ISSN: 2307-7565 VOLUME 8 ISSUE 1 JUNE 2021

Jordan Journal of Natural History

الجمعية الملكية لحماية الطبيعة
RSCN
Nature Conservation Monitoring Center

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Editorial Preface

It is a pleasure to present issue of volume 8 of the Jordan Journal of Natural History (JJNH), a journal published by the Conservation Monitoring Centre, The Royal Society for the Conservation of Nature (RSCN). The Jordan Journal of Natural History (JJNH) is an open access international scientific journal publishing original research and reviews in nature history in its broadest sense. This is taken to include conservation biology, botany, geology, paleontology, zoology, and ecology, including a broad range of systematics papers encompassing traditional taxonomic revisions and descriptions, cladistics analyses and molecular phylogenetic. The editorial policy of JJNH will follow the lines of most international journals. All manuscripts received by the editor will be examined by referees, who will be instructed to judge the papers by the significance and novelty of the results reported and to favour briefness of presentation.

The editorial board will make every effort to ensure prompt processing of the manuscripts received and to widen the circulation of the journal as far as possible. A group of distinguished scholars have agreed to serve on the editorial board. Without the service and dedication of these eminent scholars, JJNH would have never existed. Now, the editorial board is encouraged by the continuous growth of the journal and its formation into a true multidisciplinary publication. We are also honored to have the privilege of working with all members of the international advisory board served by a team of highly reputable researchers from different countries across the globe. We are also delighted with our team of national and international reviewers who are actively involved in research in different natural history fields and who provide authors with high quality reviews and helpful comments to improve their manuscripts.

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At the end of this preface, would like to thank our readers and authors for their continuing interest in JJNH, and each member of our editorial and review boards for their continued hard work, support and dedication, which made it possible to bring another new issue of JJNH to the multidisciplinary international audience. We very much appreciate your support as we strive to make JJNH one of the most leading and authoritative journals in the field of Natural History Sciences.

June, 2021

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The Jordan Journal of Natural History (JJNH) is an open access international scientific journal publishing original research and reviews in nature history in its broadest sense. This is taken to include conservation biology, botany, geology, paleontology, zoology, and ecology, including a broad range of systematics papers encompassing traditional taxonomic revisions and descriptions, cladistics analyses and molecular phylogenetic. The Jordan Journal of Natural History is published by the Conservation Monitoring Centre at the Royal Society for the Conservation of Nature, Jordan.

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Hamidan, NA, Geiger, MF and Freyhof, J. 2014. *Garra jordanica*, a new species from the Dead Sea basin with remarks on the relationship of *G. ghorensis, G. tibanica* and *G. rufa* (Teleostei: Cyprinidae). *Ichthyological Exploration of Freshwaters*, 25(3): 223-236.

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Table of Contents

New Data on the Coastal Fly Fauna (Diptera: Calliphoridae, Rhinophoridae, Sarcophagidae) of the Kherson Region (Ukraine)

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Received: October 19, 2020; Revised: December 12, 2020; Accepted: December 19, 2020

Abstract: The faunistic lists for the Kherson region of Ukraine are updated based on a literature review and a recent collecting trip in August 2020. The faunas of the following oestroid families are updated: seven genera and twenty-two species of Calliphoridae, including one species [*Lucilia richardsi* Collin, 1926] recorded for the first time in this region; four genera and four species of Rhinophoridae, including two species [*Paykullia maculata* (Fallén, 1815) and *Phyto melanocephala* (Meigen, 1824)] recorded for the first time in the region; forty-four genera and eighty-eight species of Sarcophagidae. Original data on the behaviour of adult flies feeding on aphid excreta on leaves of *Lycium barbarum* Linnaeus, 1753 (Solanaceae) and flowering plants of *Seseli tortuosum* Linnaeus, 1753 (Apiaceae) are also provided.

Keywords: Two–winged insects, Species diversity, Imaginal feeding, Northern Black Sea region

Introduction

New faunistic data on the families Calliphoridae, Rhinophoridae and Sarcophagidae (Diptera: Oestroidea) are presented based on the results of a collection trip by the authors in the Kherson Region, Ukraine. The total numbers of known genera and species of these families from the Kherson Region faunas are based on an original analysis of the literature and data from the authors' collection. The listed species are classified according to the taxonomic conception of the senior author (Povolný and Verves, 1997; Verves, 1989, 1990; Verves and Khrokalo, 2006a, 2006b).

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Materials and Methods

The flies were collected with a hand net in the Lazurne village (Skadovsk district, Kherson), 46°5.13'N, 32°31.31'E, from 04. to 15.08.2020, in different habitats surrounding the "Maiak" wellness complex. The village is located in an extremely synanthropic area: the seashore consists of a longitudinal series of cultural sand beaches 100–300 m wide, behind which there are rest houses, sanatoriums, camping sites, etc. The "Maiak" complex covers an area of about five hectares, of which approximately two are wasteland. Most flies were caught on soil, leaves, and walls; others were collected separately on a bush of *Lycium barbarum* Linnaeus, 1753 (Solanaceae) near a residential building (Figures 1–2) and on the flowering plants of *Seseli tortuosum* Linnaeus, 1753 (Apiaceae) in the wasteland (Figures 3–4). Information on the Kherson regional fauna was completed through the analysis of the scientific literature on calliphorids (Makovetskaya and Verves, 2018; Szpila and Verves, 2008; Verves, 1985b, 2004, 2005c; Verves and Khrokalo, 2006a, 2010; Verves et al., 2005),

rhinophorids (Verves, 2005a, b; Verves and Khrokalo, 2010) and sarcophagids (Richet et al., 2013; Valentyuk, 1971; Verves, 1974, 1975, 1979, 1982, 1984, 1985a, 1985b, 1993, 2000a, 2000b, 2006; Verves and Khrokalo, 2006b, 2006c, 2014a, 2014b; Verves et al., 1977, 2015; Verves and Szpila, 2008, 2011) from the region.

Figure 1. Bush of *Lycium barbarum*.

Figure 2. Aphids on leaves of *Lycium barbarum.*

Figure 3. Wasteland with thickets of *Seseli tortuosum*.

Figure 4. Solitary wasp *Megascolia maculata* between flowering branches of *Seseli tortuosum.*

Results

A total of 470 specimens were collected belonging to twenty species (Table 1), among which three (*Lucilia richardsi*, *Paykullia maculata*, and *Phyto melanocephala*) are recorded for the first time for the Kherson Region.

Interestingly, specimens of L*ucilia sericata* used a *Lycium barbarum* bush, the leaves of which were populated by numerous aphids, as a kind of "fly hostel." The flies appeared *en masse* on the leaves at about seven o'clock in the morning and fed on honeydew. After nine o'clock, almost all the flies dispersed and returned to the bush at about seventeen o'clock. Usually before twenty o'clock they hid on the underside of the leaves, where they spent the night. *Bercaea africa* adults fed on honeydew only during the day, between ten and seventeen o'clock.

Table 1. Flies, collected in the Lazurne village from 4. to 15.08.2020 in different habitats.

No	Fly species	Substrates			Sum
		soil, leaves and walls	*Lycium barbarum*	*Seseli tortuosum*	
1	*Lucilia richardsi* Collin, 1926	1 (1♂)	–	–	1 (1♂)
2	*Lucilia silvarum* (Meigen, 1826)	1 (1♀)	–	2 (1♂1♀)	3 (2♂1♀)
3	*Lucilia sericata* (Meigen, 1826)	96 (51♂45♀)	81 (31♂50♀)	170 (85♂85♀)	347 (167♂180♀)
Calliphoridae, sum		**98 (52♂46♀)**	**81 (31♂50♀)**	**172 (86♂86♀)**	**351 (169♂182♀)**
1	*Paykullia maculata* (Fallén, 1815)	2 (1♂1♀)	–	1 (1♀)	3 (1♂2♀)
2	*Phyto melanocephala* (Meigen, 1824)	3 (3♀)	–	–	3 (3♀)
Rhinophoridae, sum		**5 (1♂4♀)**	**–**	**1 (1♀)**	**6 (1♂5♀)**
1	*Senotainia albifrons* (Rondani, 1859)	1 (1♀)	–	3 (2♂1♀)	4 (2♂2♀)
2	*Senotainia conica* (Fallén, 1810)	14 (6♂8♀)	–	9 (6♂3♀)	23 (12♂11♀)
3	*Senotainia deserta* Rohdendorf, 1935	6 (1♂5♀)	–	1 (1♀)	7 (1♂6♀)
4	*Pterella convergens* (Pandellé, 1895)	1 (1♀)	–	1 (1♀)	2 (2♀)
5	*Pterella melanura* (Meigen, 1824)	–	–	2 (2♀)	2 (2♀)
6	*Sarcophila latifrons* (Fallén, 1817)	6 (1♂5♀)	–	12 (3♂9♀)	18 (4♂14♀)
7	*Sarcophila meridionalis* Rohdendorf and Verves, 1982	3 (2♂1♀)	–	21 (12♂9♀)	24 (14♂10♀)
8	*Wohlfahrtia balassogloi* (Portschinsky, 1881)	–	–	1 (1♂)	1 (1♂)
9	*Helicophagella melanura* (Meigen, 1826)	1 (1♂)	–	3 (3♀)	4 (1♂3♀)
10	*Discachaeta cucullans* (Pandellé, 1896)	1 (1♂)	–	–	1 (1♂)
11	*Heteronychia haemorrhoides* (Böttcher, 1913)	4 (4♂)	–	2 (2♂)	6 (6♂)
12	*Heteronychia lacrymans* (Villeneuve, 1912)	6 (6♂)	–	2 (2♂)	8 (8♂)
13	*Bercaea africa* (Wiedemann, 1824)	–	7 (7♂)	–	7 (7♂)
14	*Liosarcophaga parkeri* (Rohdendorf, 1937)	3 (2♂1♀)	–	1 (1♂)	4 (3♂1♀)
15	*Sarcophaga lehmanni* Müller, 1922	2 (1♂1♀)	–	–	2 (1♂1♀)
Sarcophagidae, sum		**48 (26♂22♀)**	**7 (7♂)**	**58 (29♂29♀)**	**113 (62♂51♀)**
Total, sum		**151 (79♂72♀)**	**88 (38♂50♀)**	**231 (115♂116♀)**	**470 (232♂238♀)**

Discussion

According to the Povolný's classification (1963, 1971, 1976) of degrees of synanthropy, among the twenty collected species, two (10% of all species) are eusynanthropic (*Lucilia sericata, Bercaea africa*), one (5%) – is hemisynanthropic (*Helicophagella melanura*), ten (50%) – are culturophilous (*Lucilia richardsi*, *L. silvarum*, *Phyto melanocephala*, *Senotainia albifrons*, *S. conica*, *Sarcophila latifrons*, *S. meridionalis*, *Heteronychia haemorrhoides*, *Liosarcophaga parkeri*, *Sarcophaga lehmanni*), and seven (35%) – are culturophobic (*Paykullia maculata*, *Senotainia deserta, Pterella convergens*, *P. melanura*, *Wohlfahrtia balassogloi*, *Discachaeta cucullans*, *Heteronychia lacrymans*). Thus, even an insignificant area in a cultural zone with a moderate anthropogenic load can serve as a refugium for native species. For example, an adult solitary wasp *Megasacolia maculata* (Drury, 1773) (Hymenoptera: Scoliidae) (Figure 4), which is listed in the Red Book of Ukraine (Kotenko *et al.,* 2009), was collected by the researchers in this locality. Based on these results, the overall species' lists of these three families for the Kherson Region represent, at least 80% (eighty-eight species) of the potential full list for sarcophagids, 50–60% (twenty species) for calliphorids, and no more than 20–30% (four species) for rhinophorids.

Acknowledgements

The research leading to this publication received funding from "The support of the priority research areas development of Ukraine, KPKVK 6541230". The researchers are especially grateful to Dr. Igor V. Goncharenko (Institute for Evolutionary Ecology) for the identification of the plants and to the anonymous reviewers for their careful analysis of this work.

References

Kotenko, AG, Ermolenko VM and Sheshurak, PN. 2009. Scolia–Giant. In: Akimov, IA. (Ed.). Red Book of Ukraine. Animal Word. Globalconsulting, Kyiv, Ukraine, P. 227.

Makovetskaya, K. and Verves, Yu. 2018. First records of *Chrysomya albiceps* (Wiedemann, 1819) (Diptera: Calliphoridae) in Belarus with analysis of distribution of this species in Europe. *Dipteron*, **34**: 60–67.

Povolný, D. 1963. Einige Erwägungen über die Beziehungen zwischen den Begriffen "Synanthrop" und "Kulturfolger". *Beiträge zur Entomologie*, **13**: 499–544.

Povolný, D. 1971. Synanthropy of flies. *In*: Greenberg, B. (Ed.). **Flies and Disease. Vol. 1**. Princeton University Press. Princeton, New Jersey, USA, Pp. 17–54.

Povolný, D. 1976. Zoocenological relationships of the synusiae of synanthropic and non– synanthropic species of the Sarcophaginae (Diptera) in Central Europe. *Journal of Society of Biology*, **37**: 836–840.

Povolný, D and Verves, YuG. 1997. The flesh–flies of Central Europe (Insecta, Diptera, Sarcophagidae). *Spixiana*, Suppl **24**: 1–264.

Richet, R, Verves, YG, Whitmore, D and Pape, T. 2013. Revision of *Taxigramma pseudaperta* Séguy, 1941 and comparisons with sympatric *T. multipunctata* (Rondani, 1859) (Diptera: Sarcophagidae). *Zootaxa* (**3731, 4**): 520–532.

Szpila, K and Verves, Yu. 2008. *Pollenia bulgarica* (Jacentkovský, 1939) – first record from Ukraine, with faunistic notes on other blowflies in the Askania Nova Biosphere Reserve (Diptera, Calliphoridae). *Fragmenta faunistica*, **51** (**2**): 143–146.

Valentyuk, EI. 1971. The first stage larvae of species from the genus *Wohlfahrtia* B. & B., 1889 (Diptera: Sarcophagidae)

from the Crimea and northern Black Sea arena. *Vestnik Zoologii*, **5** (**3**): 78–80.

Verves, YuG. 1974. Sarcophagids (Diptera, Sarcophagidae) of the fauna of USSR. I. Tribe Sarcophagini (Sarcophaginae) (according materials of Institute of Zoology of Academy of Sciences UkrSSR). *Vestnik Zoologii*, **8** (**1**): 30–37.

Verves, YuG. 1975. Sarcophagids (Diptera, Sarcophagidae) of the fauna of USSR. II. Subfamilies Sarcophaginae (tribe Agriini), Macronychiinae and Miltogrammatinae (according materials of Institute of zoology of Acad. Sci. UkrSSR). *Vestnik Zoologii*, **9** (**2**): 73–77.

Verves, YuG. 1979. Palaearctic species of the subgenus *Spatulapica* Fan of the genus *Heteronychia* B. B. (Diptera, Sarcophagidae). *Zoological Journal,* **58** (**6**): 860–870.

Verves, YuG. 1982. 64 h. Sarcophaginae. *In*: Lindner, E. (Ed.). **Die Fliegen der paläarktischen Region, 11** (**327**), E. Schweizerbartsche Verlagsbuchhandlung (Nägele und Obermiller). Stuttgart, Germany, S. 235–296.

Verves, YuG. 1984. A check–list of species of Sarcophagidae (Diptera) of the Ukraine and Moldavia. *In*: Skarlato OA. (Ed.). **Two–winged flies of the fauna of USSR and their significance in ecosystems**. Zoological Institute. Leningrad, USSR, Pp. 17–21.

Verves, YuG. 1985a. 64 h. Sarcophaginae. *In*: Lindner E. (Ed.). **Die Fliegen der paläarktischen Region, 11** (330), E. Schweizerbartsche Verlagsbuchhandlung (Nägele und Obermiller). Stuttgart, Germany, S. 297–440.

Verves, YuG. 1985b. Flies from the families Calliphoridae and Sarcophagidae of several regions of Ukraine. *Problems of General and Molecular Biology*, **4**: 56–60.

Verves, YuG. 1989. The phylogenetis systematics of the miltogrammatine flies (Diptera, Sarcophagidae) of the world. *Japanese Journal of Medical Science and Biology*, **42**: 111–126.

Verves, YuG. 1990. Prof. Hugo de Souza Lopes and the modern system of Sarcophagidae (Diptera). *Memórias do Instituto Oswaldo Cruz* [1989], **84** (Suppl. **4**): 529–545.

Verves, YuG. 1993. 64 h. Sarcophaginae. *In*: Lindner E (Ed.). **Die Fliegen der paläarktischen Region, 11** (331), E. Schweizerbartsche Verlagsbuchhandlung (Nägele und Obermiller). Stuttgart, Germany, S. 441–504.

Verves, YuG. 2004. Records of *Chrysomya albiceps* in the Ukraine. *Medical and Veterinary Entomology*, **18**: 308–310.

Verves, YuG. 2005a. A checklist of Ukrainian Rhinophoridae (Diptera). *Studia Dipterologica*, **11** (**2**): 609–613.

Verves, YuG. 2005b. Faunistic and taxonomical notes of Rhinophoridae (Diptera) with special reference of Ukrainian fauna. *Entomological Problems*, **35** (1): 69–74.

Verves, YuG. 2005c. An annotated list of the Ukrainian Calliphoridae (Diptera). – *Proceedings of Zoological Museum of Kyiv Shevchenko National Univ*ersity, **3**: 64–121.

Verves, YuG. 2006. 5.2.3. Dipterous insects – inquilines (cleptoparasites). In: Zerova MD, Romasenko LP, Seryogina LYa and Verves YuG. **Natural insect enemies of solitary bees of the fauna of Ukraine**. Veles. Kyiv, Ukraine, Pp. 74–110.

Verves, YuG and Khrokalo, LA. 2006a. 121. Fam. Calliphoridae. In: Sidorenko, VS. (Ed.), **Key to the Insects of Russian Far East 6** (**4**), Dalnauka. Vladivostok, Russia, Pp. 13–60.

Verves, YuG and Khrokalo, LA. 2006b. 123. Fam. Sarcophagidae – sarcophagids. In: Sidorenko, VS. (Ed.), **Key to the Insects of Russian Far East 6** (**4**), Dalnauka. Vladivostok, Russia, Pp. 64–178.

Verves, YuG and Khrokalo, LA. 2006c. Review of Macronychiinae (Diptera, Sarcophagidae) of the world. *Vestnik Zoologii*, **40** (3): 219–239.

Verves, YuG and Khrokalo, LA. 2010. The new data on Calliphoridae and Rhinophoridae (Diptera) from Ukraine. *Ukrainian Entomofaunistics*, **1** (**1**): 23–54.

Verves, YuG and Khrokalo, LA. 2014a. An annotated list of the Sarcophagidae (Macronychiinae, Miltogramminae, Eumacronychiinae and Paramacronychiinae) recorded in Ukraine (Diptera). *CESA News*, **95**: 1–47.

Verves, YuG and Khrokalo, LA. 2014b. An annotated list of the Sarcophaginae (Sarcophagidae) recorded in Ukraine (Diptera). *CESA News*, **101** (1): 7–81.

Verves, Yu. G. and Khrokalo, L. A. 2015. Review of Heteronychiina (Diptera, Sarcophagidae). *Priamus*, Suppl. **36**: 1–60.

Verves, YuG, Kotenko, AG and Nikitenko, GN. 1977. Sarcophagids (Diptera, Sarcophagidae) of the steppe zone of the Ukraine. I. Sarcophagids in the Kherson Region. *Vestnik Zoologii*, **11** (**3**): 62–66.

Verves, Yu, Radchenko, V and Khrokalo, L. 2015. A review of species of subtribe Apodacrina Rohdendorf, 1967 with description of a new species of *Apodacra* Macquart, 1854 from Turkey (Insecta: Diptera: Sarcophagidae: Miltogramminae: Miltogrammini). *Turkish Journal of Zoology*, **39** (**2**): 263–278.

Verves, Yu and Szpila, K. 2008. *Miltogramma drabermonkoi* sp. n. from Ukraine (Diptera: Sarcophagidae: Miltogramminae). *Polish Journal of Entomology*, **77**: 57–61.

Verves, Yu and Szpila, K. 2011. *Agriella gavrylenkoi*, a new species of fleshfly from Ukraine (Diptera: Sarcophagidae: Sarcophaginae). *Polish Journal of Entomology*, **80**: 123–128.

The Conservation Status of Woodchat Shrike *Lanius senator* in Armenia

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Received: November 30, 2020; Revised: December 20, 2020; Accepted: January 2, 2021

Abstract: The population of Woodchat Shrike was monitored in Armenia from 2003 to 2019. The species was found in Southern and South-eastern Armenia, inhabiting the semi-desert and the lower belt of juniper woodlands at an elevation ranging from 450 to 1500 meters above sea level. Its extent of occurrence is estimated at 4,513 km^2 and its area of occupancy – at1,968 km^2. In 2019, the population was estimated at 5,370 – 11,100 breeding pairs. The population trend shows a moderate decline during the period 2003-2019 ($p<0.01$), being reduced to 32% during the past decade (2010-2019). There are no direct threats to the species, but it declines in the lands transformed under horticultural needs and in the vicinities of an open-pit metal mine. The conservation status of the species is evaluated as Vulnerable according to criteria A2b+B1+B2abv. The following measures for the conservation of this species are suggested: (1) officially designate the proposed Emerald Sites and begin the development of some monitoring and management plans, (2) carefully assess every new horticultural project, which could occupy the native semi-deserts; (3) introduce new schemes in livestock husbandry for a sustainable grazing in semi-desert areas; (4) study the causes behind the species' decline in the vicinity of the mining areas, (5) raise public awareness about the species, and (6) continue with the species monitoring.

Keywords: Woodchat Shrike, *Lanius senator*, Armenia, Distribution, Population Trend, Conservation status.

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Introduction

Armenia is a small (29,743 km^2) landlocked mountainous country in the South Caucasus, located between the Black and Caspian Seas. The country's elevation range that varies from 375-4090 m above sea level creates varying climatic conditions, which result in different biomes that include semi-desert, juniper woodland, deciduous forest, mountain steppe, and sub-alpine. The terrain is rugged, and typically consists of variously-shaped rock outcroppings. The semi-desert, juniper woodland, and the lower belt of the tragacanth dominated mountain steppes belong to the arid types of habitat (Aghababyan *et al*. 2015, Fayvush and Aleksanyan 2016). These habitats are home to Woodchat Shrike *Lanius senator* (Adamian and Klem 1999, Aghababyan 2001), a species which is listed in the National Red Book as Vulnerable VU B1ab(iii)+2ab (iii) (Aghasyan and Kalashyan 2010). In Armenia, the species is represented by the subspecies *L.s. niloticus* (Bonaparte, 1853) (Figure 1), which is distributed across Cyprus, Southern and Easter Turkey, east to Transcaucasia, Northern Iraq, Kuwait, and Iran (Yosef and ISWG 2020). Currently, ten years after the last assessment, it is time to review the species status, taking into consideration the plans of the Armenian Ministry of Environment regarding the publication of the next edition of the Red Book of Animals of Armenia in 2022. Therefore, the current paper is aimed at documenting the current distribution, abundance, and population trends of the Woodchat Shrike, as well as discussing the existing and potential threats in addition to the current and necessary conservation measures.

Figure 1. Female of Caucasian Woodchat Shrike *Lanius senator* niloticus. Photo by V. Petrosyan.

Material and Methods

Early Woodchat Shrike's observations in Armenia recorded in the literature were collated and summarized in Adamian and Klem (1999). Systematic data collection of the breeding birds of Armenia, including the data collected for the Woodchat Shrike began in 2003 with the start of the National Bird Monitoring Program. All of Armenia was divided into 374 100 km^2 squares, following the standard 10 x 10 km Pan-European Monitoring Grid (Council of Europe 2018). In total, during the period 2003-2019, the 325 squares were visited at least once during that period, and over the 147 squares, the data were collected systematically: annually or once every 2-5 years (Figure 2). The data of 2003-2019 were obtained through general observations, and through standardized transect counts of a 1 or 2 km length. All of the collected records were used to create species-specific distribution maps, and only the standardized counts were used to estimate the population size and trends.

General observation data were collected by experienced birders and consisted of the observation dates, species, geographic coordinates of sighting, or if not known, the 10 x 10 km block, the nearest landmark (a human settlement, mountain, or historical site), the breeding condition if detectable, and the names of observers and their contact information. Standardized counts of the Woodchat Shrike were conducted from May to June in the morning, when birds were most active, and consisted of walking slowly along a 1 or 2 km fixed transect route, which usually took from one to two hours (Voříšek *et al*. 2008). The birds were detected with the naked eye, and when necessary, were identified using 8X or 10X binoculars. All the seen individuals within a 200 m stripe were recorded in the data collection protocols, and were later transferred into the single database for processing. The detailed information about each transect included: date, beginning and ending time, beginning

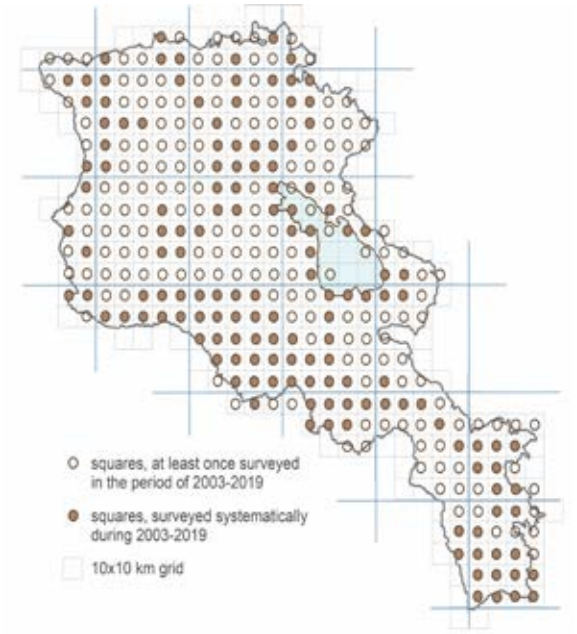

Figure 2. Surveys of breeding birds, conducted in Armenia in 2003-2019.

and ending geographic coordinates, whether individuals were seen and/or heard, and all observers. Initially, the transects have been selected randomly within a core type of habitat and were then fixed, to be counted once per annum. Because the number of bird counters has continued to grow since 2003, the number of transects also increased gradually. In total, during the period 2003-2019, the 281 transect counts in the habitat of the Woodchat Shrike have been implemented, starting with thirteen transects between 2003-2007 and ending with eighteen transects during the period 2008-2019.

The analysis of population trend was implemented using TRIM 3.0 software (Van Strien *et al.* 2004). A Collated Index of abundance was calculated, then the deviations from the Index were calculated and analyzed over time using log-linear Poisson regression, and were graphed as a linear function to reveal the population changes in the period 2003-2019 (Figure 5). The TRIM output identifies six possible population trends: strong increase, moderate increase, stable, moderate decline, steep decline, or uncertain (Pannekoek and van Strien 2005). The ArcGIS 10.0 software was used to map species distributions within Armenia. The area of species occupancy (AOO) and the extent of the species' occurrence (EOO) were computed using IUCN guidelines (IUCN Standards and Petitions Committee 2019). To compute the AOO, the researchers have multiplied the number of occupied cells by the area of an individual cell, taking 4 km^2 (2x2 km) cells as the reference scale. To compute the EOO, the rule of minimum convex polygons (the smallest polygon in which no internal angle exceeds 180° and which contains all the sites of occurrence) was applied for the species' AOO, excluding discontinuities and disjunctions within the overall distribution inside the borders of Armenia.

To assess threats to the species, interviews were conducted with local farmers and government employees within National Park Arevik and State Inspectorate for Nature Protection and Mineral Resources. The interviews with the farmers were semi-structured and were implemented as face-to-face questioning using questionnaires that contained the following questions: (1) Do they know about the existence of the Woodchat Shrike in the vicinity of their orchards; (2) Are they aware that the Woodchat Shrike is included in the Red Book; (3) Are they aware of any of the possible threats facing this species, and if so, what are those threats? (4) Are they aware that the new orchards can potentially harm the red-listed species. The interview with the State Inspectorate was conducted in a free manner, without specific questions prepared in advance, and was aimed at discovering the efforts of the Inspection in the conservation of the species and its major habitats, the main issues, which the Inspection has revealed, and the appropriate measures, which have been, or could be, undertaken to mitigate the identified issues.

Results

Distribution, population, and threats in Armenia

During the period 2003-2019, the Woodchat Shrike was recorded in Southern and South-eastern Armenia (Figure 3), inhabiting various types of semi-deserts and the lower

belt of juniper woodlands at the elevation range of 450 to 1500 meters above sea level (Figure 4). The main characteristic of the chosen habitats is the existence of relatively tall (at least 1.5 m) bushes, mainly represented by Christ's thorn (*Paliurus spina-christi* Mill.), Pallas' Buckthorn (*Rhamnus pallasii* Fisch. & C.A. Mey.), and sometimes, the wild rosehip (*Rosa* sp.), where the species makes nests, and uses those as posts for searching prey.

The extent of occurrence of Woodchat Shrike in Armenia is estimated at 4,513 km^2 and the area of occupancy is estimated at 1,968 km^2. In 2019, the population was estimated at 5,370 – 11,100 breeding pairs. The population trend shows a moderate decline during the period 2003-2019 ($p<0.01$; Wald-Test = 14.29, df = 15, P = 0.5040; overall slope parameters: additive = -0.0241, standard error = 0.0067, multiplicative = 0.9762, standard error = 0.0065 (Figure 5). According to the calculated trends, the difference between the trend's value in 2010 and in that of 2019 makes 32%, which indicates a reduction of the population over the past decade. There are no direct threats listed facing the Woodchat Shrike in Armenia. However, the species definitely declined in the lands transformed under agricultural needs – orchards and arable fields, as well as in the vicinities of open-pit metal mines.

Discussion

The species shows no changes in its historical distribution at the 10x10 km resolution, but in some sites of the Ararat Plain and Meghri district, it disappeared at the spots where new orchards and new fields for livestock fodder have been intensively developed over the period between 2003 and 2015. The new fields either destroy the initial semi-desert habitat, or transform it into orchards with large trees, or into monocrop legume fields with no bushes in the surroundings.

Meanwhile, the Woodchat Shrike shows a population decline, which is not directly linked to the occupation of the lands by the arable lands. Such decline could be explained by the following factors.

Figure 3. Distribution map of Woodchat Shrike in Armenia.

Figure 4. Typical habitat of Woodchat Shrike in Ararat Province of Armenia. Photo by K. Aghababyan.

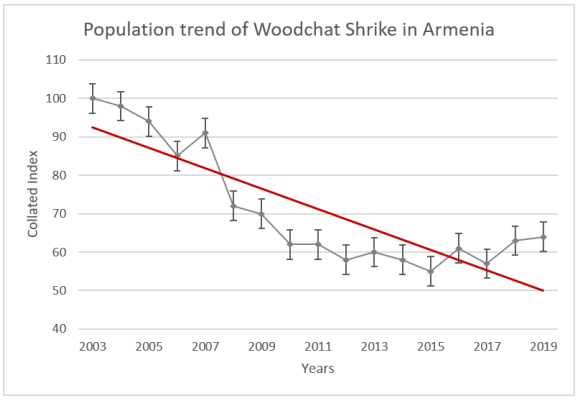

Figure 5. Population trend of Woodchat Shrike in Armenia during2003-2019.

The semi-desert areas, which are already scarce in herbal vegetation, are grazed quite heavily; this causes a change in plant composition, and accordingly – the elimination of insects, as was demonstrated in a recent study of Armenian

butterflies (Aghababyan, unpublished). Insects are the main food of the Woodchat Shrike (Adamian and Klem 1999, Aghababyan 2001, Yosef and ISWG 2000), and their elimination could lead to the decline of the Shrike as well. Also, the Shrikes' decline was recorded in the vicinity of a copper and molybdenum open-pit mine in Agarak, but the link between the operation of the mine and the species decline remains uncovered. Also, the pairs which breed next to the orchards can potentially suffer under the use of persistent pesticides, which can become accumulated through the food chains, but for the time being, there is no evidence on that.

Currently, a portion of the Woodchat Shrike's population is protected in Khosrov Forest State Reserve and National Park Arevik, but the majority of the population remains unprotected. Some areas of its distribution (Vanand, Metsamor, Noravank, Jermuk Gorge, and Arevik) have been identified as candidate Emerald Sites (Fayvush *et al.,* 2016), but the areas are not yet officially recognized; therefore, no management plans for those sites have been developed.

Taking into account the declining population trend of the species (over 30% in the last decade) and the EOO (3,907 km^2), as well as the AOO (1,967 km^2), the species remains in the same category, Vulnerable, for the next issue of the Red Book of Animals of Armenia; however the criteria should be modified into: VU A2b+B1+B2abv (IUCN Standards and Petitions Committee 2019). To protect the species, the following conservation measures are suggested: (1) officially designate the proposed Emerald Sites and begin the development of monitoring and management plans for those Sites, (2) carefully assess every new horticultural project, which presumes the occupation of the native semi-desert landscape; (3) review the policy of livestock husbandry and introduce new schemes, which can secure sustainable grazing in semi-desert areas; (4) further study the causes of the species' decline in the vicinity of mining areas, (5) increase all means of raising public awareness regarding this species, and (6) continue with the species' monitoring to track its further population trend and the efficiency of the undertaken conservation measures.

Acknowledgements

The monitoring of this species in Armenia was supported by members of the Armenian Birdwatching Association. Data collection was supported by the Observation Foundation. Over the period 2015–2017, this survey was also supported by the European Bird Census Council (EBCC) via a grant from the MAVA Foundation for the European Breeding Bird Atlas EBBA2. The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH supported Environmental Programme contributed to the data analysis. Administrative support during the study of this species was provided by the Ministry of Environment of RA, Khosrov Forest State Reserve and the Arevik National Park.

References

Adamian, M and Klem, D. 1999. **Handbook of the Birds of Armenia**. American University of Armenia, California.

Aghasyan, A and Kalashyan, M. 2010. **The Red Book of Animals of the Republic of Armenia**. Yerevan, Ministry of Nature Protection.

Aghababyan, K. 2001. **Some Peculiarities of the Vertical Distribution, Breeding Biology and Ecology of Birds in Meghry Region of Armenia**. PhD thesis, National Academy of Sciences of the Republic of Armenia, Institute of Zoology. [in Russian]

Aghababyan, K, Ter-Voskanyan, H, Tumanyan, S and Khachatryan, A. 2015. First National Atlas of the Birds of Armenia. *Bird Census News*, **28 (2)**: European Atlas News 52–58.

Council of Europe. 2018. Transfer of National Data to Pan-European 10x10 km grid for Non-EU contracting parties to Bern Convention (Guidance Document). European Topic Centre on Biological Diversity. Strasbourg, 27 September

2018. T-PVS/PA (2018) 14. 42 pp.

Fayvush, G and Aleksanyan A. 2016. **Habitats of Armenia**. Zangak, Yerevan.

Fayvush, G, Arakelyan, M., Aghababyan, K., Aleksanyan, A., Aslanyan, A., Ghazaryan, A., Oganesyan, M., Kalashyan, M and Nahapetyan, S. 2016: In: **The "Emerald" Network in the Republic of Armenia**. Baloyan S. (Eds), Yerevan. Ministry of Nature Protection.

IUCN Standards and Petitions Committee. 2019. **Guidelines for Using the IUCN Red List Categories and Criteria**. Version 14. Prepared by the Standards and Petitions Committee. 113 pp.

Pannekoek, J and van Strien, A. 2005. **TRIM 3 Manual (Trends and Indices for Monitoring data)**. Statistics Netherlands. Retrieved from https://www.ebcc.info/art-13/ on 16th of Dec 2019.

Van Strien, A., Pannekoek, J., Hagelmeijer, W and Verstrael, T. 2004. **A Loglinear Poisson Regression Method to Analyse Bird Monitoring Data.** In: Anselin, A. (Eds.) Bird Numbers 1995, Proceedings of the International Conference and 13th Meeting of the European Bird Census Council, Pärnu, Estonia. Bird Census News 13 (2000): 33-39.

Voříšek, P., Klvaňová, A., Wotton, S and Gregory R.D. 2008. **A Best Practice Guide for Wild Bird Monitoring Schemes.** First edition. RSPB/CSO.

Yosef, R. and ISWG International Shrike Working Group. 2020. Woodchat Shrike (*Lanius senator*), version 1.0. In: **Birds of the World,** del Hoyo J., Elliott, A. Sargatal, J. Christie, D.A and de Juana, E. (Eds). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bow.wooshr1.01

Olive Groves' Avifauna in Lebanon: The Composition of Bird Species and the Importance of the Inter-Relation Olive Ecosystem and Bird Diversity

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Received: December 7, 2020; Revised: January 24, 2021; Accepted: January 29, 2021

Abstract: This study deals with the composition of the avifauna in the olive groves of the West Beqaa Valley and Rachaya, and the interrelation between birds and olive groves. The study documents the breeding of twenty-two bird species in these olive groves, as well as the existence of twenty-six breeding species in the study site coming from the neighboring habitats. In addition, twenty-five species were recorded as passage migrants and/or winter visitors. The benefits provided by olive groves to the various species of the studied birds and the services in return offered by birds to the olive trees are discussed. This is the first study in Lebanon that is dedicated to the study of olive groves and their birds. It demonstrates that the interrelation between birds and olive groves is a perfect example for the understanding of the importance of biodiversity in developing agricultural production and improving its quantity and quality.

Keywords: Avifauna, Birds, Olive groves, Pests, Biodiversity, Lebanon.

Introduction

Olive groves are the basic tree cultivation in the Mediterranean and dominate the rural landscape (Loumou and Giourga, 2003). In this man-made habitat (Figure 1: Photo of typical olive groves viewed in Rachaya), many species, including birds, have adapted to and found elements of their ecological niche in it (Rey and Gutiérrez, 1996).

In Lebanon, this habitat covers a national surface area of 58000 ha (Ministry of Agriculture [MoA], 2018), of which, the authors studied 1084 ha in the Rachaya District under the project "Assessing the Biodiversity Value of Olive Sites in Mount Hermon KBA and Identifying the Environmental Impacts of Various Agricultural Practices."

The project was managed by Environment For Life NGO (EFL), and was funded by Critical Ecosystem Partnership Fund (CEPF). Also,1121 ha in West Beqaa (Aitanit, Ain Zibdeh and Khirbet Qanafar) were studied under the project "Building the Ecologic and Socio-economic Resilience of the Shouf Mountain Landscape by Restoring and Strengthening the Socio-cultural Fabric which Sustains its Biodiversity and Cultural Values."

The project was conducted in the eastern parts by the Society for the Protection of Nature NGO (SPNL), and was funded by MAVA Foundation. The studies took place during the springs (March-May) of 2018, 2019, 2020 and the autumns (mid-August-November) of 2018 and 2019. The undertaken surveys showed that the olive groves host seventy-three bird species including breeding resident birds, breeding summer visitors, wintering and passage migrant species. The main localities mentioned in the text (Rachaya and West Beqaa) are shown in Figure 2.

Materials and Methods

The methodology used depended on the objectives of the present study which are to determine the bird species that breed, feed, and roost in olive groves, and their phenological and conservation statuses, and their frequency and abundance. Accordingly, the study area was surveyed during the springs of 2018, 2019, and 2020 with the

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Figure 1. Olive groves at Rachaya District.

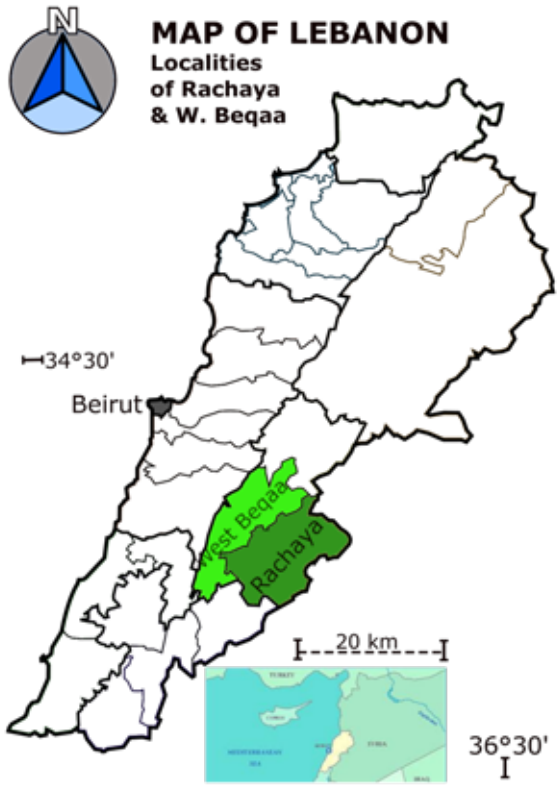

Figure 2. Location of study sites on the map of Lebanon.

Point Count Method and during the autumns of 2018 and 2019 with the Linear Transect Method, often between 08:00 and 16:00.

The Point Counts Method used is the one described by Blondel, J., Ferry, C. and Frochot, B. (1981). The spring points are randomly selected within a stratified sampling process to provide representative samples of the study area. In each point, the observer remained immobile and recorded all pairs of birds encountered within a circle of a 200-meter diameter. Twenty minutes were enough for the nesting birds to return or leave the nest to feed or bring food, as the parents cannot generally stay away from the eggs or the nestlings for more than twenty minutes. During autumn, the observer traversed with slow paces linear transects of 500 meters each with stops at intervals of 100 meters where he recorded all species and individuals seen or heard on both sides of the transects and up to 100 meters; also he recorded all food searched and eaten, when possible.

The researchers established 14 four-hectare plots representing olive groves of West Beqaa (Khirbet Qanafar, Ain Zibdeh and Aitanit) and 14 four-hectare plots at Rachaya, where one visit per month was made in each of the two sites and seven plots were studied per visit. Surveys, foraging observations, and nest searches were conducted on each plot (Point Count) during the springs and autumns mentioned above.

In addition, all shrubs, stone walls, and electric lines and poles on each plot were recorded. This study enabled the researchers to clarify the ecological interrelationships that exist in olive groves.

At the end of the study, the researchers analyzed the data collected and the details obtained from the methodologies applied in this study. Birds passing over head, without using the study area as a stopover, were all recorded but not used in the analysis of the data.

Results

The total number of bird species recorded in the olive groves in spring and autumn was seventy-three different species, whereas, the average richness per survey-plot was 4.5 species in West Beqaa and 4.34 in Rachaya with no significant difference ($P < 0.005$). Out of the seventy-three species, sixty-six are shared by both sites.

Out of the total number of species, twenty-six species are classified as resident breeding in Lebanon, but the status of some of them in olive groves may not be similar to that of the national ones (Ramadan-Jaradi, *et. al*., 2020); i.e., they were not observed breeding at the study sites. Those that were recorded as resident breeding in the olive groves belong to ten species: the Barn Owl *Tyto alba* (in open groves with ancient trees with cavities), the Tawny Owl *Strix aluco* (in ancient trees with cavities), the Eurasian Hoopoe *Upupa epops* (in ancient trees with cavities), the White-spectacled Bulbul *Pycnonotus xanthopygos* (in trees), the Graceful Prinia *Prinia gracilis* (in ground grassy or bushy understory), the Sardinian Warbler *Curruca melanocephala* (in brambles and thorny bushes between olive trees), the Common Blackbird *Turdus merula* (in trees), the Western Black Redstart *Phoenicurus (ochuros) ochruros* (in stone walls of terraces or old houses of farmers), the House Sparrow *Passer domesticus* (in houses within the olive groves, but preferably roosts in the latter, and the European Goldfinch *Carduelis carduelis* (in trees).

Twenty-five species are considered as summer breeders (migrants or non-residents that breed in Lebanon, usually after their arrival in April), and were recorded in the studied olive groves. Out of those, twelve species nest within the olive groves; they include: the European Turtle Dove *Streptopelia turtur,* the Red-backed Shrike *Lanius collurio,* the Masked Shrike *Lanius nubicus,* the Eastern Olivaceous Warbler *Iduna pallida*, the Upcher's Warbler *Hippolais languida,* the Olive-tree Warbler *Hippolais olivetorum,* the Eurasian Blackcap *Sylvia atricapilla,* the Lesser Whitethroat *Curruca curruca,* the Eastern Orphean Warbler *Curruca crassirostris,* the Common Whitethroat *Curruca communis,* the Rufous-tailed Scrub Robin *Cercotrichas galactotes,* and the Spotted Flycatcher *Muscicapa striata.*

Some of the remaining recorded species 1) may breed in shrubs, trees, or on the ground outside the olive groves (e.g. the Woodchat Shrike *Lanius senator*, the European Greenfinch *Carduelis chloris*, the Common Chaffinch *Fringilla coelebs*); generally, they are mainly those that are considered as "visitors" to the olive groves; and 2) they may be birds of passage such as the following five migratory raptor species that used the olive grove as a stopover or as a roosting site: (the Honey Buzzard *Pernis apivorus*, the Lesser Spotted Eagle *Clanga pomarine*, the Short-toed Snake Eagle *Circaetus gallicus*, the Eurasian Sparrowhawk *Accipiter nisus,* the Common Buzzard *Buteo buteo*) or such as the European Stonechat Saxicola rubicola, the Collared Flycatcher (*Ficedula albicollis*, and the Song Thrush *Turdus philomelos*).

One migratory pigeon (the Common Woodpigeon *Columba palumbus*) has participated in the late autumn with the summer breeding Turtle Dove *Streptopelia turtur* and the resident breeding Rock Pigeon *Columba oenas* in swallowing olive fruits. Other birds that belong to the warbler group, particularly of the family Sylviidae, were recorded pecking olive fruits, but sometimes swallowing small ones that fit their gape width as in the case of shrubby wild olive trees (Rey and Gutiérrez, 1996) or in ancient olive trees (Saleem Hamadeh, pers. comm.).

Two breeding species, the Turtle Dove (Figure 3) and the Syrian Serin (Figure 4) are considered Vulnerable following the

IUCN Red List (BirdLife Datazone, 2020 a & b).

During the surveys the researchers recorded all the species that were seen feeding on olive fruits on the trees or on the ground, and if they were swallowing the whole fruits or pecking the pulps only. Four species of the family Columbidae and six species of the family Turdidae (the Ring Ouzel *Turdus torquatus,* the Common Blackbird *Turdus merula,* the Fieldfare *Turdus pilaris,* the Redwing *Turdus iliacus,* and the Song Thrush *Turdus philomelos*) were observed swallowing whole olive fruits, possibly to avoid the bitter taste of olives. Twelve species of warblers were seen swallowing the small fruits of olive; otherwise, they were pecking pieces of the pulp of large fruits. Finally, in this study, ten species were found pecking pieces of olive fruits but not swallowing even the small ones.

These include: the Rufous-tailed Scrub Robin *Cercotrichas galactotes,* the European Robin *Erithacus rubecula,* the European Greenfinch *Chloris chloris* and the European Goldfinch *Carduelis carduelis.* However, all the species eating olives have shown preference to ripened fruits or to the infested ones by pest insects.

Figure 3. Turtle Dove at West Beqaa

Figure 4. Syrian Serin at Rachaya

Discussion

The persistence of olive groves in West Beqaa and Rachaya, as well as in other areas in Lebanon, is threatened by increased human agglomeration, abandonment of olive groves, fuel wood harvest, range management, diseases caused by insects, fungi and bacteria, and by the slow regeneration of trees. Olive groves are extremely valuable to wildlife not only because of the high food value of olive fruits but also because they support an abundant insect fauna. These insects support large breeding bird populations, and provide an important food source to bird migrating between wintering and breeding grounds.

The recording of twenty-two breeding bird species in an apparently monotonous and homogeneous habitat of olive trees, demonstrates the importance of this landscape. However, this richness is supported by other aspects of the olive grove landscape, i.e., the many small habitats found under the canopy of the trees. The presence of shrubs, scrubs, hedges, grass, water courses, pools, and the proximity of the groves to other groves, chiefly of fleshy fruits (plum, pears, beach, cherry, etc.) or wild maquis, garrigues and batha, have all contributed to an increased diversity of the elements of the ecological niches of the various bird species in the olive groves.

Close numbers of species were observed in olive groves in Greece (Poirazidis *et al*., 2011). In addition, the traditional management of the olive groves has also contributed to the high avian diverse richness, where the light grazing, by sheep or goats, of the herbaceous layer under the olive trees, as well as the presence of wall stones, and the ancient trees full of cavities, have also helped increase the biodiversity of the olive groves.

Historically, farmers at the time of olive fruit

collection used to leave some olive fruits on the trees for birds to eat during winter times.

Despite the fact that in the near past, farmers used to consider *Turdidae* spp. as pest birds to olive trees, it is now obvious to all that the *Turdidae* and other birds benefit the trees and offer services to them and vice versa. Bigler, *et al.* (1986) indicated that the olive fruits eaten by the birds mostly contained larvae, which indicates that birds do not have a negative impact on production, and that birds consumed 65–71% of the pupae in soil, and ants attacked most of the rest (Pienkowski and Beaufoy, 2000). In another study, Cavalloro and Delrio, 1975 said that birds were one of several important predators of the Olive Fruit Fly pupae along with ants, beetles and centipedes.

In the current study, the tiny Olive Fruit Fly *Bactrocera olea* is found to be the most harmful pest to olive trees and fruits in Lebanon (MoA, 2019). The female lays its eggs in the olive fruits and the maggots (larvae) stay in the fruits during the summer causing the early fall down of the fruits on the ground, and then the larvae pass the winter in the soil (MoA, 2019). The fallen olive fruits are premature and small in size, which makes them swallowable with the larvae not only by the *Turdidae* and *Columbidae* but also by the *Sylviidae* and most of the other species recorded in the study.

The larvae that leave the olive fruit make the pupae in the soil, but the ground feeding birds help in finding and devouring them. The flying Olive Fruit Flies are an appropriate prey to flycatchers, swallows and swifts, especially that the appearance of these birds is synchronized with that of pest insects of olive trees. The second harmful pest is the tiny Olive Moth *Prays olea* that attacks olive fruits before the stone is hardened and causes them to prematurely fall from the tree after the small larvae emerge to go and attack the leaves.

Here again the small insectivorous birds (such as the Graceful Prinia, the Black Redstart, the Willow Warbler, and the Olivaceous Warbler) lurk to devour the moth and its larvae, and to eat the small fruits that fell to the ground. On several occasions, the researchers observed the House Sparrow, which usually nests in premises but roosts in the olive grove, feeding in the early morning on the wet and immobilized moths on the branches.

The third harmful pest is the Olive Tree Borer that may kill a young tree with one larva (MoA 2019). Its large larvae and adults are attractive to many bird species in this study area, ranging from kestrels, to woodpeckers, bulbuls, shrikes and warblers. The fourth harmful pest is the Olive Bark Midge *Resseliella oleisuga,* and its larvae feed under the bark, getting to cut off the sap flow and the branches dried (Alvarado, *et al.,* 2006).

However, most of small insectivorous birds and birds eating olive fruits can significantly reduce the population of this pest (Paloma Budia, 2012). Finally, it is worth mentioning that another role for the birds that swallow the whole olive fruit is that they contribute to the dispersal of the seeds by defecation elsewhere in the wild.

Unfortunately, there are still olive farmers who are not aware of the benefits which birds provide to improve the quality and quantity of their yield by eliminating insect pests. They still lease their farms to hunters (targeting Thrushes and other species) in every hunting season. If they knew the value of birds, they would prevent hunting on their lands.

The researchers hope that the results of this study, as well as other wildlife studies currently being conducted in olive groves will contribute to the wise management and understanding of agriculture heritages and their associated wildlife populations.

Acknowledgement

The authors would like to thank Mr. Assad Serhal who provided them with the opportunity and facilities to monitor the birds in the olive groves in West Beqaa. Also, the authors are grateful to Dr. Saleem Hamadeh for encouraging them to study the relationship between olive groves and their

associated birds. Finally, sincere gratitude is extended to Mr. Sharif Jbour for his support and the suggestions during the surveys of the olive groves at Rachaya.

References

Alvarado, M, Durán, JM, González, MI, Serrano, A (Junta de Andalucía, Sevilla España. Lab. de Sanidad Vegetal); et al. 2006. Studies on Resseliella oleisuga (Targioni-Tozzetti, 1886) (Diptera: Cecidomyiidae), olive bark midge, in Seville (Spain). *FAO, AGRIS* (2006). https://agris.fao.org/agris-search/search.do?recordID=ES2006002116

Bigler, F, Neuenschwander, P, Delucchi, V and Michelakis, S. 1986. Natural enemies of preimaginal stages of Dacus oleae Gmel. (Dipt., Tephritidae) in Western Crete II. Impact on olive fly populations. *Bollettino del Laboratorio di Entomologia Agraria Filippo Silvestri*. **43**:79-96.

BirdLife International RedList. 2020a. Retrieved on 5/12/2020. http://datazone.birdlife.org/species/factsheet/european-turtle-dove-streptopelia-turtur

BirdLife International RedList. 2020b. Retrieved on 5/12/2020. http://datazone.birdlife.org/species/factsheet/22720053

Blondel, J, Ferry, C and Frochot, B. 1981. Point counts with unlimited distance. *Studies in Avian Biol.,* **6**: 414-420.

Cavalloro, R and Deliro, G. 1975. Observation on the distribution and survival of *Dacus olea* pipae in the soil. Redia **56**: 167-176.

Loumou, A and Giourga, Ch. 2003. Olive groves: "The life and identity of the Mediterranean". *Agriculture and Human Values* **20**: 87–95.

MoA, 2018. Retrieved on 19/11/2020. https://www.google.com/zrees+in+Lebanon&rlz=1C1CHBF_j4&sourceid=chrome&ie=UTF-8

Paloma Bengochea Budia. 2012. Ecotoxicology of pesticides on natural enemies of olive groves. Potential of ecdysone agonistis for controlling Bactrocerca oleae (Rosssi) (Diptera: Tephritidae). Tesis Doctora. Universidad Politecnica de Madrid.

Pienkowski, M and Beaufoy G. 2000. The environmental impact of olive oil production in the European Union: Practical options for improving the environment impact. European Forum on Nature Conservation and Pastoralism and the Association para el Analisis y Reforma de la Politica Agro-rural.

Ramadan-Jaradi, G, Itani, F, Hogg, J, Serhal, A and Ramadan-Jaradi, M. 2020. Updated checklist of the birds of Lebanon, with notes on four new breeding species in spring 2020. *Sandgrouse* **42**: 186-238.

Rey Pedro and Gutiérrez. JE. 1996. Pecking of Olives by Frugivorous Birds: A Shift in Feeding behaviour to Overcome Gape Limitation. *Journal of Avian Biology*. 27: 327-333.

Poirazidis, K, Karris, G and Martinis, A. 2011. Birds biodiversity in organic olive grove: a case study from Zakynthos Island. Conference: International Conference for Organic Agriculture and Agro-ecotourism in the Mediterranean. At: Zakynthos Island, Greece. ISBN: 978-960-85961-7-7.

A Quantitative Analysis of the Woody Vegetation in Ajloun Forest Reserve-Jordan

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Received: December 7, 2020; Revised: February 6, 2021; Accepted: February 19, 2021

Abstract: Ajloun Forest Reserve was established to conserve the evergreen oak (*Quercus coccifera* L.), which is one of the only four forest types that have been recorded in Jordan. There are many forces which cause degradation for such ecosystems, including natural (low rainfall, drought) and human (overgrazing, firing, woodcutting) factors. The objective of this study is to assess the status of vegetation structure in terms of the existing woody species using vegetation attributes. This will provide scientific-based tools for the management to identify the trend of the forest. The survey was carried out in October 2016 using 102 macro-plots with a micro-plot located in the center. The woody plants were classified into three basic classes: trees, shrubs, and climbers; also their regeneration and their vegetation attributes (density, frequency, abundance, and their relatives) were calculated. The results revealed that the estimated woody area is 54% and the ground cover is 46% of the reserve. As for the tree layer, *Quercus coccifera* L. exhibited the highest values and *Phillyrea latifolia* L. showed the lowest values. Trees' regeneration showed the same trend. As for eclimbers' layer, *Smilex aspera* L. showed the highest values, while *Ephedra aphylla* Forssk. has the lowest values. The same results apply to the climbers' regeneration. As for the shrubs' layer, *Cistus creticus* L. recorded the highest values and *Ruta chalepensis* L. recorded the lowest values. As for their regenerations, *Cistus creticus* L. recorded the highest values while some species recorded a zero value. The structure of the Ajloun Forest Reserve is composed mostly of *Quercus coccifera* L. with high values of density parameter. The regeneration is concentrated in the east, north, west, and center of the reserve, while the south and south-west areas displayed the least values of regeneration which may be attributed to the existence of little canopy cover, grazing and the fact that it is more exposed to sunlight (south facing). *Rhamnus palaestinus* Boiss. and *Cistus creticus* L. have high values, which were reported as indicator species for Mediterranean non-Forest vegetation. To ensure the sustainability of forest ecosystems, monitoring programs of woody species and their regeneration, as well as the indicator species of ecosystem degradation should be taken into consideration while making the reserve management plans.

Keywords: Evergreen Oak, Vegetation attributes, Ajloun Forest Reserve.

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Introduction

Jordan's forest communities are limited in extent in the northern parts of the country in addition to scattered regions in the south comprising less than 1% of the country's total area (DeMeo *et al*., 2010). Al-Esawi (1996) classified forests in Jordan into four types: Pine Forests (*Pinus halepensis* Mill.), Evergreen Oak Forests (*Quercus coccifera* L.), Deciduous Oak Forests (*Quercus ithaburensis* Decne.), and Juniper Forests (*Juniperus phoenicea* L.). The forest ecosystem plays a very important ecological and environmental role, and provides many services for human beings including provisioning (medicinal plants), regulating (soil erosion), in addition to some cultural (recreational), and supporting (nutrient cycling) services (Reid *et al.,* 2005). However,

there are different factors and driving forces that lead to the deterioration of such natural heritage, including natural factors (drought) and human activities (overgrazing, wood cutting, fires and agricultural expansion). The fragility of such an ecosystem in Jordan needs comprehensive monitoring programs for a better understanding of the forest dynamics. This knowledge will direct the mitigation and management policies at the conservation and sustainability of the ecological values of the forest despite all the threats.

The Ajloun Forest Reserve has an area of about 12km² totally fenced. It was established in 1987 to protect the stand of *Quercus coccifera* L. and other associated bio-species of flora and fauna. The altitude ranges from 900 to1050m with typical Mediterranean conditions, i.e., a cool rainy and snowy winter (average temperature 10°C), and a hot dry summer (average temperature 30°C). The annual rainfall is around 500mm. The soil is of the red Terra-Rosa type, which gives this Mediterranean region the best biodiversity status in the country (Al-Eisawi, 1996).

However, activities of overgrazing, woodcutting, intensive collecting of medicinal plants, invasion of alien species, climate change, tourism, and the refugee issue are responsible for the acceleration of the deterioration of this forest ecosystem (MoEnv, 2015). These accelerating challenges have led to a sharp deterioration in this ecosystem and to the loss of its biodiversity components and therefore its proper functioning and the services it provides. Indeed, woody plant regeneration in the forest is a natural process that expresses the dynamics of forest reproduction (Wang *et. al.*, 2008) and it is essential for the conservation of biodiversity in the ecosystem (Rahman *et al*., 2011).

Understanding the regeneration status and dynamics is crucial for planning management activities (Puhlick *et. al.,* 2012). This survey is aimed at assessing the status of vegetation structure in terms of the woody plant species (trees, shrubs, and climbers) using vegetation attributes including density, relative density, frequency, relative frequency, and abundance.

Materials and Methods

The survey was carried out over the period 15-30 October 2016 using the quadrate method. A total of 102 quadrates (macro-plot) of 250m X 250m were selected and a micro-plot of 10x10m located in the center of each macro-plot was implemented.Indeed, this restricted number of quadrates is taken out of the 157 quadrate that cover the whole reserve due to the rugged topography, tangled vegetation, and private lands (Figure 1).On the other hand, the Society of American Foresters classified plants according to growth habits into: trees (woody perennial plants that attain a height of at least 4-5m), shrubs ("a perennial woody plant smaller than a tree, usually with several perennial stems branched from the base"), and climbers (or vines) (a "woody or herbaceous plant with the stems not erect but depending on other plants or objects for support") (Clepper, 1944).

Furthermore, natural regeneration (non-reproductive individuals) of all recorded species was included in the listed records. The following attributes or parameters were calculated using the formulas as described by Krebs (1956) including density, relative density, frequency, relative frequency, and abundance as follow:

Density = (Total Number of individuals of a specie in all plots / Total number of plots studied)

Relative Density = [Total number of each species in all transect (plots) / Total number of plots studied] X 100

Frequency = [Total Number of plots in which the species occurs / Total number of plots studied] X 100

Relative Frequency = [Number of occurrences of a species in study area / Number of occurrences of all species in the same area] X 100

Abundance = (Total Number of individuals of species in all plots / Total number of plots in which the species occurs)

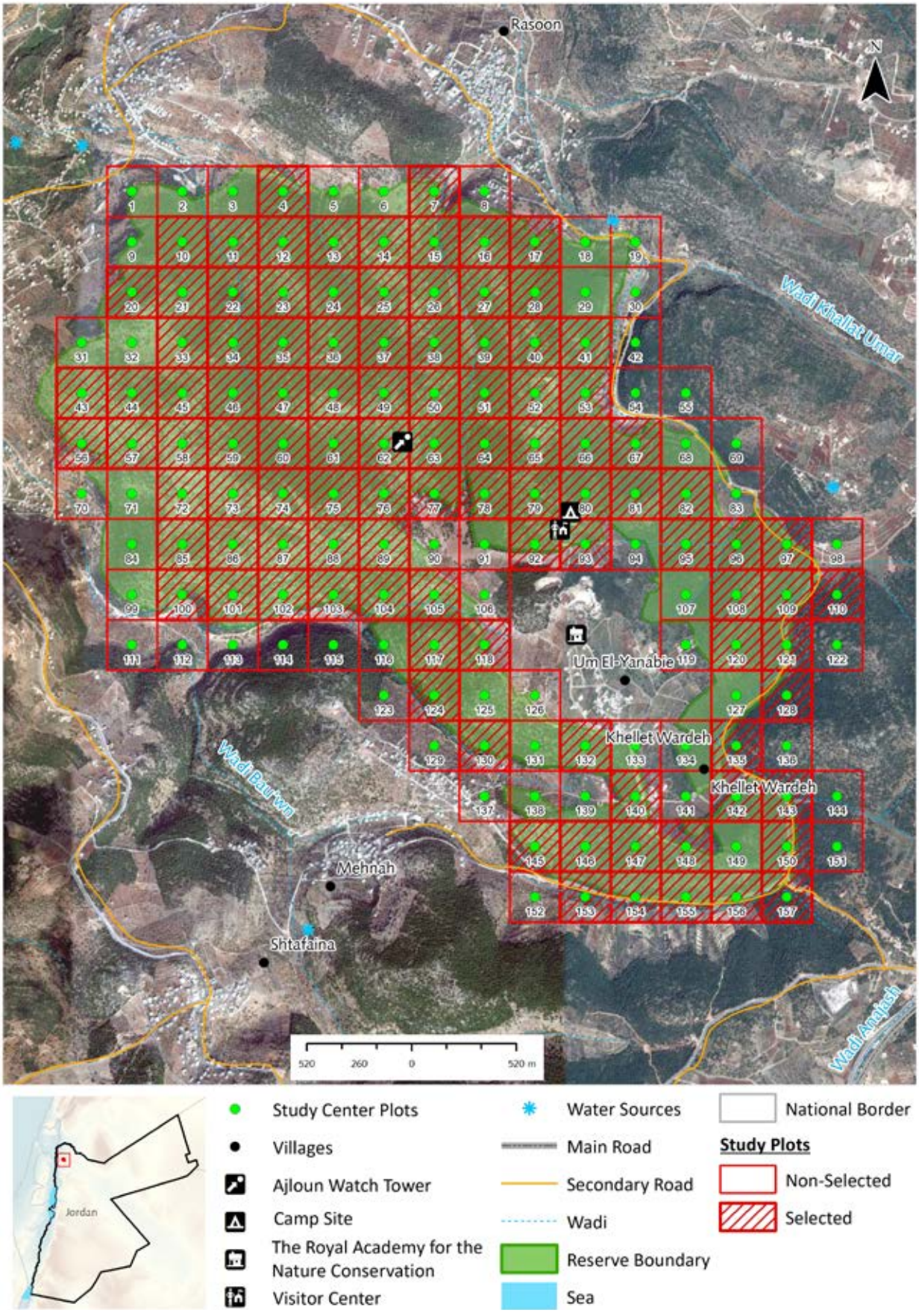

Figure 1. Map of surveyed quadrates (selected) at Ajloun Forest Reserve

However, abundance does not a full picture of the species numerical strength (Al-Eisawi and Oran, 2015), and relative abundance depends on the determination of the canopy cover of all species, which should not be considered for precision purposes. Thus, relative abundance will not be calculated in this study.

Results

Ground and Woody Cover

The results revealed that the area of the woody vegetation cover in the Ajloun Forest Reserve was estimated at 54% of the total area; of which the ground cover area constituted 46% and included small gravels, soil, rocks, and leaves.

Trees

Attributes of the Trees' Layer

During the survey, ten tree species have been recorded, of which *Quercus coccifera* L. showed the highest values of all attributes, whereas *Phillyrea latifolia* L. exhibited the lowest values of attributes in general with the exception of abundance, which has been recorded for *Crataegus aronia* (L.) Bosc ex DC. (Table 1).

Attributes of Trees Regenerations

Quercus coccifera L. regeneration has the highest value of all attributes (Table 2). *Phillyrea latifolia* L. and *Rhamnus palaestinus* Boiss recorded the lowest values of density and abundance respectively. Whereas *Phillyrea latifolia* L. recorded the lowest percentages of frequency, relative frequency, and relative density.

Climbers

Attributes of Climbers' Layer

Among the five climber's species that have been recorded in the reserve, the *Smilex aspera* L. showed the highest values of density, relative density, frequency, relative frequency, and abundance as shown in table 3. While *Ephedra aphylla* Forssk showed the lowest values of attributes with the exception of abundance, which was recorded for *Lonicera etrusca* Santi

Attributes of Climbers' Regenerations

Ephedra aphylla Forssk showed the highest abundance value followed by *Smilax aspera* L., whereas there was no record of the other climber species' regenerations within the quadrate (Table 4). At the same time, *Smilex aspera* L. recorded the highest percentages of frequency, relative density, and relative abundance followed by *Ephedra aphylla* Forssk. Zero values of regeneration for other climber species were recorded.

Shrubs

Attributes' Results of the Shrubs' Layer

Among the six shrub species that have been recorded in the survey, *Cistus creticus* L. recorded the highest values of all attributes excluding abundance, whereas the highest value was recorded by *Osyris alba* L. (Table 5). Furthermore, *Ruta chalepensis* L. recorded the lowest values of attributes excluding abundance which was recorded for *Prasium majus* L.

Attributes' Results of Shrubs' Regeneration

Cistus creticus L. recorded the highest density value followed by *Osyris alba* L. and *Phlomis viscosa* Poir, whereas other species recorded zero density values (Table 6). The ranking of species abundance values was *Osyris alba* L., *Cistus criticus* L., and *Phlomis viscosa* Poir with no records for other species. The highest percentages of frequency, relative density, and relative abundance for this species was recorded for *Cistus criticus* L. followed by *Phlomis viscosa* Poir. and *Osyris alba* L. Again, zero values of these attributes for the other shrub species within the quadrate were recorded.

Table 1. Values of all calculated attributes of recorded trees in 2016

Scientific Name	Density	Frequency%	Abundance	Relative Density%	Relative Frequency%
Arbutus andrachne L.	0.65	24.51	2.64	6.99	12.25
Cercis siliquastrum L.	0.08	2.94	2.67	0.85	1.47
Crataegus aronia (L.) Bosc ex DC.	0.16	13.73	1.14	1.69	6.86
Phillyrea latifolia L.	0.03	0.98	3.00	0.32	0.49
Pistacia palaestina Boiss.	0.58	43.14	1.34	6.25	21.57
Pyrus syriaca Boiss.	0.03	2.94	1.00	0.32	1.47
Quercus coccifera L.	7.36	93.14	7.91	79.56	46.57
Quercus infectoria G.Olivier	0.28	11.76	2.42	3.07	5.88
Rhamnus palaestinus Boiss.	0.06	4.90	1.20	0.64	2.45
Styrax officinalis L.	0.03	1.96	1.50	0.32	0.98

Table 2. Values of all calculated attributes of trees' regeneration in 2016.

Scientific Name	Density	Frequency%	Abundance	Relative Density%	Relative Frequency%
Arbutus andrachne L.	0.23	8.82	2.56	1.00	4.19
Cercis siliquastrum L.	0.14	2.94	4.67	0.61	1.40
Crataegus aronia (L.) Bosc ex DC.	0.32	16.67	1.94	1.44	7.91
Phillyrea latifolia L.	0.05	1.96	2.50	0.22	0.93
Pistacia palaestina Boiss.	1.16	52.94	2.19	5.14	25.12
Pyrus syriaca Boiss.	0.60	3.92	15.25	2.66	1.86
Quercus coccifera L.	18.10	91.18	19.85	80.44	43.26
Quercus infectoria G.Olivier	1.67	15.69	10.63	7.41	7.44
Rhamnus palaestinus Boiss.	0.15	12.75	1.15	0.65	6.05
Styrax officinalis L.	0.10	3.92	2.50	0.44	1.86

Table 3. Values of all calculated attributes of recorded climbers in 2016.

Scientific Name	Density	Frequency%	Abundance	Relative Density%	Relative Frequency%
Clematis cirrhosa L.	0.41	12.75	3.23	10.80	12.38
Ephedra aphylla Forssk.	0.21	7.84	2.63	5.40	7.62
Lonicera etrusca Santi	0.29	15.69	1.88	7.71	15.24
Rubia tenuifolia d'Urv.	0.59	20.59	2.86	15.42	20.00
Smilax aspera L.	2.31	46.08	5.02	60.67	44.76

Table 4. Values of all calculated attributes of climbers' regeneration in 2016.

Scientific Name	Density	Frequency%	Abundance	Relative Density%	Relative Frequency%
Clematis cirrhosa L.	0.00	0.00	0.00	0.00	0.00
Ephedra aphylla Forssk.	0.39	0.98	40.00	48.78	10.00
Lonicera etrusca Santi	0.00	0.00	0.00	0.00	0.00
Rubia tenuifolia d'Urv.	0.00	0.00	0.00	0.00	0.00
Smilex aspera L.	0.41	8.82	4.67	51.22	90.00

Table 5. Values of all calculated attributes of recorded shrubs in 2016.

Scientific Name	Density	Frequency%	Abundance	Relative Density%	Relative Frequency%
Asparagus aphyllus L.	0.36	20.59	1.76	6.73	19.09
Cistus criticus L.	2.65	39.22	6.75	49.09	36.36
Osyris alba L.	0.79	7.84	10.13	14.73	7.27
Phlomis viscosa Poir.	1.50	34.31	4.37	27.82	31.82
Prasium majus L.	0.06	4.90	1.20	1.09	4.55
Ruta chalepensis L.	0.03	0.98	3.00	0.55	0.91

Table 6. Values of all calculated attributes of shrubs' regeneration in 2016.

Scientific Name	Density	Frequency%	Abundance	Relative Density%	Relative Frequency%
Asparagus aphyllus L.	0.00	0.00	0.00	0.00	0.00
Cistus creticus L.	0.23	6.86	3.29	52.27	46.67
Osyris alba L.	0.12	1.96	6.00	27.27	13.33
Phlomis viscosa Poir.	0.09	5.88	1.50	20.45	40.00
Prasium majus L.	0.00	0.00	0.00	0.00	0.00
Ruta chalepensis L.	0.00	0.00	0.00	0.00	0.00

Discussion

The vegetation cover of the woody species in the Ajloun Forest Reserve constitutes around 55% of 12km² which comprises the reserve's total area. This is an indication that it is one of the highest vegetation density and diversity in the country; the forest ecosystem is described as having the highest richness and diversity of all the vegetation cover in Jordan. Al-Eisawi and Oran (2015) reported that the best vegetation covers in the north of the country ranges from 40 to 100%.

The survey confirmed the significant dominance of *Quercus coccifera* L. over other plant species in terms of both composition and regeneration. On the other hand, the current survey revealed that the Ajloun Forest Reserve is characterized by the highest number of tree density compared to other places in the country with about 925.5 trees per hectare. Specifically, the density values of *Quercus coccifera* L., *Arbutus andrachne* L., *Pistacia palaestina* Boiss., and *Quercus infectoria* L. were 736 plant/ha, 65 plant/ha, 58 plant/ha, and 28 plant/ha, respectively.

Tadros and Ananbeh (2018) reported that the density values of the leading woody species in the Ajloun Forest Reserve were as follows: *Quercus coccifera* L. (412.4 plant/ha), *Arbutus andrachne* L. (165 plant/ha), *Pistacia palaestina* Boiss (144.3 plant/ha), and *Quercus infectoria* L. (82.5 plant/ha). All previous results are in agreement with the management objective of the reserve to conserve a healthy, dominant, and representative vegetation of *Quercus coccifera* L. in the northern parts of the country (RSCN, 2016).

The survey results showed high values of the density parameter, in parallel with good regeneration levels for these plant species. The new seedlings of *Quercus coccifera* L. is concentrated in the dense areas in the east, north, west, and center of the reserve, while the south and south-west areas of the reserve showed the least regeneration value, which may be attributed to having less canopy cover, grazing, and more exposure to sun light (south facing).

All of the aforementioned indicators confirm that *Quercus coccifera* L. and its regeneration appear to be viable within the reserve, which agreed with the results of DeMeo *et al*. (2010) and Tadros and Ananbeh (2018). The current survey covers the whole area of the reserve in comparison to others. The regeneration of the tree species provides a good indicator of the ecological status. The dominance of *Quercus coccifera* L. has been recognized

and confirmed clearly, but other species need to be investigated, such as *Arbutus andrachne* L. and *Pistacia palaestina* Boiss. Proper planning is an essential requirement to ensure a successful forest management (Davis *et al*., 2001) and this includes the ability to predict future forest structure and composition (Taylor *et al*., 2008).

Correspondingly, *Cistus creticus* L. showed dominance over other species and *Rhamnus palaestinus* Boiss. showed good values in terms of vegetation attributes. *Rhamnus palaestinus* Boiss. and *Cistus creticus* L. were reported by Al-Eisawi (1996) as indicator species for the Mediterranean non-forest Vegetation and are treated as degraded forests. Recording such plants with high values of vegetation attributes should be taken into account in the making of the reserve management plans.

Most of the phytogeographical region in Jordan is under anthropogenic and natural threats that are changing the structure and composition of woody vegetation (Al-Eisawi and Oran, 2015). Subsequently, more efforts are needed toto face the ever-increasing threats through *in situ* conservation of such critical ecosystems, since the protected areas would be the cornerstone of biodiversity conservation (Gaston *et al*., 2008). Forests and the regeneration of woody species are an essential indicator the conservation of biodiversity (Hossain *et al*., 2004), which supports the developing of management activities and helps determine priorities to ensure the sustainability of these ecosystems (Haider *et al*., 2017).

Acknowledgement

The authors are grateful to the RSCN management for their support throughout this work namely Mr. Yehya Khaled- the general director and Dr. Nashat Hamidan- director of Conservation Monitoring Centre (CMC). Thanks are extended to colleagues in CMC, especially the GIS unit who prepared the required maps for this survey, and to all other colleagues who have provided support during all phases of this survey.

References

Al Eisawi D. 1996. **Vegetation of Jordan**. Regional Office for Science and Technology for the Arab States, UNESCO, Cairo.

Al-Eisawi, D and Oran, S. 2015. Assessment of the vegetation cover of northern high mountains in Jordan. *Journal of Biodiversity and Environmental Sciences*, **6 (5):** 93-106.

Clepper, H. 1944. Editorial: Forestry Terminology. *Journal of Forestry*, **42(2):** 79–80

Davis LS, Johnson KN, Bettinger PS and Howard TE. 2001. **Forest management: To Sustain Ecological, Economic and Social Values**, 4th ed. McGraw-Hill, New York.

DeMeo, D, Triepke, J, Smadi, M, Ananbeh, Y and Duran, F. 2010. Forest inventory and monitoring of Ajloun Reserve-Jordan. *Natural Areas Journal*, **30 (3):** 271-278.

Gaston, KJ, Jacksonm SF, Cantú-Salazar, L and Cruz-Piñón, G. 2008. The ecological performance of protected areas. *Annual Review of Ecology, Evolution, and Systematics*, **39 (1):** 93-113.

Haider, MR, Alam, S and Mohiuddin, M. 2017. Regeneration potentials of native tree species in three natural forests of Sylhet, Bangladesh. *Journal of Biodiversity Conservation and Bioresource Management***, 3(2):** 1–10.

Hossain, MK, Rahman, ML, Hoque, ATMR and Alam, MK. 2004. Comparative regeneration status in a natural forest and enrichment plantations of Chittagong (south) forest division. *Bangladesh Journal of Forestry Research***, 15 (4):** 255–260.

Krebs CJ. 1956. **Ecological Methodology**, Harper and Collins, New York.

Ministry of Environment (MoEnv). 2015. The National Biodiversity Strategy and Action Plan (NBSAP). Amman.

Puhlick, JJ, Laughlin, DC and Moore, MM. 2012. Factors influencing ponderosa pine regeneration in the

southwestern USA. *Forest Ecology and Management*, **264:** 10–19.

Rahman, MH, Khan, MASA, Roy, B and Fardusi, MJ. 2011. Assessment of natural regeneration status and diversity of tree species in the biodiversity conservation areas of Northeastern Bangladesh. *Journal of Forestry Research*, **22 (4):** 551.

Reid W, Mooney H, Cropper A, Capistrano D, Carpenter S and Chopra K. 2005. **Millennium Ecosystem Assessment. Ecosystems and Human Well-Being: Synthesis**. Island Press: Washington, DC, USA.

Royal Society for the Conservation of Nature (RSCN). 2016. Ajloun Forest Reserve Management Plan. Amman. (unpublished report).

Tadros, M and Ananbeh, Y. 2018. Vegetation Composition and Structure of Woody Plant Communities in Ajloun Forest Reserve. *Jordan Journal of Agricultural Sciences*, **14 (2):** 223-230.

Taylor, AR, Chen, HYH and Van Damme, L. 2008. A Review of Forest Succession Models and Their Suitability for Forest Management Planning. *Forest Science*, **55 (1):** 23-36.

Wang, H, Li, G, Yu, D and Chen, Y. 2008. Barrier effect of litter layer on natural regeneration of forests: a review. *Chinese Journal of Ecology*, **27:** 83–88.

A Local Community Participatory Approach as a New Policy toward a Complementary in situ Conservation of the Agrobiodiversity in Saint Katherine, South Sinai- Egypt

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Received: March 7, 2021; Revised: April 23, 2021; Accepted: April 30, 2021

Abstract: Changes in social lifestyles and fruit diversity occur gradually at Saint Katherine. Saint Katherine was more isolated during the occupation period (1967-1982). This study provides a significant and brief description of the most important features of the society study in Saint Katherine concerning the effects of location and the natural properties on the conservation of the agrobiodiversity. The sources of horticulture crop propagules are mainly from the local nurseries as native breeds and/or from nurseries outside the governorate. The study recorded fifteen fruit crops in the horticulture garden of Saint Katherine.The situational factors impose some sort of separation or isolation making that the exchange of genetic assets for cultivated horticulture crops limited. People had to use the existing genetic resources or ones imported from abroad. So, genetic resources of the cultivated crops become adapted to the local environment. After 1982, some cultivars were introduced from an Agricultural Nursery. For such reason, Saint Katherine is considered as a unique store for specific fruit cultivars. Horticulture crop diversity is also in decline and continues to be threatened by drought, climate change, habitat destruction, rain-floods, unsustainable use of natural resources, and by the replacement of the native cultivars with unsuitable new cultivars.

Key word: Agrobiodiversity, Genetic resources adaptation, Horticulture crop diversity, Local community, Participatory approach, Saint Katherine, Egypt.

Introduction

Traditional home gardens tend to preserve higher levels of plant diversity; cultivating a variety of crops in gardens can provide food security year-round, while the gardens are being protected against environmental change actions such as drought and pest outbreaks, as one crop partially compensates the loss of another (Fernandes and Nair, 1986; Jose and Shanmugaratnam, 1993). In addition to having practical benefits from the farmers' perspective, diverse agro-ecosystems can maintain natural processes on which farmers can rely, such as ecosystem services that maintain soil fertility (Munyanziza *et al*., 1997), water retention (Roose and Ndayizigiye, 1997), pollination (Klein *et al*., 2003; Jha and Vandermeer, 2010), and pest control (Trujillo-Arriaga and Altieri, 1990).

The cultivated lands of south Sinai reach about 14,000 feddans, which rely on rainwater for irrigation. The Governorate is famous for the cultivation of olive trees and fruits. Ferran is the most important agricultural area, known for a long time for the cultivation of fruit and olive trees. It contains many springs and wells (State Information Service).

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By using remote sensing, some 500-600 farms were believed to occur in the Saint Katherine region. In the mountains and towns, they form a dense network of farms that run along the base of mountain valleys, but in the low desert, they are, more or less, sparse reflecting the lower availability of natural water sources (Norfolk *et al*. 2013).

In the Saint Katherine's Protectorate of South Sinai, Egypt, Bedouins have traditional knowledge of agriculture and goat herding. They have been cultivating mountain gardens for more than one thousand years (Zalat and Gilbert, 2008). These mountain gardens are arid land that depend on runoff rainwater for the growth of a variety of mountainous garden products as well as vegetables and herbs (Norfolk *et al*., 2012). A system of walls and dams captures the runoff rainwater, giving it time to leak into the bedrock where it recharges the underground water and can be accessed through wells, and is used for year-round irrigation (Perevolotsky, 1981).

Due to these rainwater-harvesting techniques, the gardens have a higher potential for plant growth and appear as oases of greenery in the arid mountains. This unusual distribution of resources creates a unique location for studying the diversity effects of agroecosystems and the complementary effects on the national action plan for genetic resources' conservation in addition to the impact of geographic, social lifestyles, and political barriers on the conservation of genetic resources at Saint Katherine.

Material and Methods

Study Area

Saint Katherine Protectorate is situated in the southern part of Sinai and is part of the upper Sinai massif. In 1996, by Prime Ministerial Decree No. 904, Saint Katherine of the largely mountainous terrain in South Sinai, was formally declared as a protected area which contains a unique ingathering of natural resources, in particular high-altitude ecosystems with surprisingly diverse fauna and flora and with proportions of endemic taxa. Saint Katherine Protectorate, located in the arid North African belt, is characterized by a Saharan-Mediterranean climate. Though the altitude moderates the temperature regime, summers are relatively hot, with a mean maximum temperature of 36^{o} C during August, while winters are relatively cool with a mean minimum temperature of -7.8 ^{o}C during February (Omar *et al.,* 2012).

Saint Katherine Protectorate is classified as a hyper-arid region, with mean annual rainfall ranging between 10 mm/year and 60 mm/year in the high mountains. The topography of the high mountains allows for an additional orographic precipitation. This orographic precipitation often comes in the form of snow, and at times this can amount to 300 mm. annually (Grainger, 2003). Rainfall is sporadic, occurring usually between October and May. When it rains, the entire annual rainfall can often fall within a few days and tends to result in heavy flash floods. However, there are fluctuations in precipitation as rainfall is not an annual occurrence and having two or three consecutive years or more without precipitation is common. Precipitation takes the form of sporadic flash floods or limited local showers; thus, a highly spatial heterogeneity because of the received moisture is also common (Omar, 2017).

The study was conducted over the period between April and June, 2019 in the Saint Katherine area, South Sinai, Egypt. Thirty-five gardens from nine areas were selected for studying the horticulture crops of Saint Katherine (Table 1).

Genetic Resources

Fifteen horticulture genetic resources were addressed in Saint Katherine gardens (Table 2).

Methodology

The study depends mainly on the information gathered, using a householder questionnaire, from the studied samples of communities at Saint Katherine. A proper questionnaire

Table 1. Number of sites of the study area

No.	Region	Elevation (a.s.l) in meter	No. of Gardens
1	El Arbeen	1700	1
2	El Esbaia	1600	3
3	El Rasis	1560	11
4	El Shamia	1560	1
5	Wadi El telaha	1500	2
6	Wadi El Raha	1500	4
7	Wadi Gebal	1800	7
8	El Sheikh Awad	1100	2
9	El Tarfa	1200	4
	Total		35

Table 2. The fruit crops cultivated in Saint Katherine.

	No. of trees/ farm		**Production**		Date of cultivation
	No.	range	Kg/tree	range	
Olea europaea	23.58±29.69	(3-120)	17.63±8.54	(8-35)	(1970-2017)
Malus domestica	5.68±5.83	(2-25)	8.05±6.11	(2-25)	(1940-2018)
Prunus armeniaca	5.2±4.70	(2-20)	10.05±9.13	(2-30)	(1970-2017)
Prunus persica	6.86±5.87	(3-18)	9.14±8.21	(3-25)	(1978-2014)
Prunus domestica	3.375±2.39	(2-9)	6.63±7.84	(2-25)	(1978-2018)
Pyrus communis	3.00±1.41	(2-5)	7.50±8.43	(2-20)	(1985-2018)
Punica granatum	4.50±4.19	(2-20)	16.78±9.28	(4-30)	(1955-2018)
Vitis vinifera	11.72±16.66	(2-70)	12.08±9.64	(3-35)	(1940-2018)
Citrus aurantiifolia	1.60±0.82	(1-3)	1.00±0.50	(1-2)	(2007-2017)
Cydonia oblonga	2.77±2.45	(1-10)	10.92±9.67	(2-25)	(1940-2017)
Citrus Singensis	4.00±1.00	(3-7)	5.33±1.53	(4-7)	(2008-2016)
Pistacia vera	14.14±12.86	(4-40)	1.71±0.76	(1-3)	(1980-2017)
Juglans regia	1.00±0.00	(1-1)	1.25±0.35	(1-1.5)	(1978-1985)
Prunus dulcis	13.26±14.00	(1-50)	4.74±3.13	(2-15)	(1945-2017)
Morus sp.	1.20±0.42	(1-2)	4.10±1.79	(2-7)	(1940-2016)

was planned in line with the study objective for data collection to determine and analyse the horticulture crops and sustainable plant genetic resources at Saint Katherine. In this regard, various personal meetings with heterogeneous groups in nine regions were held. Also, the type of horticulture crops, the number of cultivated individuals, date of cultivation, sources of crop propagules and production per tree as well as the soil characteristics s and types of Erosions were all collected to determine the study outline, and identify the most affected crops with different barriers.

Results and Discussion

Fifteen horticulture genetic resources have been recorded in Saint Katherine gardens (Table 3). Older horticulture crops at Saint Katherine were planted before the occupation period (before 1967). Some cultivars including *Malus domestica, Vitis vinifera, Cydonia oblonga and Morus sp.* (Figure 1) have been planted since 1940. Other cultivars such as *Prunus dulcis* have been planted since 1945 and *Punica granatum* has been planted since 1955. The oldest cultivars (100%) recorded were seven horticulture crops, namely: *Olea europaea* (Figure 2), *Prunus armeniaca, Prunus persica, Prunus domestica, Vitis*

Figure 1: An old tree of *Morus* sp. at Saint Katherine

Figure 2 An old tree of *Olea europaea*.

Table 3. The older fruit crops cultivated in Saint Katherine.

	Old cultivars	New cultivars
Olea europaea	100.00	0.00
Malus domestica	73.68	26.32
Prunus armeniaca	100.00	0.00
Prunus persica	100.00	0.00
Prunus domestica	100.00	0.00
Pyrus communis	50.00	50.00
punica granatum	27.78	66.67
Vitis vinifera	100.00	0.00
Citrus aurantiifolia	25.00	75.00
Cydonia oblonga	100.00	0.00
Citrus Singensis	0.00	100.00
Pistacia vera	42.86	57.14
Juglans regia	100.00	0.00
Prunus dulcis	96.30	3.70
Morus sp	60.00	40.00

vinifera, Cydonia oblonga,and *Juglans regia* followed by *Prunus dulcis* (96.30) and *Malus domestica* (73.68) (Table 3).

Olive trees constituted the maximum number of trees that is 100 and 120 at El Rasis of location (28.56361 N, 33.95375 E, 1545m) and (28.54041 N, 33.99191 E, 1641m) respectively. The minimum number of olive trees was three - five, recorded in different traditional gardens.

The most adaptive horticultural crops at Saint Katherine are the vegetatively propagated plants and plants propagated by seeds. Recently, the farmers and Bedouins contacted the agricultural nursery at Ismailia governorate, Desert Research Centre, and Agricultural Research Centre for new cultivars of horticulture crops (Table 4). Few propagules of *Prunus armeniaca* were planted in 1970 during the occupation period of Saint Katherine. These propagules were delivered from abroad. The characteristics of this cultivar resemble those of the cultivars planted in Palestine.

The recent cultivation of most horticulture crops has started since 2014 and is ongoing right now. While the most recent plantation of *Juglans regia* was during the seasons of 1985.

The predominant apparent soil type is the sandy and the sandy and gravelly soils. The sandy loamy soil was apparently recorded at the site of Telaha-1 (Table 5). The slope of soil has no effect on the cultivation of horticulture fruits due to the excellent land preparation before plantation.

The soil is subject to low wind erosion at the small traditional gardens, while water erosion threatens the large garden being close to water running in the wades during the flash flood, especially those surrounded by a weak fence (Table 5).

Farmers and Bedouins believe that drought threatens the agrobiodiversity of horticultural crops the most at Saint Katherine. It is followed by the threat of wild birds to *Malus domestica, Pyrus communis, Vitis vinifera, Cydonia oblonga,* and *Morus* sp. Some other factors which threaten the agrobiodiversity of St. Katherine include insects, pests, fruit worms, rot diseases, gummosis of trees and the attack of bats.

The Bedouins of Saint Katherine need more agricultural extended service package to combat all these factors threatening the agrobiodiversity (Table 6). There are no marketing problems, because most of

Table 4. The origin of fruit crops cultivated in Saint Katherine.

	Origin of tree				
	Propagation in St. Katherine	Agricultural Nursery	Seed propagation	Desert research centre	NA
Olea europaea	16.67	-	-	-	83.33
Malus domestica	-	26.32	-	-	73.68
Prunus armeniaca	-	-	70	-	30.00
Prunus persica	57.14	-	28.57	-	14.3
Prunus domestica	-	-	12.50	-	87.50
Pyrus communis	25.00	50.00	-	-	25
punica granatum	-	66.67	-	-	27.78
Vitis vinifera	64.00	-	-	-	36.00
Citrus aurantiifolia	-	75.00	-	-	25.00
Cydonia oblonga	-	-	46.15	-	53.8
Citrus Singensis	-	100.00	-	-	-
Pistacia vera	14.29	57.14	28.57	-	0.00
Juglans regia	-	-	-	-	100
Prunus dulcis	-	-	51.85	3.70	44.44
Morus sp	30.00	40.00	-	-	30

Table 5. The apparent soil characteristics and types of erosions in the targeted areas of Saint Katherine

	Apparent soil characteristics				Type of erosion			Water salinity
	sandy	sandy-loamy	sandy-Gravelly	Erosion	wind	water	All factors	EC µS/cm
Olea europaea	79.17	4.17	16.67	low	100.00	-	-	(125-830)
Malus domestica	78.95	-	21.05	low	100.00	-	-	(125-830)
Prunus armeniaca	85.00	-	15.00	low	100.00	-	-	(125-830)
Prunus persica	100.00	-	-	low	100.00	-	-	(125-520)
Prunus domestica	75.00	-	25	low	100.00	-	-	(125-370)
Pyrus communis	100.00	-	-	low	100.00	-	-	(193-255)
punica granatum	72.22	-	27.78	low	100.00	-	-	(125-584)
Vitis vinifera	80.00	-	20.00	low	100.00	-	-	(125-830)
Citrus aurantiifolia	75.00	-	25.00	low	100.00	-	-	(370-830)
Cydonia oblonga	84.62	-	15.38	low	100.00	-	-	(125-830)
Citrus Singensis	66.67	-	33.33	low	100.00	-	-	(370-1005)
Pistacia vera	85.71	-	14.29	low	100.00	-	-	(125-830)
Juglans regia	100.00	-	-	low	100.00	-	-	(255-319)
Prunus dulcis	77.78	-	22.22	low	92.59	3.70	3.70	(121-830)
Morus sp	70.00	-	30.00	low	100.00	-	-	(135-830)

the horticulture crops planted in the small gardens are consumed as family food. The farmers and Bedouins only sell surplus fruit products. From spring to late autumn, there are always some seasonal fruits in the Sinai Mountains where the weather is wetter and cooler than the rest of the desert. The valleys of the mountainous region around Saint Katherine contain over 500 ancient orchards. Many are abandoned today, but one can still find a lot of beautiful gardens that are cared for. On one hand, the Bedouins in the Saint Katherine Mountains must deal with the deficiency of water and with the effective flash floods that occasionally sweep through the valleys on the other. Therefore, the walls

Table 6. The threats to the studied horticultural crops at Saint Katherine.

	Threats						
	Climatic factors (drought)	Insect and pests	Gummosis of trees	Bats	Wild birds	Fruit worm	Rot disease
Olea europaea	100.00	29.17	-	-	-	-	-
Malus domestica	100.00	5.26	-	31.58	10.53	-	-
Prunus armeniaca	100.00	-	20.00	-	-	-	-
Prunus persica	100.00	-	-	-	-	28.57	-
Prunus domestica	100.00	-	-	-	-	-	-
Pyrus communis	100.00		-	-	50.00	-	-
punica granatum	100.00	83.33	-	-	-	83.33	83.33
Vitis vinifera	100.00	-	-	-	64.00	-	-
Citrus aurantiifolia	100.00	-	-	-	-	-	-
Cydonia oblonga	100.00	-	-	-	69.23	-	-
Citrus Singensis	100.00	-	-	-	-	-	-
Pistacia vera	100.00	-	-	-	-	-	-
Juglans regia	100.00	-	-	-	-	-	-
Prunus dulcis	100.00	-	25.93	3.70	-	-	-
Morus sp	100.00	-	-	-	50.00	-	-

of the gardens are built stoutly, to help the gardens survive during the flash floods and to hold the soil. At the same time, the presence of holes in the walls and channels also helps redirect the water to wells and reservoirs. The gardeners are experts in grafting. They put branches of better yielding fruit varieties on local cultivars and /or trees that are more resistant to drought. In some instances, up to three different fruit species were grafted on a single tree.

Changes in social lifestyles and fruit diversity are gradually happening at Saint Katherine. Saint Katherine was more isolated during the occupation period (1967-1982). The only road between Saint Katherine and the surrounding areas was towards the east. These situational factors impose some sort of isolation or separation making the exchange of genetic assets for cultivated crops limited. People had to use the existing genetic resources or ones imported from abroad. The native genetic resources of the cultivated crops become completely adapted to the local environment. After the end of the occupation period, some cultivars were introduced from agricultural nurseries. For this reason, Saint Katherine is considered as a unique store for specific fruit cultivars including olives, grapes, pomegranate, lemons, apples, apricots, peaches, oranges, guava and almonds.

References

Fernandes, ECM and Nair, PKR. 1986. An evaluation of the structure and function of tropical homegardens. *Agricultural Systems*. **21**: 279-310.

Grainger, J. 2003. People are living in the park. Linking biodiversity conservation to community development in the Middle East region: a case study from the Saint Katherine Protectorate, Southern Sinai. *Journal of Arid Environments*. **54**, 29-38.

Jha, S and Vandermeer, JH. 2010. Impacts of coffee agroforestry management on tropical bee communities. *Biological Conservation*. **143**: 1423-1431.

Jose, D and Shanmugaratnam, N**.** 1993. Traditional home gardens of Kerala: a sustainable human ecosystem. *Agroforestry Systems*. **24**: 203-213.

Klein, AM, Steffan-Dewenter, I and Tscharntke, T. 2003. Fruit set of

highland coffee increases with the diversity of pollinating bees. *Proceedings of the Royal Society Biological Sciences*. **270**: 955-961.

Munyanziza, E, Kehri, HK and Bagyaraj, DJ. 1997. Agricultural intensification, soil biodiversity and agro-ecosystem function in the tropics: the role of mycorrhiza in crops and trees. *Applied Soil Ecology*. **6**:77-85.

Norfolk, O, Abdel-Dayem, M and Gilbert, F. 2012 Rainwater harvesting and arthropod diversity within an arid agro-ecosystem. *Agriculture*, *Ecosystem and Environment*. **162**: 8-14.

Norfolk, O, Eichhorn, M and Gilbert, F. 2013 Traditional agricultural gardens conserve wild plants and functional richness in arid South Sinai. *Basic Applied Ecology* **14(8):** 659-669. https://doi.org/10.1016/j.baae.2013.10.004.

Omar, K. 2017. Community –based Conservation of threatened plants *Silene schimperiana* and *Polygala sinaica* in South Sinai, Egypt. Final report, www.rufford.org. pp 90.

Omar, K, Khafagi, O and Elkholy MA. 2012. Eco-geographical analysis on mountain plants: A case study of *Nepeta septemcrenata* in South Sinai, Egypt. *Lambert Academic Publishing*, pp 236.

Perevolotsky, A. 1981. Orchard Agriculture in the High Mountain Region of South Sinai. *Human Ecology*. **9**: 331-357.

Roose, E and Ndayizigiye, F. 1997. Agroforestry, water, and soil fertility management to fight erosion in tropical mountains of Rwanda. *Soil Technology*. **11**: 109-119.

Trujillo-Arriaga, J and Altieri, MA. 1990. A comparison of aphidophagous arthropods on maize polycultures and monocultures, in Central Mexico. *Agriculture*, *Ecosystem and Environment*. **31**: 337-349.

Zalat, S and Gilbert, F. 2008. Gardens in a sacred landscape: Bedouin heritage and natural history in the high mountains of Sinai. *American University in Cairo Press, Cairo.*

Short Communication

A Teratological Record of the Southern Green Stink Bug *Nezara viridula* (Hemiptera, Heteroptera, Pentatomidae) from the Occupied Palestinian Territories (West Bank)

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Received: November 2, 2020; Revised: December 14, 2020; Accepted: December 26, 2020

Abstract: The first teratological case of Southern Green Stink Bug (*Nezara virdula*) from the Palestine Museum of Natural History botanical garden in Bethlehem, Palestine is reported. This anomaly appears on the pronotum, scutellum and the corium part of the species, and it seems to occur less in these morphological structures of true bugs (Heteroptera).

Keywords: Malformation, anomaly, true bug, West Bank, Palestine.

The Southern Green Stink Bug (*Nezara viridula*) is a widely-distributed species of true bugs in the tropical and subtropical regions in the Americas, Africa, Asia, Europe, and Australia. The distribution of this species is increasing with the increase of global warming (Tougou et al., 2009). *N. viridula* is a pest species on agricultural crops including fruits, nuts, grains, and vegetable crops (Jones, 1988).

Morphological anomalies appear occasionally in insects especially the suborder Heteroptera affecting the antenna and other structures (Asiain and Márquez 2009; Carvajal *et al.,* 2019; Taszakowski and Kaszyca-Taszakowska, 2020). Teratology can be exhibited as a simple change in structure (morphology) (Faúndez and Rider, 2017; Faúndez and Rocca, 2016) In other cases, it can be more complex such as when having an extra part in the insect body including antennas (Burke *et al.,* 2018) or compound eyes (Clark and Neto, 2010).

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A specimen of the Southern Green Stink Bug *Nezara viridula* is found at the Palestine Museum of Natural History (PMNH) botanical garden (Bethlehem, Palestine) on October 22, 2020 with a teratological disorder (Figure 1). This teratology appears in the pronotum as wrinkled aberrance from the middle and goes down. The scutellum shows shrinkage, and the left corium comes up the right corium due to a defect in the connected point with the pronotum. The left wing of *N. virdula* is destroyed (see Figure 1A and B). Socha (1995) discuss the malformation in the wings of *Pyrrhocoris apterus* and show results of several generations of breeding. In the case of this study, it was only one specimen and the appeared morphological anomalies have been described.

Apparently, this is the first record of a teratological case in *N. viridula*. In general, anomalies of the pronotum, scutellum, and corium seem to occur less often than antennal anomalies in true bugs (Heteroptera) (Carvajal *et al.,* 2019; Steinhaus and Zeikus, 1968; Taszakowski and Kaszyca-Taszakowska, 2020).

Acknowledgments

We thank the Ministry of Education and Higher Education and the EUPI "Unity and Diversity in Nature and Society" grant support of the work of the Biodiversity center where this work was performed. The author, not the funders, is solely responsible for the content of this communication.

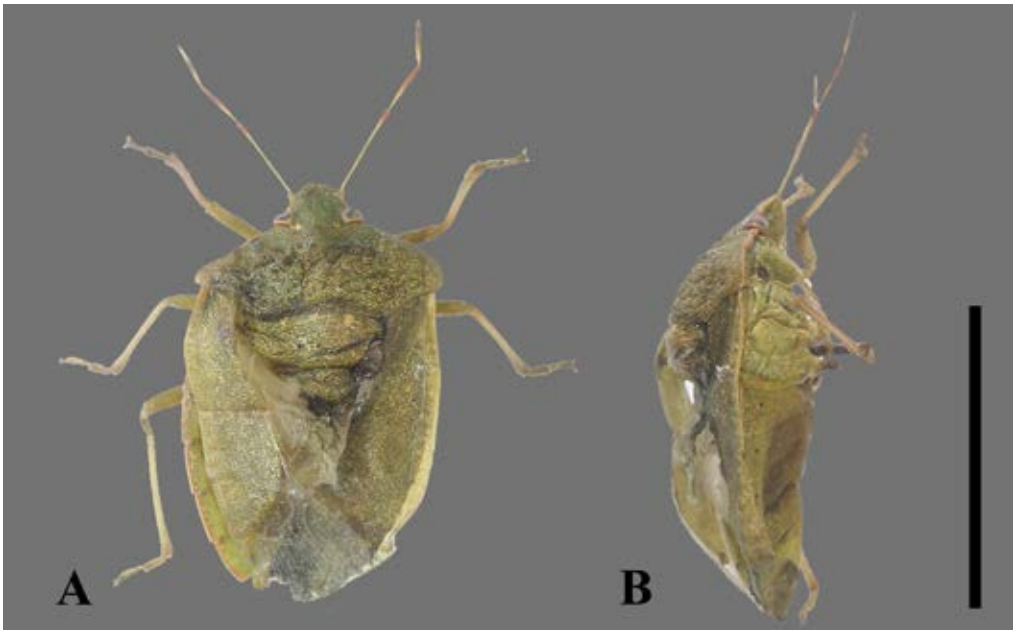

Figure 1. *Nezara viridula*, A: Dorsal view, B: Lateral view, Scale Bar = 10 mm.

References

Asiain, J and J Márquez. 2009. New teratological examples in Neotropical Staphylinidae (Insecta: Coleoptera), with a compilation of previous teratological records. *Revista Mexicana de Biodiversidad*, **80**: 129-139.

Burke, AF, Sole, CL and Scholtz, CH. 2018. A remarkable teratological case for *Eucymatodera parva* Schenkling, 1908 (Cleridae: Tillinae) from Namibia. *African Entomology,* **26(1):** 250-253.

Carvajal, MA, CJ Vargas and E.I. Faúndez. 2019. New data on *Pellaea stictica* Dallas (Heteroptera: Pentatomidae) in South America. *Revista Chilena de Entomología*, **45(3):** 419-424.

Clark, SM and Neto, LAB. 2010. A remarkable teratological specimen of *Pseudoluperus longulus* (Leconte) (Coleoptera: Chrysomelidae) from Utah, USA. *The Coleopterists Bulletin*, **64(4):** 383-385.

Faúndez, EI and Rider, DA. 2017. Two teratological cases in *Hillieria acuminata* Distant, 1910 (Heteroptera: Pentatomidae: Pentatominae: Aeptini). *Boletín de la Sociedad Entomológica Aragonesa*, **60:** 353-354.

Faúndez, EI and Rocca, JR. 2016. Tres casos teratológicos en ligeidos (Heteroptera: Lygaeoidea) chilenos. In Anales del Instituto de la Patagonia (Vol. 44, No. 2, pp. 49-53). Universidad de Magallanes.

Jones, WA. 1988. World review of the parasitoids of the southern green stink bug, *Nezara viridula* (L.) (Heteroptera: Pentatomidae). *Annals of the Entomological Society of America*, **81(2):** 262-273.

Steinhaus, EA and Zeikus, RD. 1968. Teratology of the beetle *Tenebrio molitor* I. Gross morphology of certain abnormality types. *Journal of Invertebrate Pathology*, **10(2):** 190-210.

Socha, R. 1995. Selection for an unstable micropterism in Pyrrhocoris apterus (Heteroptera: Pyrrhocoridae). *Journal of Zoology*, 236(3): 407-415.

Taszakowski, A. and Kaszyca-Taszakowska, N., 2020. Teratological cases of the antennae in the family Aradidae (Hemiptera: Heteroptera). *Scientific Reports*, **10(1):**1-11.

Tougou, D., Musolin, D.L. and Fujisaki, K., 2009. Some like it hot! Rapid climate change promotes changes in distribution ranges of *Nezara viridula* and *Nezara antennata* in Japan. *Entomologia Experimentalis et Applicata*, *130(3):* 249-258.

Jordan Journal of Natural History, 8, 2021 Pages 47-50

Short Communication

Towards Improving Conservation Strategies for the Endangered Arabian Wolf, *Canis lupus arabs*

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Received: November 30, 2020; Revised: December 28, 2020; Accepted: January 5, 2021

While wolf populations are recovering globally (Chapron *et al*., 2014; Mech 2017), the International Union for Conservation of Nature (IUCN) lists the unique desert-adapted Arabian wolf, *Canis lupus arabs*, as an endangered subspecies (Mallon and Budd 2011). Ranging across arid regions of the southern Levant and Arabian Peninsula, the Arabian wolf often relies on human resources (Shalmon 1986); this may be attributed to a severely depleted natural prey base coupled with the low productivity of arid and hyper-arid environments. Where conflict with wolves is low, such as in crop farming landscapes throughout Al Naqab and Wadi Araba, Arabian wolves have developed such an affinity with humans that they rarely venture more than 5 km from human infrastructure (Barocas *et al.,* 2018).

The population in the Al Naqab/ Wadi Araba area was estimated at around 90 – 150 individuals (Cohen *et al.,* 2013); a relatively stable number for an arid to hyper-arid region of roughly 12,000 km^2. In contrast, the most recent population across Saudi Arabia, Yemen, Oman, and the United Arab Emirates (UAE; *potentially extinct*, Cunningham 2004), is estimated at 500 – 600 and is declining (Mech and Boitani 2004). Taking into consideration that the latter area is more than 200 times the size of the former, covering around 90 % of the Arabian wolf's range, it is crucial to understand the factors driving the Arabian wolf's demise across such a significant portion of its range, and to develop strategies to overcome these.

Pastoralism remains a predominant form of agriculture across the vast majority of the Arabian wolf's range. Of course, when wolves' reliance on human resources leads to livestock depredation, conflicts between wolves and pastoralists are inevitable. In fact, in some pastoralist landscapes across the Arabian Peninsula where populations tenaciously persist (Cunningham and Wronski 2010a), conflict is so pronounced that the rate of encountering a persecuted wolf carcass is as high as one in every 8 km (Cunningham *et al.,* 2009)). On top of the livestock-related persecution, age-old beliefs that wolves endanger human lives (Seddon and Khoja 2010), and wolf body parts can be used for therapeutic purposes (Aloufi and Eid 2016), persist. As such, Arabian wolves continue to be hunted and persecuted, despite their low numbers (Cunningham and Wronski 2010b).

Jordan holds a critical jurisdiction for the conservation of the Arabian wolf as its location provides a stepping-stone between the stable population of Al Naqab/ Wadi Araba, and the declining population of the Arabian Peninsula. The conservation status of the Arabian wolf in Jordan remains unclear, with sparse records over the last few decades: two wolves were recorded during a 2001 carnivore survey in the north-eastern Badia (Bunaian *et al.,* 2001), and wolves were recorded in 2011 (Edwards et al. 2017) in addition to a captured wolf being released in

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2016 (Hamidan N., unpublished data), within the Dana Biosphere Reserve. Nonetheless, numbers appear to be negligible (Hamidan N., RSCN, personal communication). Illegal hunting remains a concern in Jordan, although this is being increasingly curbed by the efforts of the Royal Society for the Conservation of Nature (RSCN; Eid and Handal 2018). As long as hunting and direct persecution persist, the Kingdom's designated protected areas remain important strongholds for wildlife, including wolves (Amr *et al.,* 2004).

During the summer of 2019, the researchers sampled an area of approximately 1,800 km^2 in Wadi Araba, and the adjacent Dana Biosphere Reserve, using camera-traps and passive tracking surveys (searching for wolf tracks – i.e. pugmarks) to assess wolf activity and determine the importance of this region for Arabian wolf conservation. Extending north to cover the Fifa Nature Reserve, the current study area included two protected areas governed by the RSCN, as well as vast agricultural landscapes predominantly used by Bedouin pastoralists. To increase the probability of detection, camera-trapping primarily focussed on permanent water points (i.e., springs and artificial water sources), while tracking surveys were conducted in areas where there was enough suitable substrate that could be cleared daily and searched for fresh tracks (i.e., 500 m transects).

Both camera-traps and tracking confirmed that the area surrounding the Dana Biosphere Reserve is an important region for the Arabian wolf (Figure 1). The researchers recorded most wolf activity in the lower (western) reaches of the Dana Reserve (e.g., Ein Salamani; Figure 2), and the adjacent agricultural fields northeast of the reserve's boundary. A young wolf was confirmed by camera-traps at Ein Ibn Thicker in the Fifa Nature Reserve; however, no wolf tracks were recorded within the Fifa Reserve. Camera-traps confirmed a single wolf in the upper part of the Dana Reserve close to Rumana Camp, and the researchers were provided with anecdotal reports of wolf sightings and vocalisations around the same area. An interesting point worth mentioning was that the locals and rangers interviewed within the Reserve did not have any outspoken issue with wolves, nor were there reports of wolves approaching tourists or behaving in an aggressive manner.

On the other hand, while conducting tracking surveys in agricultural lands to the northeast of the reserve's boundaries, a Bedouin farmer approached the researchers one morning to inform them that he had lost a young goat the previous night, presumably to a wolf. While this individual did not advocate retaliation or lethal control of wolves, he understandably hoped that more could be done to prevent future livestock losses. Our tracking surveys revealed that wolf activity was higher in close proximity to human resources, suggesting an urgency to develop strategies towards human-wolf coexistence within these pastoralist landscapes.

Acknowledgements

There are several members of the RSCN to which the researchers wish to extend their sincerest gratitude. Many thanks go to Dr Nashat Hamidan and Thabit Alshare for allowing this research to take place and for organising the logistics. The researchers are utterly appreciative of the time that Abdullah Al'Oshoush and Yahya Al'Muhafazah spent with them in the field, organising and assisting with fieldwork locally. Many thanks go to Ibrahim Mahasneh and the staff at the Fifa Nature Reserve for their hospitality in the field. Lastly, thanks are also extended to the rangers – Ibrahim, Abdalrahman, and Faraj – as well as Malik Nananah and the rangers at the Dana Biosphere Reserve for their guidance, knowledge, and assistance in the field. Sincere thanks also go to Peter C. and Nashat H. for their helpful comments and guidance leading to the publication of this manuscript.

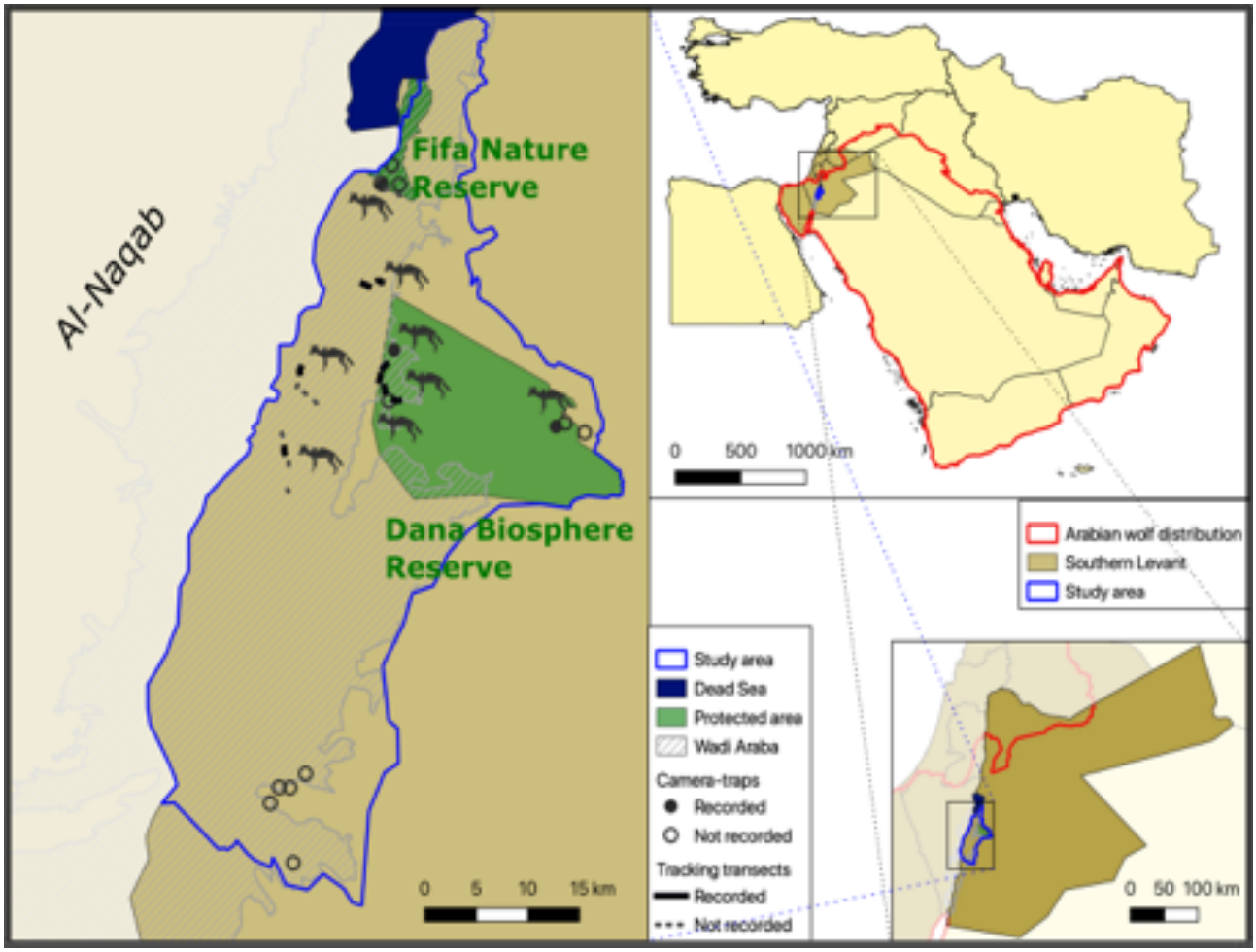

Figure 1. Location of the study area (a), illustrating the important region for wolves around the Dana Biosphere Reserve (wolf images correspond to where Arabian wolves were recorded in this study's surveys); the study area's location within Jordan (b); and the Arabian wolf's range across the Middle East (c).

Figure 2. Camera trap image of an Arabian wolf at a protected spring (Ein Salamani) in the western reaches of the Dana Biosphere Reserve.

References

Aloufi, A and Eid, E. 2016. Zootherapy: A study from the Northwestern region of the Kingdom of Saudi Arabia and the Hashemite Kingdom of Jordan. *Indian Journal of Traditional Knowledge*,**15 (4)**: 561–569.

Amr, ZS, Hamidan, N and Quatrameez, M. 2004. Nature Conservation in Jordan. *Biologiezentrum*. **2**: 467–477.

Barocas, A, Hefner, R, Ucko, M, Merkle, JA and Geffen, E. 2018. Behavioral adaptations of a large carnivore to human activity in an extremely arid landscape. *Animal Conservation* **21** *: 433–443*.

Bunaian, F, Hatough, A, Ababaneh, D, Mashaqbeh, S, Yousef, M and Amr, Z. 2001. The Carnivores of the Northeastern Badia, Jordan. *Turkish Journal of Zoology*, **25**: 19–25.

Chapron, G, Kaczensky, P, Linnell, JDC, von Arx, M, Huber, D, Andrén, H, López-Bao, JV, Adamec, M, Álvares, F, Anders, O, Balciauskas, L, Balys, V, Bedo, P, Bego, F, Blanco, JC, Breitenmoser, U, Brøseth, H, Bufka, L, Bunikyte, R, Ciucci, P, Dutsov, A, Engleder, T, Fuxjäger, C, Groff, C, Holmala, K, Hoxha, B, Iliopoulos, Y, Ionescu, O, Jeremic, J, Jerina, K, Kluth, G, Knauer, F, Kojola, I, Kos, I, Krofel, M, Kubala, J, Kunovac, S, Kusak, J, Kutal, M, Liberg, O, Majic, A, Männil, P, Manz, R, Marboutin, E, Marucco, F, Melovski, D, Mersini, K, Mertzanis, Y, Myslajek, RW, Nowak, S, Odden, J, Ozolins, J, Palomero, G, Paunovic, M, Persson, J, Potocnik, H, Quenette, P-Y, Rauer, G. Reinhardt, I, Rigg, R, Ryser, A, Salvatori, V, Skrbinsek, T, Stojanov, A, Swenson, JE, Szemethy, L, Trajçe, A, Tsingarska-Sedefcheva, E, Vána, M, Veeroja, R, Wabakken, P, Wölfl, M, Wölfl, S, Zimmermann, F, Zlatanova, D and Boitani, L. 2014. Recovery of large carnivores in Europe's modern human-dominated landscapes. *Science*, **346**: 1517–1519.

Cohen, O, Barocas, A and Geffen, E. 2013. Conflicting management policies for the Arabian wolf *Canis lupus arabs* in the Negev Desert: is this justified? *Oryx*, **47**: 228–236.

Cunningham, PL. 2004. Checklist and status of the terrestrial mammals from the United Arab Emirates. *Zoology in the Middle East*, **33**: 7–20.

Cunningham, P, Wronski, T and Al Aqeel, K. 2009. Predators persecuted in the Asir Region, western Saudi Arabia. *Wildlife Middle East*, **4** (1): 6

Cunningham, PL and Wronski, T. 2010a. Distribution update of the Arabian wolf (*Canis lupus pallipes*) from Saudi Arabia. *Wildlife Middle East*, **5** (3): 4

Cunningham, P and Wronski, T. 2010b. Arabian wolf distribution update from Saudi Arabia. *Canid News*, **13**: 1–6.

Edwards, S, Al Awaji, M, Eid, E and Attum, O. 2017. Mammalian activity at artificial water sources in Dana Biosphere Reserve, southern Jordan. *Journal of Arid Environments*, **141**: 52–55.

Eid, E and Handal, R. 2018. Illegal hunting in Jordan: Using social media to assess impacts on wildlife. *Oryx*, **52**: 730–735.

Mallon, D and Budd, K. 2011. **Regional Red List Status of Carnivores in the Arabian Peninsula**. IUCN, Sharjah, UAE.

Mech, LD. 2017. Where can wolves live and how can we live with them? Biological Conservation, **210**: 310–317.

Mech, LD and Boitani, L. 2004. Grey wolf. *In*: Sillero-Zubiri, C, Hoffmann, M and Macdonald, DW.(Eds), **Canids: Foxes, Wolves, Jackals and Dogs. Status Survey and Conservation Action Plan**. IUCN/SSC Canid Specialist Group, Gland, Switzerland and Cambridge, UK, Pp.124-129.

Seddon, PJ and Khoja, AR. 2003. Youth attitudes to wildlife, protected areas and outdoor recreation in the Kingdom of Saudi Arabia. *Journal of Ecotourism*, **2**: 67–75.

Shalmon, B. 1986. Wolves in the southern Arava. *Re'em*, **5**:60-74.

Short Communication

Tail Malformation in *Ablepharus rueppellii* (Reptilia: Scincidae) from the Occupied West Bank, Palestine

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Received: February 24, 2021; Accepted: April 13, 2021

Abstract: This is the first record of a symmetrical bifurcation and malformation in the tail of Festa's skink, *Ablepharus rueppellii,* in the West Bank, Palestine.

Keywords: Malformation, Bifurcation, *Ablepharus rueppellii,* Scincidae, West Bank, Palestine.

Festa's skink, *Ablepharus rueppellii* (Gray, 1839), is a member of the family Scincidae. The genus *Ablepharus* includes ten species distributed across southeast Europe, the Middle East including Sinai, and across eastern Asia in China and Kyrgyzstan (Sindaco *et al*., 2008). *Ablepharus rueppellii* (Gray, 1839) is a common species found in the Levant (Palestine, Syria, Lebanon, and Jordan) and in Sinai (Werner, 2016; Disi, 2002; Roll *et al.,* 2013). *A. rueppellii* lives in the Mediterranean phytogeographical zone where it inhabits areas with oak and pine trees (Handal *et al.,* 2016; Werner, 2016). Roll *et al.* (2013) found that *A. rueppellii* penetrates into Al Naqb Desert (southern Palestine); they showed in a distributional map, the localities of this species in the northern and central areas of the West Bank.

Malformation especially of the tail is common in reptilian species (Christopoulos and Pafilis, 2020). Most of the tail malformations appear as bifurcation, and in some cases as trifurcation or other (Pheasey *et al.,* 2014; Koleška and Jablonski, 2015; Passos *et al.*, 2016; Pelegrin and Leão, 2016). Malformation in the limbs of lizards is uncommon or even rare (Christopoulos and Pafilis, 2020; Kolenda *et al*., 2017). Most of tail anomalies in lizards come in heterogeneous shapes (Pola and Koleska, 2007; Koleska *et al.,* 2017; Maria and Al-Razi, 2018).Few records of the genus *Ablepharus* reported tail malformation, and none showed symmetrical bifurcation in the tail (Ramadanović and Zimić, 2019; Werner, 2016).

A specimen of *Ablepharus rueppellii* (PMNH-V1046, Beit Jalla, 27.vii.2016) showed malformation in the tail (Figure 1 A and B). The bifurcated parts of the tail were measured as 11 mm to 10.9 mm; this malformation comes with an extra tail under the original tail. The total length of the individual was 78 mm (SVL 31 mm), the tail was measured at 47 mm. Based on pattern, shape, and scalation of the tail, the upper part bifurcation appeared to be original (Figure 1B). The lizard was in good condition when it was collected without other deformities or injuries. The appearance of the malformation in the tail does not seem to have affected its daily life. This is the first record for a symmetrical bifurcation malformation in the tail of *Ablepharus rueppellii* (Figure1-B). According to Werner (2016) *A. rueppellii* tail was recorded with a lower branch that grew out of a wound in the upper original branch. The same malformation in the tail of *Ablepharus deserti*, as a forked and branched from the major tail, was observed in Kyrgyzstan (Jablonski, 2016).

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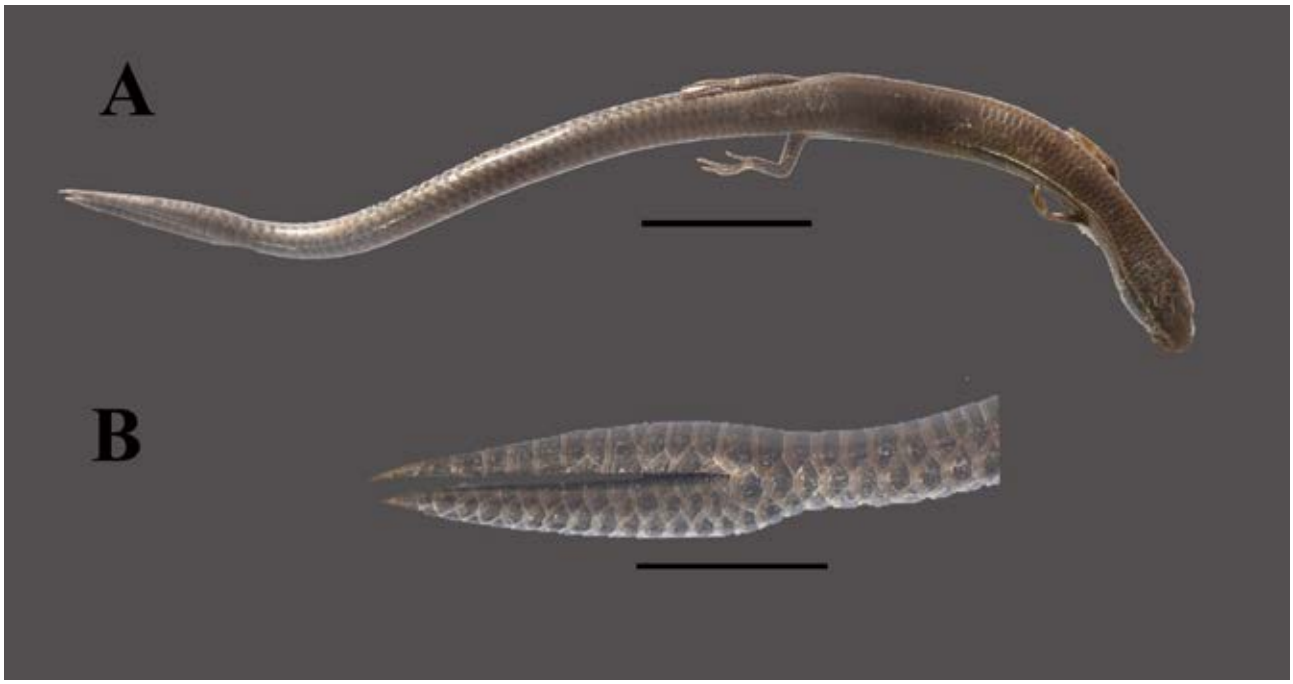


Figure 1. *Ablepharus rueppellii,* **A**: Dorsal view Scale bar = 10mm, **B:** Lateral view of the tail, Scale bar = 5mm.

Acknowledgment

We thank the team of the Palestine Institute for Biodiversity and Sustainability (PIBS) for the effort of studding the biodiversity in Palestine and collecting important specimens. Great thanks go to Dr. Zuhair Amr and Dr. Mazin Qumsiyeh for reviewing and editing this research. This Research was conducted in the Biodiversity Center (funded by EUPI grant ENI/2019/162124/83 "Unity and diversity in nature and society") at the Palestine Institute for Biodiversity and Sustainability (PIBS).

References

Christopoulos A and Pafilis P. 2020. Hindlimb malformation in a widely distributed skink, *Chalcides ocellatus*. *Herpetology Notes*, **13**:.15-17.

Disi AM. 2002. **J**ordan Country Study on Biological Diversity: The Herpetofauna of Jordan. The General Corporation for the Environment Protection, The Hashemite Kingdom of Jordan, Amman.

Handal EN, Amr Z, and Qumsiyeh M. 2016. Some Records of Reptiles from the Palestinian Territories. *Russian Journal of Herpetology*, **23**(4): 261-270.

Jablonski D. 2016. Tail bifurcation in a desert lidless skink (*Ablepharus deserti*) from Kyrgyzstan. *Reptiles & Amphibians*, **23**(3), pp.171-172.

Kolenda K, Wieczorek M, Najbar A, Najbar B and Skawiński T. 2017. Limb malformation and tail bifurcation in sand lizards (*Lacerta agilis*) and common lizards (Zootoca vivipara) from poland. *Herpetology Notes*, **10**: 713-716.

Koleška D and Jablonski D. 2015. Tail trifurcation recorded in *Algyroides nigropunctatus* (Duméril & Bibron, 1839). *Ecologica Montenegrina*, **3**: 26–28.

Koleska D, Svobodova V, Husák T, Kulma M and Jablonski D, 2017. Tail bifurcation recorded in Sauromalus ater. *Herpetology Notes*, **10**: 363-364.

Maria M and Al-Razi H. 2018. Observation of tail bifurcation in *Hemidactylus frenatus* (Schlegel, 1836). *Herpetology Notes*, **11**: 953-954.

Passos DC, Fonseca PHM, Romo de Vivar PR, Kanayama CY, Teixeira VPA, and

Martinelli AG. 2016 Tail trifurcation in the lizard *Salvator merianae* (Squamata: Teiidae) investigated by computer tomography. *Phyllomedusa* **15**: 79–83.

Pelegrin N, and Leão SM. 2016. Injured *Salvator merianae* (Teiidae) regenerates six tails in central Argentina. *Cuadernos de Herpetología*, **30**: 21–23.

Pheasey H, Smith P, Brouard JP, and Atkinson K. 2014. *Vanzosaura rubricauda* (Red-tailed Vanzosaur). Bifurcation and trifurcation. *Herpetological Review*, **45**(1): 138–139.

Pola L and Koleska D. 2017. Tail bifurcation in Common wall lizard (*Podarcis muralis* Laurenti, 1768) from Liguria, Italy. In 9th Workshop on Biodiversity (Jevany, Czech Republic 8-9 July 2017). Proceedings of the 9th Workshop on biodiversity (pp. 93-97).

Ramadanović D. and Zimić A. 2019. Record of a *Lacerta agilis* Linnaeus, 1758 with erythronotus colour morph and tail bifurcation. *Herpetology Notes*, 12: 779-781.

Roll U, Tallowin O, Berkowic D, Maza E, Ostrometz- ky Y, Slavenko A. Shacham B, Tamar K and Meiri S. 2013. "Rueppel's Snake-eyed skink, *Ablepharus rueppellii* (Gray, 1839) (Reptilia: Squamata: Scincidae): Distribution extension and geographic range in Israel," Check List, **9**: 458 – 464.

Sindaco R, Jeremčenko VK, Venchi A and Grieco C. 2008. The Reptiles of the Western Palearctic, Annotated Checklist and Distributional Atlas of the Turtles, Crocodiles, Amphisbaenians and Lizards of Europe, North Africa, Middle East and Central Asia (p. 589). Latina: Edizioni Belvedere.

Werner YL. 2016. Reptile Life in the Land of Israel with Comments on Adjacent Regions. Edition Chimaria. p.494.

Professor Dawud M H. Al-Eisawi (1946-2020)

It is with great regret that we learned of the untimely death of Professor Dawud Al-Eisawi, on the morning of 24th December 2020, after losing his battle against the Corona virus. He was the founder of the Jordan Journal of Natural History and closely supervised every volume for the past seven years. All those involved with the Journal, as represented by its Editorial, Associate and International Boards, were shocked and saddened by the news of his death.

Born in 1946, Al-Eisawi grew up in a busy working family in Kufor Aana in Palestine. He developed a love of the natural world early on and became ever more interested in the land and its plants as he grew older. His family supported his scientific curiosity and, in the late 60s, sent him to study agricultural science at Alexandria University in Egypt. Here he met Professor Lutfi Bolus (1932 - 2015), the author of The Flora of Egypt. Bolus noticed Al-Eisawi's passion for plants and his excellent memory and skills, especially in plant taxonomy. Bolus provided much needed encouragement during Al-Eisawi's studies and formative years. After his graduation in 1971, Al-Eisawi returned to Jordan where he joined the staff of Jordan University in the Department of Biology (Faculty of Science) as a lecturer.

In 1977, he secured a place at the University of Reading in the United Kingdom, where he finished his PhD in the systematic study of Umbelliferae (Apiaceae plant family) in Jordan and reviewed the Genera *Tordylium* L. and *Turgenia* Hoffm.

After receiving his doctorate in 1977, El-Aisawi re-joined the Biology Department at the University of Jordan as an Assistant Professor. By 1988 he had advanced along his academic path to become Professor of Botany. While he was teaching at the University, Al-Eisawi started to explore the flora of Jordan, inspired by the knowledge gained from his PhD. He was also enthusiastic about establishing a new niche in botanical science, linking plant taxonomy to ecology.

Professor Al-Eisawi (2019)

As a teacher, he was well known for his superior capabilities in transferring knowledge to his students, which he did with a delightful and passionate spirit that conveyed his own love of the plant kingdom above all else. For example, when teaching plant anatomy, he used to teach each individual BSc student to produce their own slides in a proficient way, rather than use pre-prepared slides.

Field Trip in Dana Biosphere Reserve (2016)

Professor Al-Eisawi in the easatern desert of Jordan in Al-Wesad area while pressing the plants specimens for further indentification. This photo is taken by John E. Clarke in 1978.

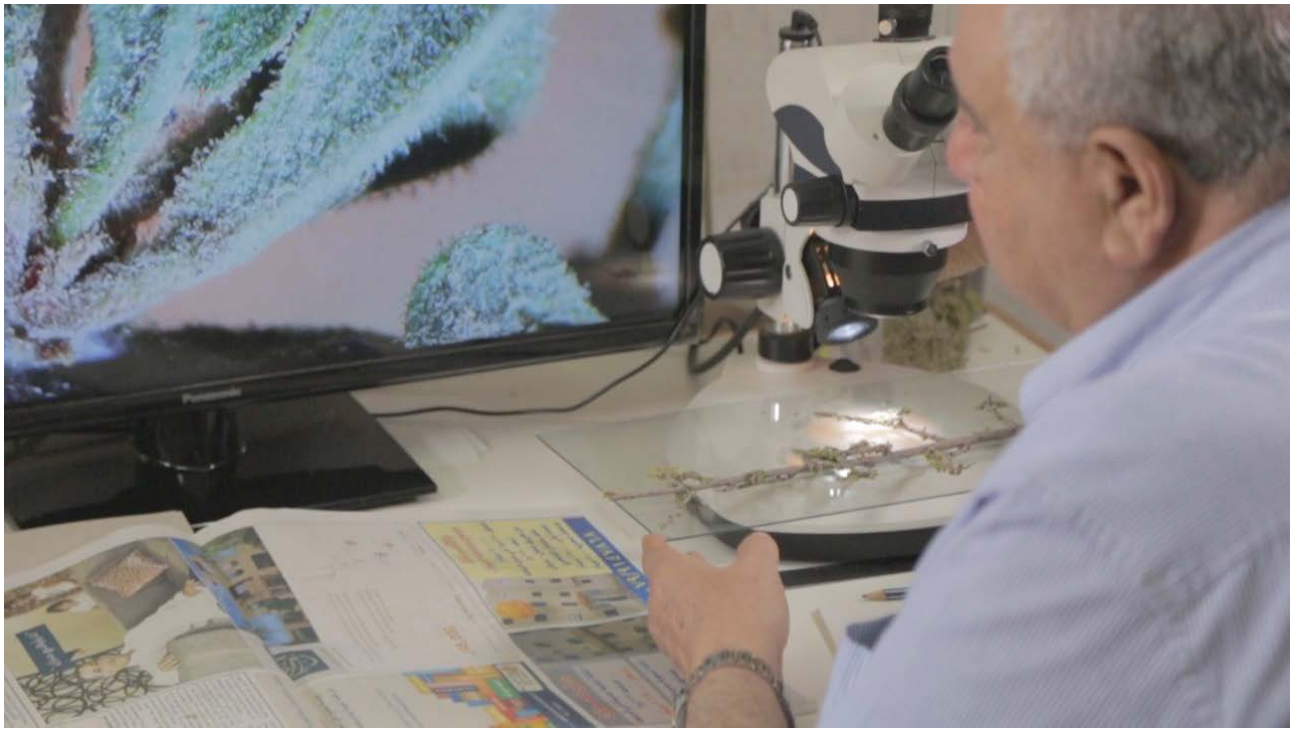
He was one of the scientific founders of the Royal Society for the Conservation of Nature (RSCN) and he joined the mission led by John E. Clarke in 1978 to collect the plants of Jordan and describe the vegetation of proposed protected sites. The output of this mission became the basis of the road map for the establishment of protected areas in Jordan.

He supported RSCN over many years and his involvement continued to the end of his life. After retirement, he devoted much of his time to the Conservation Monitoring Centre at RSCN, and re-created the floral research programme in terms of objectivity, field methodology, conceptual design and taxonomy. He used to arrive very early in the morning to start working in the Herbarium, looking at the plant taxonomy of its collections in great detail. He helped to build the capacity of RSCN's research team, joining them in the field and documenting all their specimens. His companionship in the lab and in the field was of great value to all staff. His continuous advice and supervision were exceptional and he left this life assured that the Herbarium of RSCN was up to international standards.

His scientific legacy, which exceeded 200 publications, included a published list of the plants of Jordan in 1982. This was updated several times until the last publication in 2013. His lasting legacy also includes unique publications on the vegetation of Jordan, wildflowers of Jordan and the flora and vegetation of Hawar Island in the Kingdom of Bahrain.

In his academic life he supervised many Masters and PhD students and directed their studies in the fields of plant taxonomy, anatomy and palynology, as well as in the skills of writing, identification and preparation of specimens and proper documentation.

He would use his summer semesters to visit regional or overseas herbaria and botanic gardens so as to catch up with the latest knowledge in his field and to do specimen comparisons and taxonomical revisions. He



Professor Al-Eisawi examining floral specimens in the laboratory of the Conservation Monitoring Centre at the Royal Society for the Conservation of Nature.

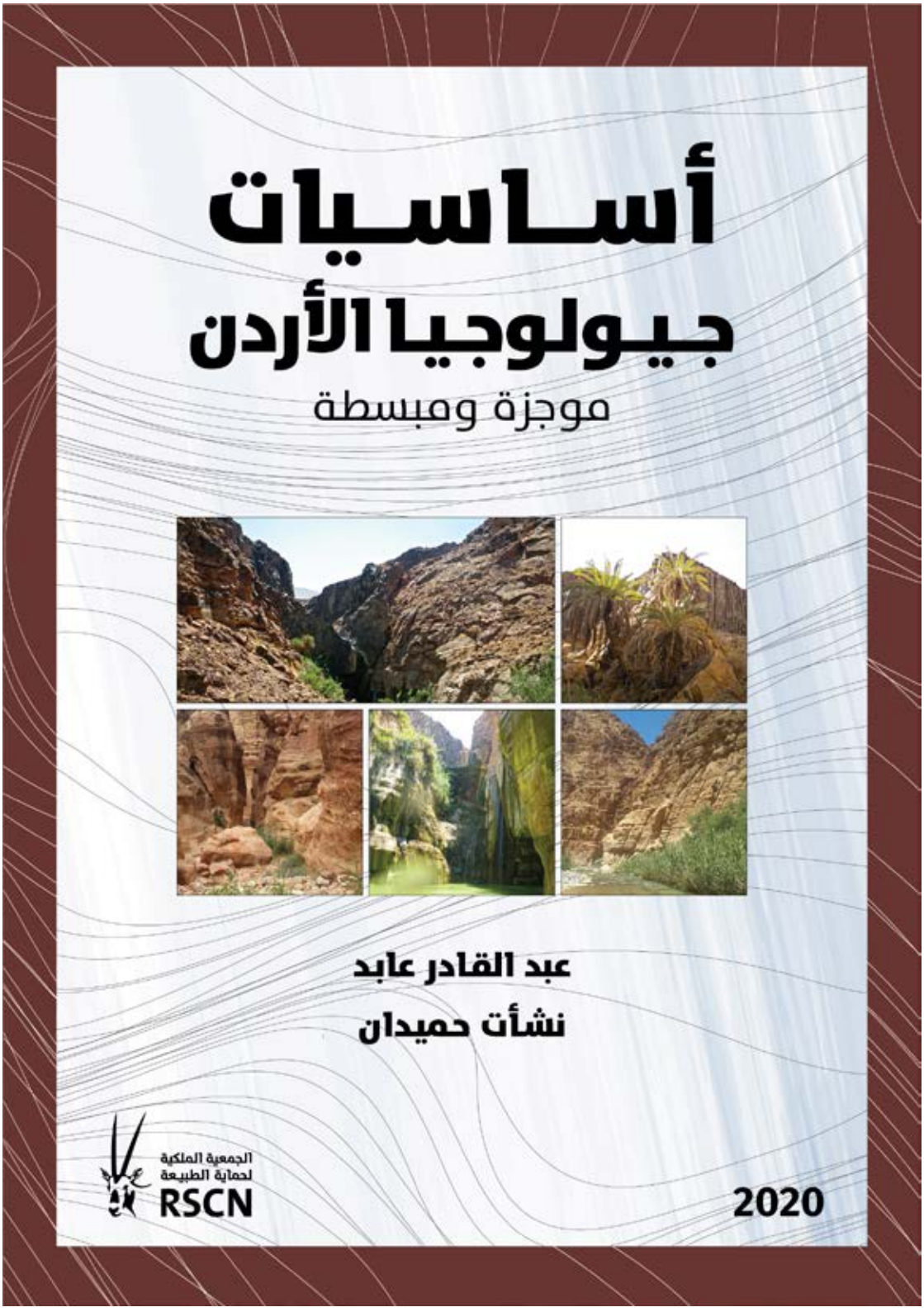
was well-known to international and highly esteemed botanical organisations such as Kew Botanic Gardens, Royal Botanic Garden Edinburgh, Missouri Botanical Garden and many more.

The family of the Jordan Journal of Natural History sends its deepest condolences to Professor Al-Eisawi's family for their loss. Professor Al-Eisawi will never be forgotten by his colleagues, his students and the scientific community. We will we treasure our memories of him and he will stay connected to our heart strings forever.

Nashat A. Hamidan

Newly Published 2020

Geology of Jordan [In Arabic]



The Royal Society for the Conservation of Nature

Is a national organization devoted to the conservation of Jordan's wildlife. It was founded in 1966 under the patronage of His Majesty the late King Hussein and has been given responsibility by the government to establish and manage protected areas and enforce environmental laws. As such, it is one of the few non-governmental organizations in the Middle East to be granted such a public service mandate.

ISSN: 2307-7565