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Survey and Identification of Grasshoppers Species in Al-Orman Garden in Egypt

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ABSTRACT

A total of 1069 Orthopids belonged to 6 species derived from 2 families (Acrididae and Pyrgomorphidae) were collected from Al-Orman garden during 2019 and 2020. The most common grasshopper species were *Calphorus compressicornis* 52% and 50%, followed by *Aiolopus thalassinus* 37% and 38%, then *Acrotylus insubricus* 3% and 5%, then *Heteracris littoralis* 3% and 3%, then *Eyprepocnemis plorans* 3% and 2%, & finally *Pyrgomorpha conica* 2% and 2%, respectively. These 6 species were collected at the garden in 2019 and 2020. The dominant species were (*C. compressicornis* and *A. thalassinus*). The seasonal abundance of grasshopper occurred in August in summer season, one peak only was obtained in both years.

INTRODUCTION

Al-Orman botanical garden established in 1875, Orman is the Turkish word for Forest; it is one of the largest gardens in Egypt, located on the west bank of the Nile at Giza, in Cairo 30°01'45"N 31°12'47"E. It covers about 28 feddans. A herbarium building with more than 7000 plants, a Gene Bank, and a one and half feddans rocker garden with succulents and several cactus varieties are included in the Gardens. There is a reservoir of water and marsh plants, in which the two most common plants of ancient Egypt, Papyrus, and Lotus, are found. There are also, few feddans and uncommon varieties of Ficus, Palm, Bamboo, and Conifers in the rose garden (FAO, 2012). The garden currently hosts 835 species planted in 12 sections; the rock garden containing more than 200 species of cactus and succulents, the rose garden, the water pond containing water plants, and the multi greenhouse (Abd El Ghany *et al.*, 2007).

Grasshoppers are dominant herbivores with a broad variety of morphological, biological, and behavioral, diversified into grassland, desert, semi-aquatic, alpine, and tropical forest environments (Cigliano *et al.*, 2000). Grasshoppers may give rise to wastage everywhere, but few species achieve economic importance, defoliate grasses by direct feeding on leaves, stem, and tissues, or cutting off leaf plus stem and head during feeding. High groups of grasshoppers on rangeland may damage implant crowns so roughly that many plants will not be able to recover. Also, grasshoppers can consume a large amount of foliage quickly, besides, stop the growth of roots, and nutrient uptake is a limitation for many days when over 50% of the growing herbage from the lawn consumed, moreover, consuming more than 65% of the growing grass, once during the

growing season can decrease the whole root length by 30% or more; when herbage is continuously defoliated, within years, it will be weak and die (John *et al.*, 2006).

The present study aimed to survey and identify grasshopper species obtained at Al-Orman garden. Furthermore, this study is considered as the first survey and identify grasshopper at Al-Orman garden.

MATERIALS AND METHODS

Collecting Adults:

Adults of grasshoppers (males and females) were collected by authors who surveyed all over Al-Orman garden, it is well known as a diurnal insect, the collection process was started from 7-10 AM every two weeks, in 2019 and 2020, by sweeping on grasses using net for catching insects individually. The collected specimens were killed immediately in cyanide bottles, then kept in a plastic jar to obtain data of collection, such as the date of collection and the number of individuals, then transferred to the lab. In the lab, specimens are prepared for studies. First, the specimens were pinned vertically through the centreline of the mesothorax by a pin, then fixed on setting boards with a V-shaped groove was cut in the board, using setting papers to hold, spreading and stretching wings in the right position on the setting boards, specimens dried in a well-ventilated place. Every specimen had a label. Permanent collections were kept in storage boxes for further studies (Upton and Chapman, 2010). Photos of samples took by using a Sony digital camera.

Grasshopper Identification:

Both females and males of obtained specimens were chosen to be examined under dissecting binocular microscope. The examined specimens were compared with the preserved specimens in the Ministry of Agriculture Collection (MAC), Plant Protection Research Institute, Survey and Taxonomy Department.

Biodiversity Measures:

The measurement of males and females as body length, antennae length, pronotum length, tegmen (length and width), hind femur length, and tibia length are obtained.

RESULTS AND DISCUSSION

Identification of Studied Species:

Six species of grasshoppers in (Fig. 1) have been recorded at Al-Orman garden during the studied seasons, also all measurements of species presented in (Table 1). These species belong to six genera and two families (Acrididae and Pyrgomorphidae). One of the most numerous lineages within Orthoptera is the Acrididae family, with more than 6,700 species spread globally, (Cigliano *et al.*, 2018). In Egypt, the total number of Acrididae species is more than one hundred (Haggag *et al.*, 2008). This family represented at Al-Orman garden by three sub-families and five species as Oedipodinae (*A. Thalassinus* and *A. insubricus*); *Eyprepocnemidinae* (*E. plorans* and *H littoralis*) and Acridinae (*C. compressicornis*).

The family Pyrgomorphidae is known as one of the most colorful families of grasshoppers, including around 500 species widely spread globally. Commonly called gaudy or bush grasshoppers, some species are culturally important, and others are agricultural pests (Mariño-Pérez and Song 2017). Pyrgomorphidae presented in Egypt by few species and by one species in this study *P. cognata*.

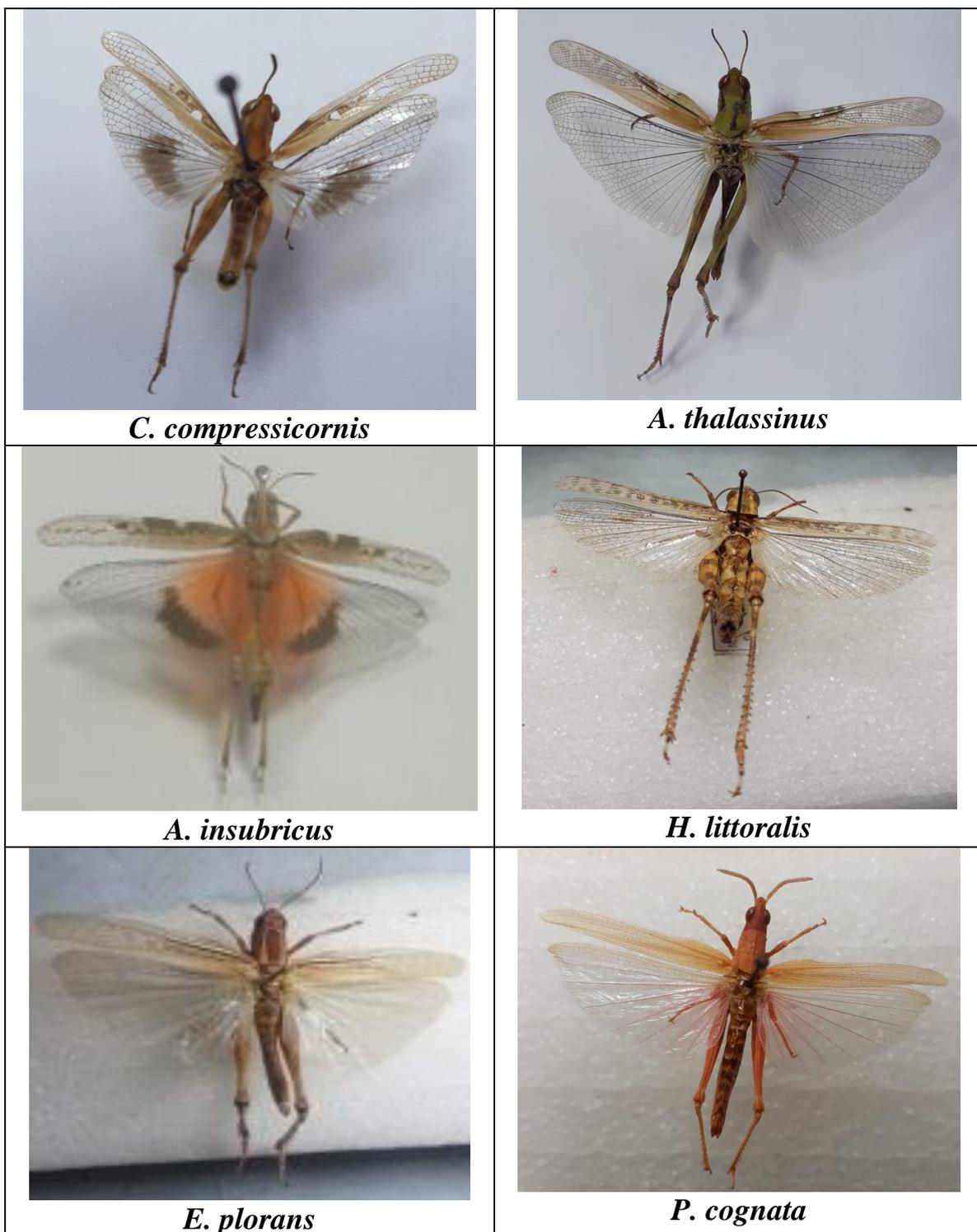


Fig. 1: The studied grasshopper species at Al-Orman garden.

Table 1: Measurement (Cm.) of different species of grasshopper recorded Al-Orman during 2019 and 2020.

Measurements	Grasshopper species										
	<i>C. compressicornis</i>		<i>A. Thalassinus</i>		<i>A. insubricus</i>		<i>H. littoralis</i>		<i>E. plorans</i>		<i>P. cognata</i>
	F	M	F	M	F	M	F	M	F	M	F
Body length	2.1±0.10	1.37±0.06	2.93±0.15	1.82±0.08	2.4±0.28	1.57±0.06	3.27±0.17	2±0.1	4.16±0.25	2±0.04	2.1±0.14
Antennae length	0.47±0.06	0.53±0.06	0.63±0.06	0.56±0.09	0.70±0	0.73±0.06	1.22±0.32	1.03±0.05	1.2±0	0.9±0.01	0.65±0.07
Promotum length	0.4±0.10	0.27±0.06	0.47±0.06	0.34±0.06	0.35±0.07	0.33±0.06	0.72±0.09	0.46±0.05	0.8±0.17	0.5±0.05	0.35±0.07
Tegmen length	1.53±0.06	1.03±0.15	2.6±0.10	1.70±0.31	2.10±0.14	1.77±0.06	2.90±0.11	1.73±0.11	3.93±0.11	2±0.07	1.85±0.07
Tegmen width	0.4±0.10	0.27±0.06	0.53±0.06	0.36±0.09	0.35±0.07	0.30±0	0.5±0.08	0.23±0.5	0.53±0.11	0.4±0	0.30±0
Hind femur length	1.17±0.15	0.77±0.06	1.57±0.32	1.38±0.08	0.95±0.07	0.90±0	2±0	1.43±0.11	2.73±0.58	1.4±0.11	1.05±0.07
Tibia length	0.97±0.06	0.77±0.15	1.07±0.12	0.94±0.11	1.05±0.07	0.83±0.06	2±0	1.23±0.05	2.16±0.15	1.5±0.06	0.85±0.07

(Abbreviation: F= Female, M= Male)

1- *Calphorus compressicornis* (Latreille, 1804)

Synonyms: *Acrydium compressicornis* Latreille 1804

Oxycoryphus compressicornis (Latreille, 1804)

Calephorus dubius (Rambur, 1838)

Calephorus elegans Fieber, 1853

Calephorus venustus (Walker, 1870)

Calephorus laetus (Walker, 1870)

Oxycoryphus venustus Walker, 1870

Calephorus compressicornis camerunensis Sjöstedt 1931

Distribution of the world: Libya and Spain.

2- *Aiolopus thalassinus* (Fabricius, 1781)

Common name: Rice grasshopper

Synonyms: *Aiolopus acutus* Uvarov, 1953

Epacromia angustifemur Ghiliani, 1869

Gryllus flavovirens Fischer von Waldheim, 1846

Distribution of the world: Algeria, Hungary, Georgia, India, Jordan, Korea, Libya, Pakistan and Spain.

A. thalassinus is an important graminivorous pest of different plants and grasses. *Aiolopus* consists of 13 Asian, African and European species (Min and Min, 2008). Haggag, 2011, clearly indicates that the most commonly spread grasshopper in the Egyptian agricultural fields is *A. thalassinus*. Hoppers stages feed on small grasses and seedling crops that are more robust than adults (Baloch, 1978).

3- *Acrotylus insubricus* (Scopoli, 1786)

Common name: Redwing grasshopper.

Synonyms: *Gryllus insubricus* Scopoli, 1786,

Acrydium maculatum Olivier, 1791

Gryllus fasciatus Fabricius, 1793

Oedipoda maderae Serville 1838.

Oedipoda inficita Walker, 1870.

Oedipoda variegata Walker, 1870.

Acrotylus versicolor Burr, 1898.

Acrotylus insubricus biskrensis Maran, 1958.

Distribution of the world: mainly spread in Africa, Eurasia, and southern Europe, Algeria, Canary Island, Czechoslovakia, France, Georgia, Hungary, India, Italy, Jordan, Kuwait, Libya, Madeira, Morocco, Nigeria, Rumania, Somalia, Spain, Sudan, Tunisia

and Turkey.

A. insubricus inhabits a range of habitats, as bare land (Massa *et al.*, 2012), Mediterranean, bushland, grasslands, dunes, gardens, grazing land, or urban areas (Nagy, 1958 and Hochkirch, 1998).

4- *Heteracris littoralis* (Rambur, 1838)

Common name: Homogenous clover grasshopper.

Synonyms: *Thisoicetrus littoralis* (Rambur, 1838

Gryllus littoralis Rambur, 1838

Thisoicetrus littoralis aethiopica (Carl, 1916)

Thisoicetrus littoralis asiaticus Uvarov, 1933

Heteracris bituberculatus (Bei-Bienko, 1948)

Distribution of the world: Europe, Libya, Pakistan and Turkey.

The economic importance of *H. littoralis* comes from targeting several crops planted, vegetables, and even trees after it's attacking it may leave the cultivated area as a desert, and it's economic damage was recorded in Egypt by (Mistikawy 1929 and Nakhla 1967).

5- *Eyprepocnemis plorans* (Charpentier, 1825)

Common name: Clover grasshopper.

Synonyms: *Eyprepocnemis plorans pallida* Uvarov, 1921

Acridium plorans (Charpentier, 1825)

Heteracris plorans (Charpentier, 1825)

Caloptenus plorans (Charpentier, 1825)

Eyprepocnemis plorans (Charpentier, 1825)

Acridium reticulatus Fischer von Waldheim, 1839

Caloptenus tarsius Fischer von Waldheim, 1846

Eyprepocnemis plorans pallida Uvarov, 1921

Eyprepocnemis plorans senegalensis Bolívar, I., 1914

Distribution of the world: Algeria, France, Georgia, India, Jordan and Turkey.

Eyprepocnemis plorans is one of the most economical species that caused significant damage. It caused serious damage about 95% to crops at the Nile Delta, but few studies occurred in Egypt (Abdel-Fattah, 2002).

6- *Pyrgomorpha cognata* Krauss, 1877

Distribution of the world: Afghanistan, Algeria, Caucasus, Iraq, Iran, Libya, Northern Africa, Turkey. West of Europe and West Pakistan.

3.2.: Survey of grasshopper species:

Survey of grasshopper species on grasses was carried out through two seasons in 2019 and 2020 at Al-Orman garden. Results presented in (Table 2) and (Fig. 2 and 3) showed that six species of grasshopper were found during the studied years in 2019. *C. compressicornis* and *A. Thalassinus* were the dominant species, where their total numbers were the highest (261 and 188 insects/year) by percentage (52% and 37%), respectively. While the other species recorded in low numbers as *A. insubricus*, *H. littoralis*, *E. plorans* and *P. cognata* (17, 15, 12 and 11) by percentage (3%, 3%, 3% and 2%), respectively. The same result obtained in 2020, where *C. compressicornis*, *A. thalassinus* were the most grasshopper species abundance where the total numbers were (282 and 214 insects/year) by percentage (50% and 38%), respectively. the population density of the other species expressed lower numbers as *A. insubricus*, *H. littoralis*, *E. plorans*, and *P. cognata* (25, 18, 13, 13 insects/year) by percentage (5%, 3%, 2% and 2%), respectively in (Table 2) and (Fig. 3). Conversely, Mustafa *et al.*, 2017 found during their surveying of

grasshopper at Tebbin region, South Cairo, Egypt that the percentage of species number was 26.7%, and 14.5% in *A. thalassinus* and *C. compressicornis*.

Table 2: Population density of grasshopper species at Al-Orman during 2019 and 2020.

inspected months	<i>C. compressicornis</i>		<i>A. thalassinus</i>		<i>A. insubricus</i>		<i>H. littoralis</i>		<i>E. plorans</i>		<i>P. cognata</i>	
	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
1 Jan.	3	7	1	6	0	0	0	1	1	0	0	0
15 Jan.	4	5	2	5	0	0	1	1	0	0	0	0
1 Feb.	4	8	1	5	1	0	1	0	1	0	0	0
15 Feb.	1	4	1	2	0	0	0	0	0	0	0	0
1 Mar.	1	4	1	2	0	0	0	0	0	0	0	0
15 Mar.	4	5	3	2	0	0	0	1	0	0	0	0
1 Apr.	9	6	7	4	0	0	0	0	1	0	0	0
15 Apr.	8	8	6	6	1	0	0	1	0	1	0	0
1 May.	10	9	7	7	1	0	0	1	1	0	0	0
15 May.	11	12	8	8	1	1	1	1	0	1	0	0
1 Jun.	10	15	8	10	1	0	0	0	0	0	0	0
15 Jun.	14	17	10	12	0	1	0	0	0	0	1	1
1 Jul.	22	20	15	15	1	0	2	1	1	1	0	1
15 Jul.	24	25	18	19	2	4	2	2	0	2	2	1
1 Aug.	29	28	22	20	3	4	3	5	1	4	2	3
15 Aug.	26	29	23	25	2	5	2	2	2	1	2	3
1 Sep.	17	20	11	16	1	4	1	0	1	1	1	2
15 Sep.	16	16	12	14	2	3	0	0	0	0	2	0
1 Oct.	11	12	8	10	0	0	0	0	1	0	0	1
15 Oct.	10	5	7	4	0	1	0	1	0	1	0	1
1 Nov.	9	8	6	5	0	1	0	0	1	1	1	0
15 Nov.	9	8	5	5	1	1	0	0	0	0	0	0
1 Dec.	5	5	3	6	0	0	1	1	1	0	0	0
15 Dec.	4	6	3	6	0	0	1	0	0	0	0	0
Total number	261	282	188	214	17	25	15	18	12	13	11	13

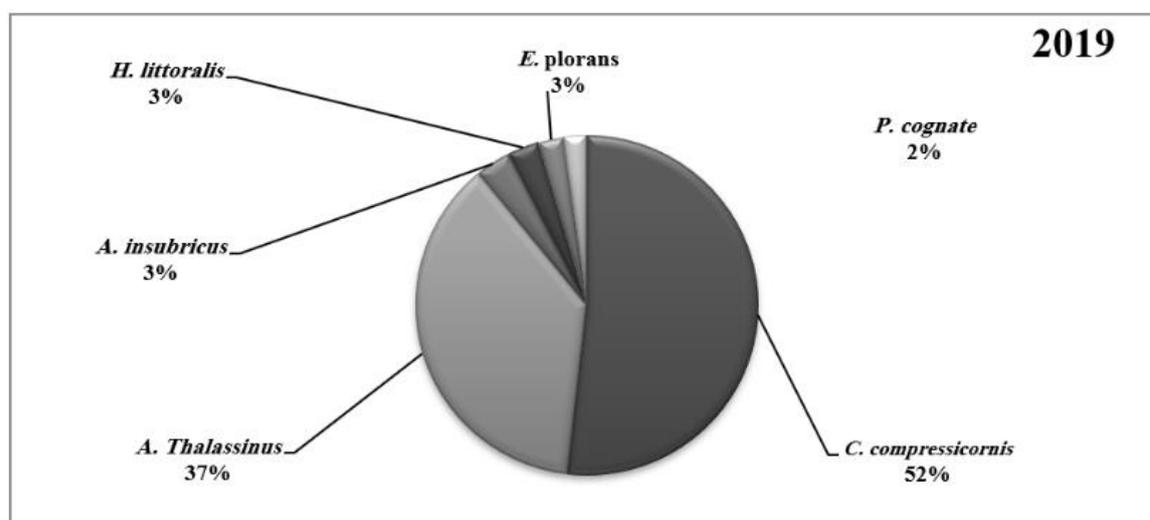


Fig. 2: Population density of grasshopper species obtained at Al-Orman garden during seasons 2019.

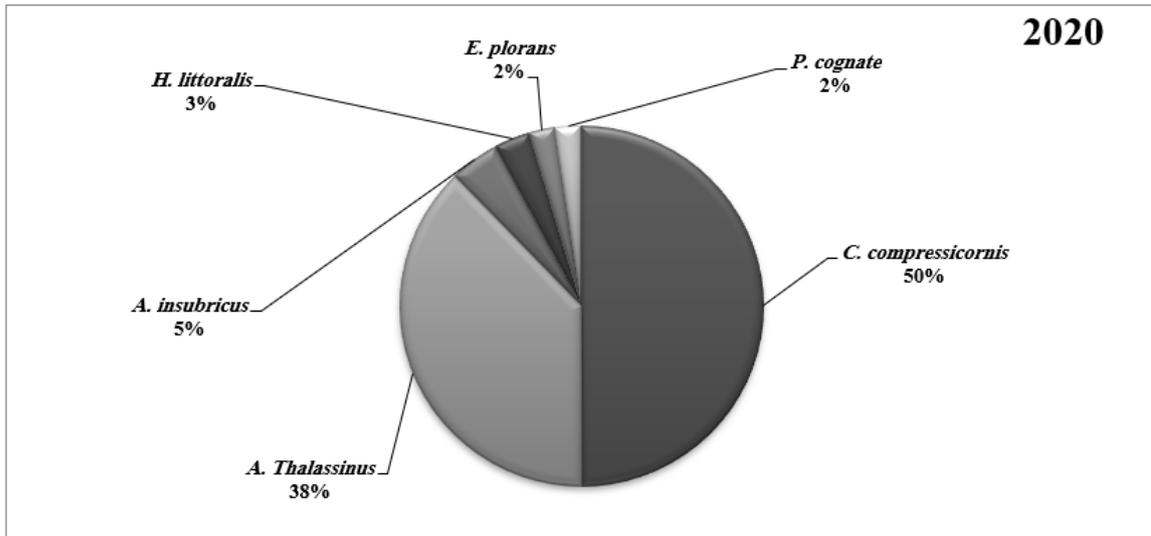


Fig. 3: Population density of grasshopper species obtained at Al-Orman garden during seasons 2020.

Seasonal Abundance of Dominant Species:

The result's peak of population density for both grasshoppers *C. compressicornis* and *A. thalassinus* at Al-Orman garden during 2019 and 2020 was presented in (Table 2) and (Fig. 4 and 5).

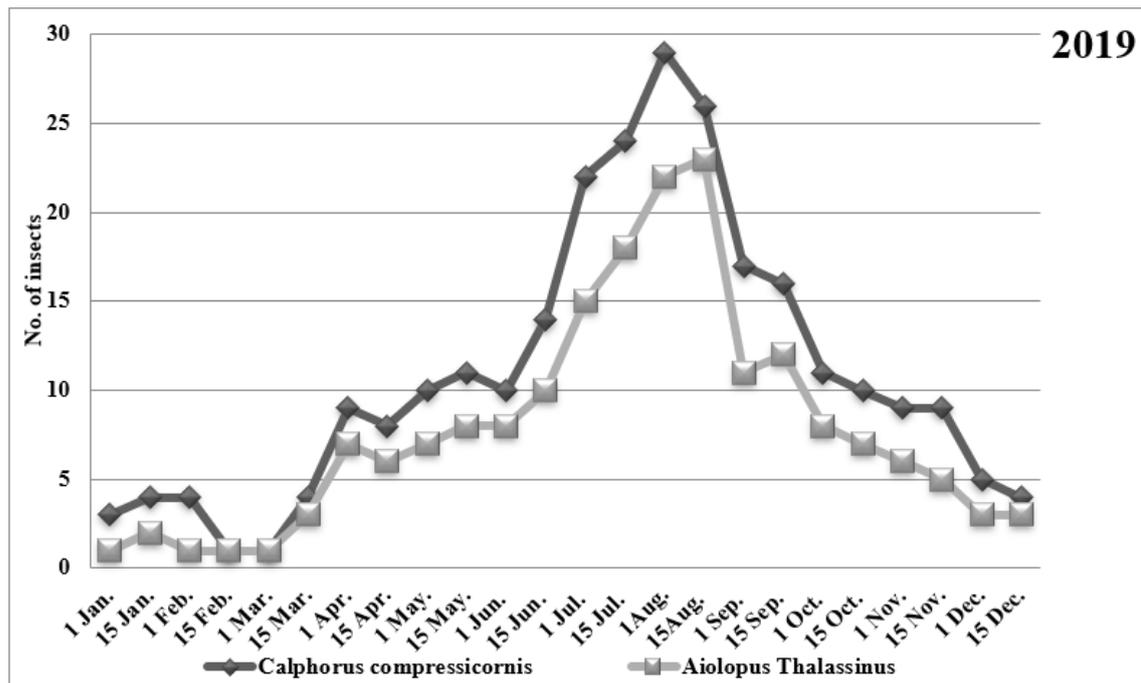


Fig. 4: Population fluctuation of *C. compressicornis* and *A. thalassinus* during 2019.

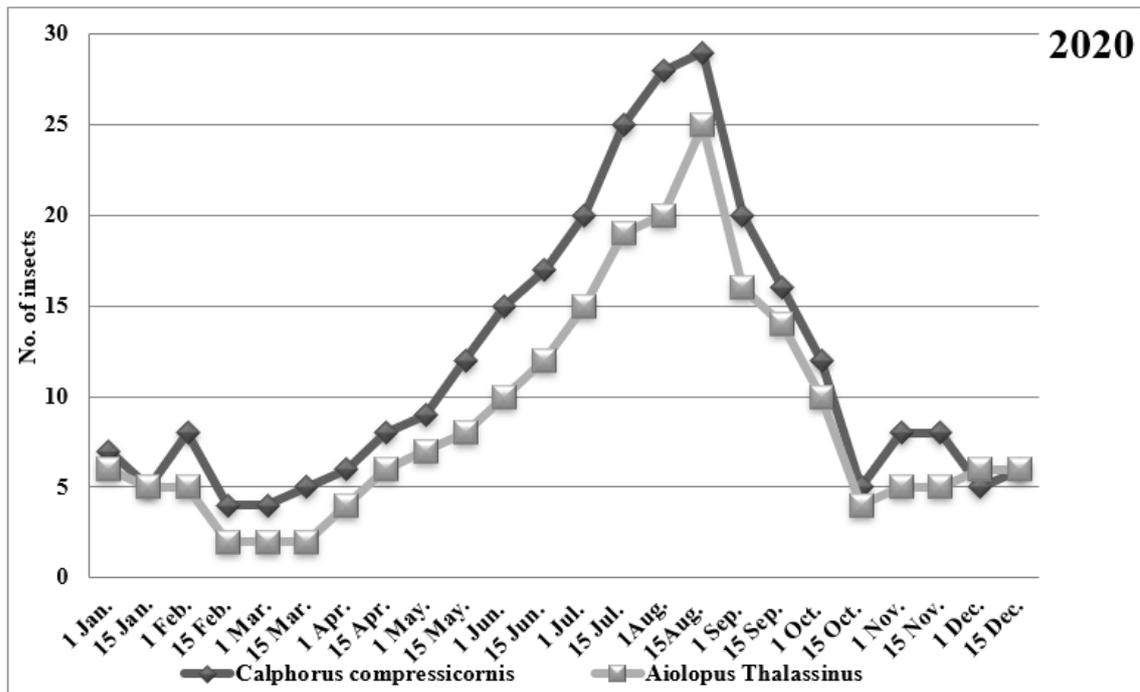


Fig. 5: Population fluctuation of *C. compressicornis* and *A. thalassinus* during 2020.

1. *C. compressicornis*:

The population was fluctuated during both years 2019-2020 in February and August between (1 - 29 and 4 - 29 insects/year), respectively. One peak was obtained in August for the studied years.

2. *A. thalassinus*

The seasonal abundance in 2019 and 2020 of *A. thalassinus* was ranged between (1- 23 and 2 - 25 insects/year), respectively. It was highest during August (23 and 25 insects/year) in 2019 and 2020, respectively.

The result's peak of population density for both grasshoppers *C. compressicornis* and *A. thalassinus* at Al-Orman garden during 2019 and 2020 in Table (2) and Figures (4 and 5), it represented the seasonal abundance during the summer season, the same data obtained by (Abdel-Ghaffar, 2019) who surveyed Gharb El Mawhoob in Egypt, found the peak of the grasshopper was in the summer, particularly in July and August, then decrease in the rest of the summer, also, according to Mustafa *et al.*, 2017 they reported that the peak of grasshopper seasonal abundance and maturity began in Egypt from June to October, in agreement with (Severin and Gilbertson 1917) who reported that, in a pod, grasshoppers lay more than 20 elongated eggs under the soil surface. Egg pods are very resistant to moisture and cold, they stay unhatched during winter, and on the other hand, all other stages of the insects die. Hatching occurs in the middle of June and usually finishes at the end of June. If the temperature during spring is cool and dry, it will postpone hatching and proceed into July. Usually, there is only one generation of grasshoppers per year.

Conclusion:

In general, this is the first study on grasshoppers in Al-Orman garden; the most famous big botanical gardens in Cairo included survey, identification, and seasonal abundance of grasshoppers' species during 2019 and 2020. This study focused on the presence of this pest on the garden grass that leads us; to manage and control it in future studies.

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ARABIC SUMMARY

حصر وتعريف انواع النطاطات في حديقة الاورمان بمصر

سميرة محمد نبيل عبد الواحد - معالي عيسى وافى - محمود يوسف حسن حنيش
معهد وقاية النباتات-مركز البحوث الزراعية - الجيزة- الدقى

تم تجميع عدد 1069 من النطاطات والتي تنتمي الى 6 أنواع من عائلتين (Acrididae و Pyrgomorphidae) من حديقة الأورمان خلال عامي 2019 و 2020. وكانت أكثر أنواع النطاطات شيوعاً *Calphorus compressicornis* بنسبة 52% و 50% يليه *Aiolopus thalassinus* بنسبة 37% و 38%، ثم *Acrotylus insubricus* بنسبة 3% و 5%، ثم *Heteracris littoralis* بنسبة 3% و 3% ثم *Eyprepocnemis plorans* بنسبة 3% و 2%، و أخيراً *Pyrgomorpha conica* بنسبة 2% و 2% على التوالي. تم جمع هذه الأنواع الستة من الحديقة في 2019 و 2020 وكان نوعي النطاط (*A. thalassinus* و *C. compressicornis*) هما النوعين السائدين. كانت الوفرة الموسمية للنطاطات خلال شهر أغسطس في فصل الصيف وله قمة واحدة فقط في كلا العامين.