsl and 75 m asl) in the surrounding of the Dead Sea. With just these two localities known for this new discovered species, it may be vulnerable to habit changes. We consider it crucial to protect the known sites, at least until assemblage more information about this species.

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Tridactylidae

Xya pfaendleri (HARZ, 1970)

Synonyms: *Tridactylus pfaendleri palaestinae* HARZ, 1971, according to Günther, 1990 who has checked the types in the Natural History Museum in Vienna. Paratypes of this taxon from Sudan belongs to *Xya harzi* GÜNTHER, 1990. *Tridactylus pfaendleri palaestinensis* HARZ, 1975 misspelling of palaestinae Harz, 1971. *Tridactylus musicus* HARZ, 1978, preoccupied homonym of *Tridactylus musicus* Tindale, 1928 (which is a synonym of the Australian species *Tridactylus australicus* Mjöberg, 1913), compare Harz, 1979c. *Tridactylus indistinctus* HARZ, 1979b replacement name for the homonym *musicus* HARZ, 1978. Synonymized by Günther (1980, 1990) after checking the types in the Museum Genève.

Material studied: 50 individuals from 15 localities.

Records: 14.04.2008 Um Qais, 1Ad. (GBIFCH00170578) – 16.04.2008 Al Qulai'at, 1Ad. (GBIFCH00170579) – 10.08.2009 Wadi Ziglab, 4Ad. (CL12015-18 4Adults) – 08.11.2009 Wadi Ziglab, 7Ad., 1Nymph (GBIFCH00170603-10) – 07.08.2009 Wadi Kufrinja, 1Ad. (GBIFCH00170592) – 12.08.2009 Wadi Shu'yab, 2Ad., 1Nymph (GBIFCH00170593-95) – 17.04.2009 Wadi Wala, 6Ad. (GBIFCH00170589-91, CL12012-14 3Adults) – 04.04.2010 Wadi Ibn Hammad (downstream hammam), 1Nymph (GBIFCH00170611) – 08.04.2008 Wadi Ibn Hammad (upstream hammam), 2Ad. (GBIFCH00170584-85) – 07.04.2009 Wadi Karak, 4Ad. (GBIFCH00170580-83) – 10.04.2009 Wadi Hudeira, 3Ad. (GBIFCH00170586-88) – 17.08.2009 Wadi Afra, 1Adult, 2Nymphs (GBIFCH00170601-02) – 14.08.2009 Wadi Feifa, 2Nymphs (GBIFCH-00170596) – 30.05.2012 Wadi Ghuweir, 1Adult, 3Nymphs (GBIFCH00170612-13) – 16.08.2009 Wadi Musa (Petra), 3Ad., 4Nymphs (GBIFCH00170597-600).

This single Tridactylidae species is widespread in Jordan. In our sampling it is found at 15 different localities, which makes up more than 50 percent of all records. It occurs at all elevations (from -265 m bsl to 865 m asl) and can be expected at most wetlands, where the individuals borrow inside the wet sand.

Jordan has also at the heart of some taxonomic issues related to this species. The type locality of *X. pfaendleri palaestinae* Harz, 1971 lies at Wadi Musa (Petra). However the material at hand fits into the concept of a single, quite uniform species. Therefore, Günther has synonymized all material from Jordan with *Xya pfaendleri* (GÜNTHER 1980, 1990). We sampled material from the type locality at Wadi Musa and agree fully with Günther's view.

Future prospective

The collection of the second author has made it possible to get a quite extensive overview on the Tetrigidae and Tridactylidae of Jordan. The field researches were however focused on aquatic habitat as the second author was making a dragonfly study in the country. Arid and semi-arid habitats were so clearly under investigated.

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We can only encourage other colleagues to pay attention to these fascinating groups during their next visits to the region. Much might to be learned from further collections, as records before 1950 very often lacks proper separation of the species due to taxonomic lumping. Given the few individuals stored in Museums any new record will broaden our view of distribution ranges. It is for example remarkable, that *T. depressa* is not recorded from Jordan until know, given its occurrence in the neighbouring countries Israel (FISHELSON 1985) and Lebanon (GIGLIO-TOS 1893).

As the whole area suffers from severe water shortages (DINAR 2004), any wetland species might also be under constant threat. The new species *T. monnerati* (described separately in LEHMANN 2014) seems to be endemic to Jordan and is only known from two localities. This species needs special attention from the Jordan ministry of environment.

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