EGYPTIAN ACADEMIC JOURNAL OF
BIOLOGICAL SCIENCES
ENTOMOLOGY

A

ISSN
1687-8809

WWW.EAJBS.EG.NET

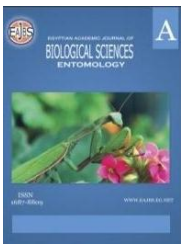
Vol. 18 No. 3 (2025)

Citation: *Egypt. Acad. J. Biolog. Sci. (A. Entomology) Vol. 18(3) pp.29-40 (2025)*
DOI: 10.21608/EAJBSA.2025.461616

Egypt. Acad. J. Biolog. Sci., 18(3):29-40 (2025)

Egyptian Academic Journal of Biological Sciences
A. Entomology
ISSN 1687- 8809

http://eajbsa.journals.ekb.eg/



Natural Occurrence of *Hyperaspis* sp. (Coleoptera: Coccinellidae), that Prey on the Pink Hibiscus Mealybug, *Maconellicoccus hirsutus* (Green), Attacking Hibiscus Shrubs

Ismaeil A. Bahy EL-Din
Biological Control Research Department, Plant Protection Research Institute, Agriculture Research Centre.
*E-mail: ismaeilbahyeldin@gmail.com

ARTICLE INFO

Article History
Received:19/9/2025
Accepted:24/10/2025
Available:28/10/2025

Keywords:
Hibiscus shrubs, *Maconellicoccus hirsutus*, *and Hyperaspis sp.* predator Relationship, pest-predator ratio.

ABSTRACT

Hibiscus shrubs, *Hibiscus rosa sinensis* L. (Malvaceae), being attacked by the pink hibiscus mealybug, *Maconellicoccus hirsutus.* The predator *Hyperaspis* sp. was recorded associated with pest species during a study period extended from third week of July till second week of November, in two successive seasons, 2021 and 2022, in Giza Governorate. Results revealed that September had the highest peaks of both the pink hibiscus mealybug, *M. hirsutus* (7253 & 7984 individuals), and the *Hyperaspis sp*. predator (105 & 148 individuals) on hibiscus shrubs in the 2021 and 2022 seasons, respectively. Relationship existed between pest species and predator was also evaluated, indicating that, increase of the pink hibiscus mealybug, *M. hirsutus* population was synchronized with that of predator population. So, this predator plays an important natural role in reducing pest population during its active period. Accordingly, this work can through light on possibility of rearing and releasing this predator against such pest in gardens and landscape and other agricultural plants that are subjected to pest attack.

INTRODUCTION

Hibiscus shrubs, *Hibiscus rosa sinensis* L. (Malvaceae) are belonging to ornamental plants which possess many flowers´ color, being cultivated in gardens and landscape (Pearline *et. al*., 2015 and Kumar A. & Kumar S., 2022), besides having many medicinal uses (Ashwinee & Sonavne, 2022 and Shanthini *et. al*, 2025).

These shrubs are attacked by the pink hibiscus mealybug, *Maconellicoccus hirsutus* L. (Green) (Homoptera: Pseudococcidae) (Mohammad *et. al*, 2010), where their crawlers suck shrubs´ sap leaves, causing their distortion (EPPO, 2005). Severe pest´ infestations lead to occurrence of wilting symptoms with die-back appearance, resulting in heavy honeydew occurrence (Sreedevi *et. al*, 2020), which will be lately covered with a black sooty mould (Gonzalez-Gaona *et. al*, 2010 and Osman, 2012). Then, they move to attack many other healthy hibiscus branches and finally move towards trunk shrubs (Abdallah, 2023). As a result, the pink hibiscus mealybug, *M. hirsutus* is greatly responsible for causing severe economic problems to hibiscus shrubs (Khan, 2023).

Continuous searching for having new safe control methods against mealybugs'

infestations were made to avoid hazards side effects of using harmful chemical pesticides and their effects on human health and his surrounding environment (Sarojmoni *et al.*, 2022), where another goal is also to protect these natural enemies (Oaya *et al.*, 2019). Biological control techniques appeared to be of an important value for controlling mealybugs´ infestations (Bashir *et al.*, 2023) and have received continuous higher developing researches in this direction.

Predators represent main component agents of biological control, where many of them were shown to have ability to be laboratory mass reared followed by their releasing them in different agriculture fields against many attacking pests (Sarojmoni *et al.*, 2022). Predatory´ species of family Coccinellidae were found to play an important role in developing biological control strategies (Abd-Rabou *et al.*, 2012 and Bashir *et al.*, 2023). For example, sucking insects' pests such as, scale insects, mealybugs and aphids are shown as common preys of ladybird predatory coccinellids beetles, *Hyperaspis* species (Bogaert *et al.,* 2012). This predatory´ species was recorded attacking many mealybugs such as; *M. hirsutus*, *Ferrisia virgate* (Ckll.) *Phenacoccus solenopsis* and *Planococcus citri* (Drder *et al.*, 2024). Therefore, this study was carried out to record population density of the pink hibiscus mealybug, *M. hirsutus* attacking hibiscus shrubs and also to find out relationships existed with its associated predatory species *Hyperaspis* sp. during 2021 and 2022 seasons, in experimental farm of A.R.C., located in Giza Governorate.

It was aimed for studying following points:

1. Estimating percentages of its infestation hibiscus shrubs and population density of the pink hibiscus mealybug, *M. hirsutus* and its predator, *Hyperaspis* sp.

2. Determining relationship existed between key pest and its predator.

3. Statistical analysis of obtained data was concerned on recording the following:

3.1. Correlations occurred on hibiscus shrubs (by comparing means values).

3.2. Effect of means of temperature and relative humidity on some tested ecological factors.

MATERIALS AND METHODS

1. Experimental Design:

Present study was carried out during period extended from third week of July till second week of November, in two successive seasons, 2021 and 2022, in a farm of Agricultural Research Center (A.R.C.), located in Giza Governorate as follows:

1.1. No chemical insecticides were applied on hibiscus shrubs during period of study.

1.2- Five hibiscus shrubs were investigated (which were served as replicates), where, five shrubs directions were investigated representing, North, South, East, West and center (i.e., four directions and center of each shrub). Period of study was; (from 20/7/2021 till 9/11/2021) in first season (2021) and (from 21/7/2022 till 10/11/2022) in second season (2022).

1.3. Sampling was carried out by using direct count method on hibiscus shrubs for both of; the pink hibiscus mealybug, *M. hirsutus* and its associated predator, *Hyperaspis* sp. Weekly total sample of 625 hibiscus leaves (= 5 shrubs×5 direction×5 branches×5 leaves/each branch), were directly randomly examined on Hibiscus shrubs.

2. Infestation and Population Density of the Mealybug, *M. hirsutus* on Hibiscus Shrubs:

Percentage of hibiscus leaves infestation, mean total number of infested leaves samples, mean total number of the pink hibiscus mealybug individuals per one leaf and mean total number of the pink hibiscus mealybug individuals per one branch were recorded. Percentage of hibiscus leaves infestation, mean total number of infested leaves samples, mean total number of the pink hibiscus mealybug individuals per one leaf and mean total number of the pink hibiscus mealybug individuals per one branch were calculated as follow:

a- % **Hibiscus leaves´ infestation** $= \frac{\text{Total no.of infested leaves}}{\text{Total no.of leaves´ sample (625)}} x100$

b- **Mean total no. of infested leaves/leaves´ samples** $= \frac{\text{Total no.of infested leaves}}{\text{Total no.of leaves´ sample (625)}} x10$

c- Mean total no. of pest individuals/one leaf $= \frac{\text{Total no.of pest individuals}}{\text{Total no.of leaves´ sample (625)}} x100$

d- **Mean total no. of pest individuals/one branch** $= \frac{\text{Total no.of pest individuals}}{\text{Total no.of branches sample (125)}} x100$

3. Population Density of *Hyperaspis* sp. Predator and General Ratios (pest: predator):

At the same time, this weekly samples were also used for recording population density of the predator, *Hyperaspis* sp. (where their individuals were directly counted on hibiscus shrubs). Predatory specie was identified in Departments of Biological Control Research and Classification Research, Plant Protection Research Institute, Agricultural Research Center.

Mean total number of this predatory coccinellid, percentages of its occurrence and also general ratios (existed between pest individuals: *Hyperaspis* sp. individuals) were also recorded.

4. Statistical Analysis:

Obtained data were statistically analysed according to SPSS program version (15.0), for comparing means values of resulted data (where, the least significant difference was carried out at L.S.D.0.01&0.05 levels of probability).

It was also made for calculating correlation coefficient (r-value) for relationships recorded between many ecological factors and weather factors (including means of temperature and relative humidity), that were obtained from Meteorological Station at A.R.C.

RESULTS AND DISCUSSION

1. Infestation of the Mealybug, *M. hirsutus* on Hibiscus Shrubs:

Data presented in Table (1) and Figure (1), showed infestation of hibiscus leaves by the pink hibiscus mealybug, *M. hirsutus*, attacking hibiscus shrubs, during 2021 and 2022seasons, in Giza Governorate.

Infestation in season 2021 began to appear with few infested hibiscus leaves in 20/7/2021 (I.e., in the third week of July). Where, percentage of infested leaves per sample, mean total numbers of infested leaves per sample and mean total numbers of infested leaves per one branch were; 4.64%, 0.05 and 0.23. Respective value for season 2022 were; 5.92%, 0.06 and 0.30, while, the mean weekly values for two seasons together were; 5.28, 0.06 and 0.27, respectively. At end of season 2021, the previous corresponding values were; 5.06%, 0.07 and 0.28and were; 6.56%, 0.07 and 0.33 for season 2022.

In season 2021, highest percentage of infested leaves per sample, mean total numbers of infested leaves per sample and mean total numbers of infested leaves per one branch were; 68.48% (during second week of September, i.e., in 14/9/2021), 0.68 (during first week of September, i.e., in 7/9/2021) and 3.42 (during second week of September, i.e., in 14/9/2021), respectively. Respective values for season 2022, were; 76.96%, 0.77 and 3.85 (all were during second week of September, i.e., in 15/9/2021).

These tested ecological features per season 2021 were; 28.46% (4.64-68.48%), 0.39±0.05 (0.05-0.68) and 1.51±0.26 (0.23-3.42), respectively. While, these values per season 2022 were; 36.26% (5.92-76.96%), 0.35±0.06 (0.06-0.77) and 1.77±0.31 (0.30-3.85), respectively.

So, mean of two studied season 2021 and 2022, these values were; 32.36% (5.28-71.20%), 0.37 (0.06-0.68) and 1.68 (0.27-3.56), respectively.

Table 1: Weekly infestation of hibiscus leaves and branches by the pink hibiscus mealybug, *M. hirsutus* that were recorded, during seasons 2021 and 2022.

Dates of inspection	Season 2021			Dates of inspection	Season 2022			Means weekly/ 2 seasons			Mean weather factor			
	1	2	3		1	2	3	1	2	3	Temp. (C°)		R.H. (%)	
											2021	2022	2021	2022
20/7/2021	4.64	0.05	0.23	**21/7/2022**	5.92	0.06	0.30	5.28	0.06	0.27	31.06	28.87	53.13	54.82
27/7	6.72	0.07	0.34	**28/7**	8.80	0.09	0.44	7.76	0.08	0.39	30.81	29.20	53.80	53.60
3/8	12.16	0.12	0.61	**4/8**	12.96	0.13	0.70	12.56	0.13	0.66	32.06	30.01	54.70	51.87
10/8	21.44	0.21	1.07	**11/8**	24.16	0.24	1.21	22.80	0.23	1.14	33.96	29.51	45.91	56.84
17/8	40.16	0.44	2.01	**18/8**	48.32	0.48	2.42	44.24	0.46	2.22	31.77	28.93	55.77	56.65
24/8	44.32	0.51	2.22	**25/8**	56.48	0.56	2.82	50.40	0.54	2.52	30.40	31.00	58.41	51.03
31/8	51.36	0.57	2.57	**1/9**	60.48	0.60	3.02	55.92	0.59	2.80	30.81	28.70	59.24	63.97
7/9	56.96	0.68	2.85	**8/9**	66.72	0.67	3.34	61.84	0.68	3.10	28.44	28.36	59.96	61.37
14/9	68.48	0.62	3.42	**15/9**	73.92	0.74	3.70	71.20	0.68	3.56	28.89	28.16	51.24	59.64
21/9	62.40	0.46	3.13	**22/9**	76.96	0.77	3.85	69.68	0.62	3.49	27.94	27.24	54.86	53.06
28/9	45.60	0.34	2.28	**29/9**	68.96	0.53	2.65	57.28	0.41	2.47	26.47	28.79	57.53	53.17
5/10	33.76	0.25	1.69	**6/10**	44.00	0.44	2.20	38.88	0.35	1.95	25.21	28.71	60.86	53.86
12/10	24.96	0.25	1.25	**13/10**	26.72	0.27	1.34	25.84	0.26	1.30	24.20	24.46	61.91	55.30
19/10	15.84	0.16	0.79	**20/10**	16.16	0.16	0.81	16.00	0.16	0.80	26.31	24.90	55.20	53.46
26/10	10.56	0.11	0.53	**27/10**	10.72	0.11	0.54	10.64	0.11	0.54	22.75	23.10	58.49	63.69
2/11	6.88	0.07	0.34	**3/11**	8.64	0.09	0.43	7.76	0.08	0.39	24.94	22.69	57.81	63.19
9/11	5.06	0.07	0.28	**10/11**	6.56	0.07	0.33	5.81	0.07	0.31	23.54	21.37	66.63	56.31
Mean/ Season	28.46% (4.64-68.48 %)	0.39 ± 0.05 (0.05-0.68)	1.51 ± 0.26 (0.23-3.42)	**Mean/ season**	36.26% (5.92-76.96%)	0.35 ± 0.06 (0.06-0.77)	1.77 ± 0.31 (0.30-3.85)	**Mean/ 2 seasons**			28.21 C° (22.75-33.96)	27.29 C° (21.37-31.00)	56.79 % (45.91-66.63)	56.58 % (51.03-63.97)
											Mean/2 seasons			
								32.36% (5.28-71.20%	0.37 (0.06-0.68)	1.68 (0.27-3.56)	27.75 C° (21.37-33.96)		56.69% (45.91-66.63)	

1- % infested leaves/sample 2- Mean total no. of infested leaves/sample 3-Mean total no. of infested leaves/one branch.

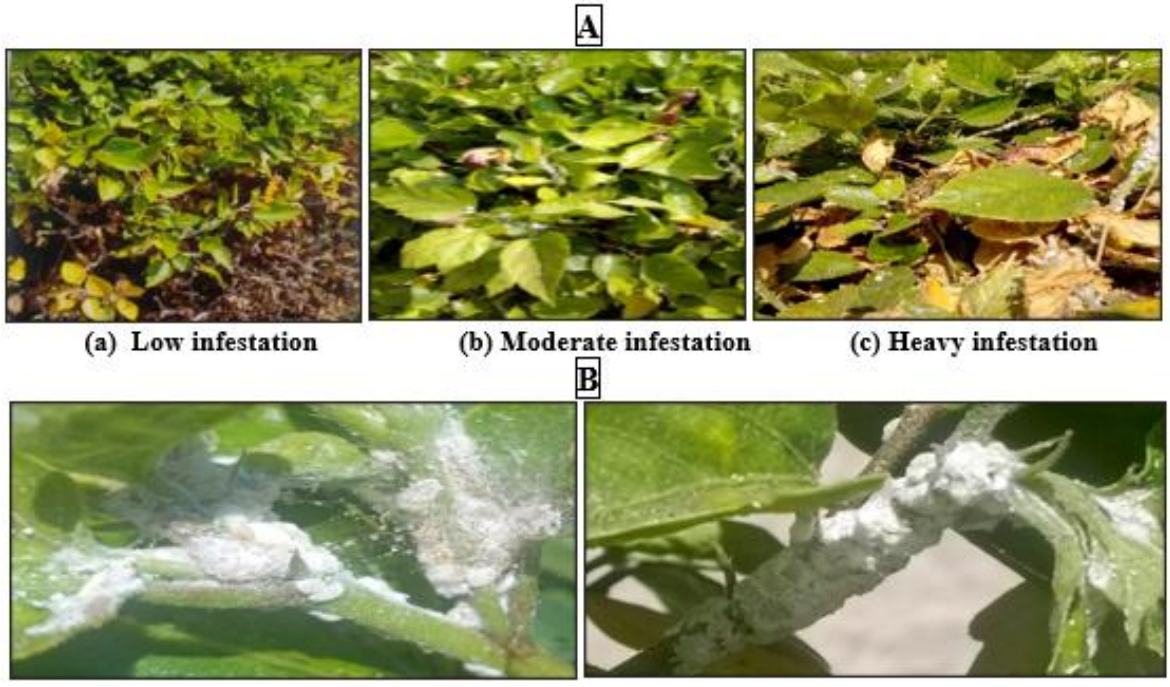


Fig. 1: A-Steps of hibiscus shurbs levels of infestation by the pink hibiscus mealybug. *M. hirsutus* **B-** Individuals of the pest during their attacking to hibiscus shrubs.

2. Population Density of the Pink Hibiscus Mealybug, *M. hirsutus* on Hibiscus Shrubs:

From the obtained result in Table (2) it was found that, in 20/7/2021 & 21/7/2022 at begging of seasons 2021and 2022. mean total number of the pink hibiscus mealybug, *M. hirsutus*, mean total number of infested leaves, mean total number of the pink hibiscus *M.*

hirsutus individuals/one infested leaf and mean total number of pest individuals per sample (625 leaves) were; (31&52 individuals, 29&37 leaves, 1.07&1.41 individuals and 0.05&0.08/leaves. Respective values in case of highest mean total number of the pink hibiscus mealybug, *M. hirsutus*, mean total number of infested leaves, mean total number of the pink hibiscus *M. hirsutus* individuals/one infested leaf and mean total number of pest individuals per sample were; (7253&7984 individuals in 14/9/2021 & 22/9/2022, at means of temperature and relative humidity were (28.89 C°&27.24 C° and 51.24% &53.06% R.H.), 428&481 leaves in 14/9/2021& 22/9/2022, at means of temperature and relative humidity were (28.89 C° &27.24 C° and 51.24% & 53.06% R.H.), 17.37 & 22.10 individuals in 21/9/2021& 29/9/2022 at means of temperature and relative humidity were (27.94 C° &28.79 C° and 54.56% & 53.17% R.H.) and 11.60&12.77 individuals in 14/9/2021& 22/9/2022, (at means of temperature and relative humidity of 28.89 C° &27.24 C° and 51.24% & 53.06% R.H.) for two seasons, respectively). At the end of seasons the values of previous tested factors were; (42 & 74 individuals), (35 & 44 leaves), (1.20 & 1.80 individuals) and (0.07 & 0.12 individuals), respectively. Mean total number of the pink hibiscus mealybug, *M. hirsutus*, mean total number of infested leaves, mean total number of *M. hirsutus* individuals per one infested leaf and mean total number of pest individuals per each sample (625 leaves) per season were; (1822.18±598.49), (188.18±33.01), (6.31±1.58) and (2.92±0.96) for season 2021. But as for season 2022 they were recorded as (2271.00±713.27), (220.76±39.06), (7.08±1.65) and (3.64±1.14), respectively, with a mean per two studied seasons of (2046.00±651.76), (206.24±36.47), (6.67±1.60) and (3.28±1.04), respectively.

Table 2: Weekly total numbers of the pink hibiscus mealybug, *M. hirsutus* leaves and branches of hibiscus shrubs that were recorded, during seasons 2021 and 2022.

Dates of inspection	Season 2021				Dates of inspection	Season 2022				Means weekly/2 seasons			
	A	B	C	D		A	B	C	D	A	B	C	D
20/7/2021	31	29	1.07	0.05	**21/7/2022**	52	37	1.41	0.08	41.50	33.00	1.24	0.07
27/7	47	42	1.12	0.08	**28/7**	76	55	1.38	0.12	61.50	48.50	1.25	0.10
3/8	84	76	1.11	0.13	**4/8**	112	81	1.38	0.18	98.00	78.50	1.25	0.16
10/8	152	134	1.13	0.24	**11/8**	218	151	1.44	0.35	185.00	142.50	1.29	0.30
17/8	289	251	1.15	0.46	**18/8**	472	302	1.56	0.78	380.50	276.50	1.36	0.62
24/8	517	277	1.87	0.83	**25/8**	789	353	2.24	1.26	653.00	315.00	2.06	1.05
31/8	1863	321	5.80	2.98	**1/9**	2167	378	5.73	3.47	2015.00	379.50	5.77	3.23
7/9	4639	356	13.03	7.42	**8/9**	5341	417	12.81	8.55	4990.00	386.50	12.92	7.99
14/9	7253	428	16.95	11.60	**15/9**	7512	462	16.26	12.02	7382.50	445.00	16.61	11.81
21/9	6774	390	17.37	10.83	**22/9**	7984	481	16.60	12.77	7379.00	435.50	16.99	11.80
28/9	4136	285	14.51	6.62	**29/9**	7316	331	22.10	11.71	5726.00	308.00	18.31	9.17
5/10	3350	211	15.88	5.36	**6/10**	3879	275	14.11	6.21	3614.50	243.00	15.00	5.79
12/10	1213	156	7.78s	1.94	**13/10**	1650	167	9.88	2.64	1431.50	161.50	9.88	2.29
19/10	438	99	4.42	0.70	**20/10**	618	101	6.12	0.99	528.00	100.00	5.27	0.85
26/10	91	66	1.38	0.15	**27/10**	235	67	3.51	0.38	163.00	66.50	2.45	0.27
2/11	58	43	1.35	0.10	**3/11**	112	54	2.07	0.18	85.00	48.50	1.71	0.14
9/11	42	35	1.20	0.07	**10/11**	74	41	1.80	0.12	58.00	38.00	1.50	0.10
										Mean/2season			
Mean/ season	1822.18 ± 598.49 (31-7253)	188.18 ± 33.01 (29-428)	6.31 ± 1.58 (1.20-17.37)	2.92 ± 0.96 (0.05-11.60)	**Mean/ season**	2271.00 ± 713.27 (52-7984)	220.76 ± 39.06 (37-481)	7.08 ± 1.65 (1.41-22.10)	3.64 ± 1.14 (0.08-12.77)	2046.00 ± 651.76 (41.50-7382.50)	206.24 ± 36.47 (33.00-445.00)	6.67 ± 1.60 (1.24-18.31)	3.28 ± 1.04 (0.07-11.81)

Note: **A-** Total no. of pest individuals**.** **B-** Total no. of infested leaves.
C- Mean total no. of pest individuals/one infested leaf. **D**- Mean total no. of pest individuals/each sample (625 leaves).

The pink hibiscus mealybug, *M. hirsutus* was the only mealybug species recorded infesting hibiscus shrubs during this study. In similar results, pest species was recorded attacking hibiscus shrubs by many authors such as: Mohammad *et al.* (2010); Abd-Rabou & Moustafa (2011); Abdel-Salam *et al.* (2013); Ana-Lċia *et al.* (2016) and Milonas & Partsinevelos (2017). From Tables (1&2), it was observed that, occurrence of pest was

recorded during period extended from July to November, with highest total numbers during September month, in both two studied seasons 2021 and 2022. In Egypt, Mousa *et al.* (2001) and Mohammad *et al.* (2010) found that, the pink hibiscus mealybug, *M. hirsutus* was the most injurious mealybug species on Hibiscus shrubs that was recorded from April until November. While, El-Sherbeni *et al.* (2010) indicated that, maximum total numbers of pest individuals were recorded during a period extended from first week of August till first week of September with occurrences of three peaks during 15th April, 15th June, and mid-September. But, Abd-Rabou and Moustafa (2011) found that, active period of pest species on hibiscus shrubs was from April to November, while highest populations of pest occurred in September.

3. Population Density of *Hyperaspis* sp. Predator, Relationship between Pest & Associated Predator and General Ratios (between Pest and this Predator):

3.1. Population Density of *Hyperaspis* sp. Predator.

Data presented in Table (3) and Figures (2&3) show population density of *Hyperaspis* sp. predator on hibiscus shrubs during 2021 and 2022 seasons. Monthly few numbers were recorded (1&2 individuals) in second half of July 2021 & 2022 seasons, respectively. Its population peaks were 105 and 148 individuals in second half of September 2021 & 2022 seasons, respectively. Mean total numbers of *Hyperaspis* sp. predator per each season and mean total numbers per two seasons together were: (30.63±13.42 (with range of 1-105) & 47.00±19.02 (with range of 2-148) and 310.50 (with range of 245-376) individuals) in case of 2021 and 2022 seasons, respectively. Similarly, the predator *Hyperaspis* sp. was recorded preying on mealybugs species by Patel *et al.* (2009), Osman (2012), Abd El-Mageed *et al.* (2018) and Drder *et al.*, (2024). Also, Dreyer *et al.* (1997) mentioned that the mealybugs' species; *P. manihoti, P. madeirensis* and *Ferrisia virgate* were essential preys for *H. notata* both for completing their development and also for production of females' eggs. Also, Sreedevi *et al.* (2020) observed that, *H. maindroni* was found associated with the cassava mealybug, *Phenacoccus manihoti* colonies, which was the most abundant coccinellid species found in relation with the mealybug colonies. In general, Drder *et al.* (2024) indicated that, the predator, *H. vinciguerrae* was recorded associated with the following mealybugs' species; the pink hibiscus mealybug, *M. hirsutus,* the cotton mealybug, *Phenacoccus solenopsis*, the striped mealybug, *Ferrisia virgate* and the citrus mealybug, *Planococcus citri*.

Table 3: Bimonthly total numbers of *Hyperaspis* sp. predator that were recorded associated with the pink hibiscus mealybug, *M. Hirsutus* on hibiscus shrubs, in 2021 and 2022 seasons.

Biweekly samples	Season 2021	Season 2022	Bimonthly mean/2 seasons
Second half of July	1	2	1.50
First half of August	2	6	4.00
Second half of August	5	8	6.50
First half of September	27	43	35.00
Second half of September	105	148	126.50
First half of October	69	109	89.00
Second half of October	32	44	38.00
First half of November	4	16	9.50
Total /season	245	376	
Mean total /season (range)	30.63±13.42 (1-105)	47.00±19.02 (2-148)	
Mean total /2seasons (range)	310.50 (245-376)		

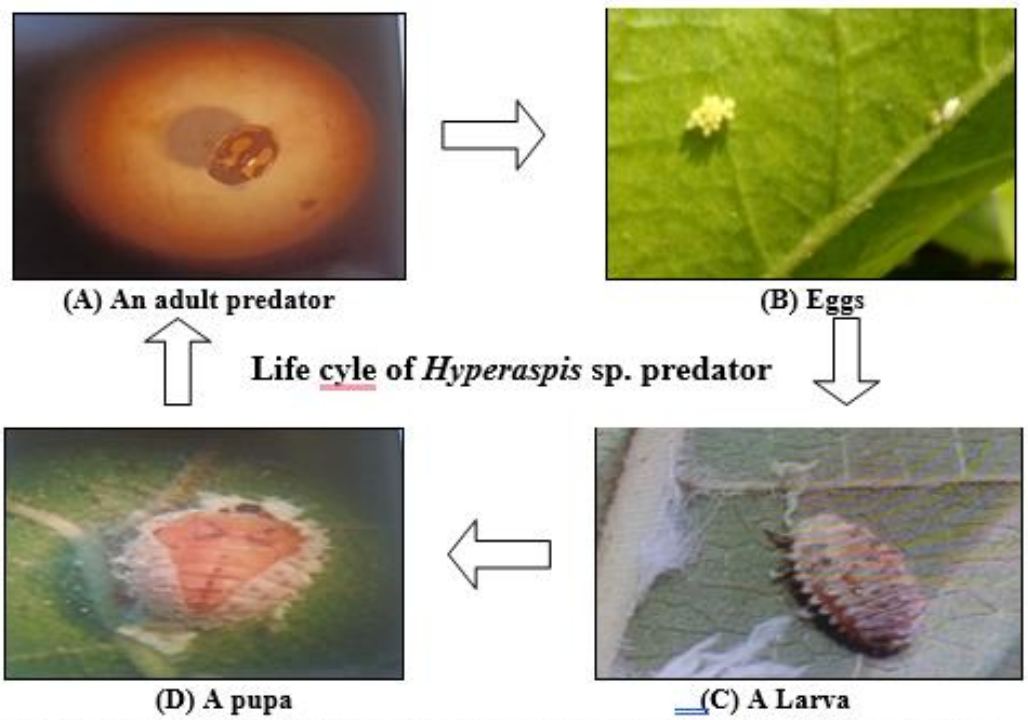


Fig. 2: Life cycle of *Hyperaspis* sp. predator that was recorded preying on the pink hibiscus mealybug, *M. hirsutus* on hibiscus shrubs.

Fig. 3: Predation of *Hyperaspis* sp. predatory larva on the pink hibiscus mealybug, *M. hirsutus*.

3.2. Relationship between Pest and Associated Predator.

Highest monthly total numbers of the pink hibiscus mealybug, *M. hirsutus* were during September month (22802 (= 4639+7253+6774+4136), in season 2021) & (30320 (= 2167+5341+7512+7984+7316), in season 2022). While monthly total number of *Hyperaspis* sp. were recorded during the same month of *Hyperaspis* sp. (132 (=27+105), in season 2021 & 191 (=43+148), in season 2022).

So, results indicated that September month had the highest totals of both of the pink hibiscus mealybug, *M. hirsutus* and also the predator *Hyperaspis* sp. This shows that, increase of the pink mealybug, *M. hirsutus* population was synchronized with that of *Hyperaspis* sp. predator (Fig., 4), indicating occurrence of an important natural role of this predatory species against pest population. Accordingly, the predator *Hyperaspis* sp. can be reared in the laboratory mass rearing and released against such pest and in garden and landscape or other plants that are subjected by pest attack.

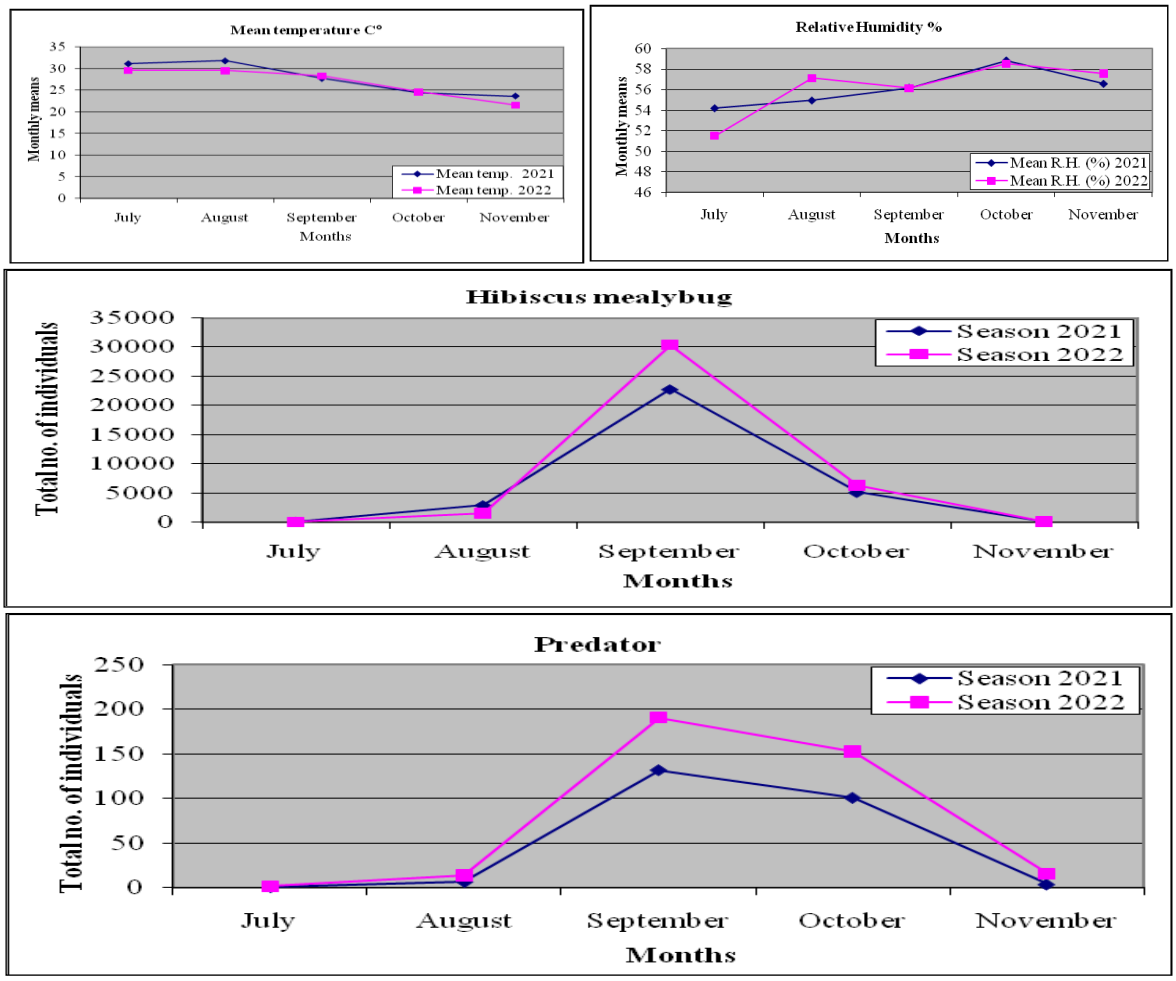


Fig.4: Monthly mean total numbers of the pink hibiscus mealybug, *M. hirsutus* and *Hyperaspis* sp. predator in relation to means of temperature and relative humidity that were recorded in 2021 and 2022 seasons.

3.3. Ratio Recorded between the Pink Hibiscus Mealybug, *M. hirsutus* and *Hyperaspis* sp. Predator:

From Table (4), monthly ratio between the pink hibiscus mealybug, *M. hirsutus* and *Hyperaspis* sp. predator were: 78.00:1, 415.00:1, 172.74:1, 50.41:1 and 25.00:1: in July, August, September, October and November, respectively, in season, 2021. Respective values for season, 2022 were: 64.00:1, 113.64:1, 158.74:1, 41.71:1 and 11.63:1. Recorded seasonal ratios for seasons 2021 and 2022 were; 126.44:1 and 102.68:1, respectively, with a recoded general ratio for the two studied seasons together of 112.05:1.

Table 4: Monthly ratios recorded between the pink hibiscus mealybug, *M. hirsutus* and *Hyperaspis* sp. predator on hibiscus shrubs, during 2021 and 2022 seasons in Giza Governorate.

Months	Season 2021	Season 2022	Monthly ratios/for 2 seasons
July	78.00:1	64.00:1	68.67:1
August	415.00:1	113.64:1	214.10:1
September	172.74:1	158.74:1	164.46:1
October	50.41:1	41.71:1	45.17:1
November	25.00:1	11.63:1	14.30:1
Ratio/season	126.44:1	102.68:1	**General ratio/2seasons 112.05:1**

Statistical Analysis of Obtained Data:

Table (5) revealed statistical analysis of obtained data in case of comparing means total number of the pink hibiscus mealybug, *M. hirsutus* individuals and total number of *Hyperaspis* sp. predator during seasons 2021 and 2022. Also, statistical analysis was made to find relationships occcured between the same previous factors and weather factors (including means of tempreture and relative humidity).

1. In Case of Comparing Means of Many Ecological Factors:

There were very highly positive significant relationships in case of comparing mean total number of the pink hibiscus mealybug, *M. hirsutus* individuals, mean total number of *Hyperaspis* sp. predator between seasons 2021 and 2022. Where r-value were; 0.975****(significant= 0.000) and 0.996****(significant= 0.000), respectively.

2. In Case of Relationships between many Tested Factors with Means of Weather Factors:

2.1. In Case of Means of Temperature.

No relationships were found in case of mean total number of the pink hibiscus mealybug, *M. hirsutus* individuals and mean total number of *Hyperaspis* sp. predator and means of tempreture. R- values were: (0.084 (significant = 0.747) & 0.207 (significant = 0.425), (-0.123 (significant = 0.753) & 0.186 (significant = 0.633)) , for seasons 2021 and 2022, respectively.

2.2. In Case of Means of Relative Humidity.

No relationships were found in case of mean total number of the pink hibiscus mealybug, *M. hirsutus* individuals, mean total number of *Hyperaspis* sp. predator with means of relative humidity. R-values were; (-0.070 (significant = 0.790) & - 0.029 (significant = 0.913)), & (- 0.170 (significant = 0.662)) & - 0.083 (significant = 0.831)), for seasons 2021 and 2022, respectively.

Table 5: Comparing means of many tested factors and their relationships in related with weather factors (means of temperature and relative humidity).

Comparing means	**Season (2021) × Season (2022)**			
1-Total no. of the pink hibiscus mealybug, *M. hirsutus* individuals.	r- values= 0.975**** (significant= 0.000)			
2-Total no. of *Hyperaspis* sp. predator.	r- values= 0.996**** (significant= 0.000)			
Effect of weather factors	**Season (2021)**		**Season (2022)**	
	Means temp. (C°)	**Means R.H. %**	**Means temp. (C°)**	**Means R.H. %**
1-Total no. of the pink hibiscus mealybug, *M. hirsutus* individuals.	r- values= - 0.084 (significant = 0.747)	r- values= - 0.070 (significant = 0.790)	r- values= 0.207 (significant = 0.425)	r- values= - 0.029 (significant = 0.913)
2-Total no. of *Hyperaspis* predator.	r- values= - 0.123 (significant = 0.753)	r- values= - 0.170 (significant = 0.662)	r- values= 0.186 (significant = 0.633)	r- values= - 0.083 (significant = 0.831)

In conclusion, results indicated that, *Hyperaspis* sp. predator was the only predatory species recorded preying on the pink hibiscus mealybug, *M. hirsutus* on hibiscus shrubs during this study. Highest biweekly total number of *Hyperaspis* sp. predator was recorded during second half of September, 2021 and 2022. The occurrence of pest was during period extended from July to November, with highest weekly total numbers during second and fourth weeks of September in two studied seasons. Highest monthly total numbers of the pink hibiscus mealybug, *M. hirsutus* (22802&30320 individuals), that were recorded during September 2021 and 2022, i.e., pest occurrence was synchronized with that of *Hyperaspis*

sp. predator, indicating that an existing important natural role of this predatory species was happed against key pest. Accordingly, this predator can be mass reared and released against such pest on Hibiscus shrubs or other ornamental plants in gardens and landscape and other related plants that are subjected to pest attack. Obtained result is similar with those recorded by many authors. Where, Sreedevi *et al.* (2020) emphasized natural role of *Hyperaspis* sp. in management practices applied against mealybugs. Similarly, Bashir *et al.* (2023) indicated role of coccinellid beetles as beneficial predators. Many attempts were made to use such predator in biological control of mealybugs, for example, Neuenschwander (2001) showed that, several species of *Hyperaspis* has been successfully introduced to attain biological control programs, as, *Hyperaspis marmottani* Fairm., was shown as a potentially effective predator of the cassava mealybug, *Phenacoccus manihoti* Matile-Ferrero, also, *Hyperaspis* spp. predators were introduced in Africa from South America for controlling the cassava mealybug.

Declarations:

Ethics Approval: This study did not involve human participants or animals. The research was limited to sampling without any insecticide in a farm of the Agricultural Research Center (A.R.C.), located in Giza Governorate.

Authors Contributions: Main Author.

Competing Interests: The author declares no conflict of interest of any kind.

Availability of Data and Materials: All datasets analysed and described during the present study are available.

Funding: This work has received no external funding.

Acknowledgements: Not applicable.

REFERENCES

Abdallah, A. F. (2023). Modern techniques in integrated pest management to achieve sustainable agricultural development. *International Journal of Family Studies, Food Science and Nutrition*, 4(1):1-15.

Abd El-Mageed, A. E. M.; Youssef, N. M. and Mostafa, M. E. (2018). Efficacy of some different insecticides against cotton mealybug, *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) and its associated predators. *Journal of Plant Protection and Pathology, Mansoura University*, 9(6):351–355.

Abdel-Salam, A. H.; Ghanim, A. A.; Elkady, H. A.; El-Nagar, M. E. and Awadalla, H. S. S. (2013). Effect of different host plants on the attractiveness the mealybug species and their associated predators at Mansoura district. *Journal of Plant Protection and Pathology, Mansoura University*, 4(3):287–292.

Abd-Rabou, S. and Moustafa, M. (2011). The Efficacy of some natural and chemical formulations against the hibiscus mealybug, *Maconellicoccus hirsutus* and its natural enemies in the laboratory and field in Egypt. *Egyptian Journal of Agricultural Research*, 89(1):81-104.

Abd-Rabou, S.; Ahmed, N. and Moustafa, M. (2012). Predators of scale insects (Hemiptera: Coccoidea) and their role in control in Egypt. *Egyptian Academic Journal of Biological Science (A. Entomology)*, 5(3):203-209.

Ana Lc̦ia, B. G. P.; Martinelli, N. M.; Alexandrino, J. G.; Jn̦ior, A. L. M.; Penteado-Dias, A. M. and Almeida, L. M. (2016). Natural enemies associated with *Maconellicoccus hirsutus* (Hemiptera: Pseudococcidae) in the state of Swo Paulo, Brazil. *Florida Entomologist*, 99(1):21-25.

Ashwinee, R. S and Sonavne, I. K. (2022). The Review on medicinal uses of hibiscus flower.

International Journal for Multidisciplinary Research (IJFMR), 4(5):1-8.

Bashir, J., Mehraj, M.; Khan, Z. H. and Ali, M. N. (2023). Biological control of insect and fungal pests by predominant Coccinellidae beetles -a review. *International Journal of Current Microbial Applied Science*, 12(09):277-287.

Bogaert, J.; Adriaens, T.; Constan, J.; Lock, K. and Canepari, C. (2012). *Hyperaspis* ladybirds in Belgium, with the description of *H. magnopustulata* Nov. and faunistic notes (Coleoptera: Coccinellidae). *Bulletin Society of Royal Belgian Entomology*, 148:34–41.

Drder, F. M; Mohanny, K.M.; Attia, A. R. and Mohamed, G. S. (2024). Survey of mealybugs and their natural enemies at Qena Governorate, Egypt. *International Journal of Agricultural Sciences*, 6(2):163-168.

Dreyer, B. S.; Neuenschwander, P.; Baumgärtner, J. and Dorn, S. (1997). Trophic influences on survival, development and reproduction of *Hyperaspis notate* (Coleoptera: Coccinellidae). *Journal of Applied Entomology*, 121:249–256.

EEPPO (2005). Data sheets on quarantine pests, *Maconellicoccus hirsutus*. *OEPP/EPPO, European and Mediterranean Plant Protection Organization Bulletin*, 35:413- 415.

El-Sherbeni, A. E.; El-Hawary, I. S.; Farrag, Z. S.; Hendawy, A. S. and Mashaa, R. E. (2010). Ecological studies on insect parasitoids attacking pink hibiscus mealybug, *maconellicoccus hirsutus* (green) (Hemiptera: Pseudococcidae) at Kafr El-Sheikh Governorate. *Journal of Plant Protection and Pathology, Mansoura University*, 1(11):909–920.

Gonzalez, G.E.; Martinez, G. S.; Zhang, A.; Gutierrez, J. L. and Sosa, F. C. (2010). Validation of two pheromonal compounds for pink hibiscus mealybug in Mexico. *Agrociencia*, 44(1):65-73.

Khan, M. M. H. (2023). Host range, incidence and damage of pink hibiscus mealybug (*Maconellicoccus hirsutus*) infesting ornamental plants. *South Asian Association for Regional Cooperation (SAARC). Journal of Agricultural*, 21(1):203-215.

Kumar A. and Kumar, S. (2022). Pharmacological review on *Hibiscus Rosa Sinensis*, International *Journal of Novel Research and Development IJNRD,* 7(11):245-252.

Milonas, P. G. and Partsinevelos, G. K. (2017). The pink hibiscus mealybug *Maconellicoccus hirsutus* (Green) (Hemiptera: Pseudococcidae). *In Greece Hellenic. Plant Protection Journal*, 10:80-83.

Mohammad, H. A.; Moussam, S. F.; Abo-Ghalia, A. H. and Ahmed, S. A. (2010). Efficiency of certain insecticides on the populations of the pink hibiscus mealybug *Maconellicoccus hirsutus* (Green) and their natural enemies under the field condition in Ismailia Governorate, Egypt. *Egyptian Academic Journal of Biological Sciences (E. Toxicology and Pest Control)*, 2(2):11-17.

Mousa, S. F.; El-Heneidy, A. H.; Hendawy, A. S.; Adly, D. and Gonzalez, D. (2001). Pink hibiscus mealybug, *Maconellicoccus hirsutus* (Green), parasitoids in Egypt. *Egyptian Journal of Biological Pest Control*, 11(2):195-196.

Neuenschwander, P. (2001). Biological control of the cassava mealybug in Africa: A review. *Biological Control*, 21:214-229.

Oaya, C. S.; A. Malgwi, M.; Degri, M. M. and Samaila, A. E. (2019). Impact of synthetic pesticides utilization on humans and the environment: an overview. *Agricultural Science and Technology*, 11(4):279-286.

Osman, E. A. (2012). Biological studies on the mealybug, *maconellicoccus hirsutus* (green) (Hemiptera: Pseudococcidae) reared on potato sprout tubers under laboratory conditions. *Journal of Plant Protection and Pathology, Mansoura University*, 3(9):989-999.

Patel, H. P.; Patel, A. D. and Bhatt, N. A. (2009). Record of coccinellids predating on

mealybug, *Phenacoccus solenopsis* Tinsley (Homoptera : Pseudococcidae) in Gujarat. *Insect Environment*, 14(4):179-180.

Pearline, D.; Kamat, N. and Thiagarajan, P. (2015). *Rosa sinensis* (Hibiscus) – A versatile Indian origin plant. *Journal of Chemical and Pharmaceutical Science*, 8(4):01-05.

Sarojmoni, D. M.; Himadree, P.; Gunjan, J. and Monika, J. (2022). Pesticide impact on human health sonowal international. *Journal of Zoological Investigations*, 8(2):717-725.

Shanthini G. N.; Harini, R. R.; Nithyakalyani, K.; Kokila, S.; Madhavan, S.; Nithyashree, B. and Rajalakshmi, M. (2025). Anatomical, phytochemical and in vitro anti-arthritic screening from white flowers of Hibiscus *rosa sinensis* L. *World Journal of Pharmaceutical Research*. 14(8):851-868.

Sreedevi K. N. V. V.; Joshi, S.; Mohan, M.; Kumar, M. S.; Mahendiran, G.; Venkatesan, T.; and Shylesha, A. N. (2020). Record of coccinellid predator, *Hyperaspis maindroni* Sicard (Coleoptera: Coccinellidae) on invasive cassava mealybug, *Phenacoccus manihoti* Matile-Ferrero (Hemiptera: Pseudococcidae). *Journal of Biological Control,* 34(4):303-307.

ARABIC SUMMARY

التواجد الطبيعى للمفترس *Hyperaspis* sp. (Coleoptera: Coccinellidae)، الذى يفترس بق الهيبسكس الدقيقى *Maconellicoccus hirsutus* (green)، المهاجم لشجيرات الهيبسكس.

إسماعيل عبد الحليم بهى الدين
قسم بحوث المكافحة الحيوية – معهد بحوث وقاية النباتات – مركز البحوث الزراعية.

تنتمى شجيرات الهيبسكس *Hibiscus rosa sinensis* L. (Malvaceae) الى نباتات الزينة، والتى يتم زراعتها فى الحدائق العامة والمسطحات الخضراء. وتتعرض هذه الشجيرات للإصابة ببق الهيبسكس الدقيقى *Maconellicoccus hirsutus* (green).

وقد تم تسجيل المفترس *Hyperaspis* sp. مرتبطاً بالآفة خلال فترة الدراسة والتى امتدت من الأسبوع الثالث من يوليو حتى الأسبوع الثانى من نوفمبر، خلال موسمى الدراسة 2021 و 2022م ، فى محافظة الجيزة.

أوضحت الدراسة أن شهر سبتمبر هو الشهر الذى سجل فيه أعلى تعداد لكلاً من البق الدقيقى (7253، 7984 فرداً) والمفترس (105، 148 فرداً) على شجيرات الهيبسكس خلال موسمى الدراسة 2021 و 2022 م ، على التوالى.

كما تم دراسة العلاقة بين كلاً من الآفة والمفترس، والتى ظهر من خلالها أن الزيادة فى تعداد بق الهيبسكس الدقيقى *M. hirsutus*، قد تزامنت مع الزيادة فى تعداد المفترس. وهذا يظهر مدى الدور الطبيعى المهم الذى يؤديه هذا المفترس فى خفض تعداد الآفة خلال فترة نشاطها.

وتبعاً لذلك، فإن هذا العمل يلقى الضوء على إمكانية تربية وإطلاق هذا المفترس لمكافحة تلك الآفة فى الحدائق العامة والمسطحات الخضراء وعلى النباتات الأخرى التى تهاجم بها.