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Survey of pests attacking canola plants and population density of aphids with relation to climatic factors in Qalubia Governorate

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Abstract

Field experiments were carried out at Moshtohor, Qalubia Governorate, throughout the 2022–2023 and 2023–2024 seasons to survey pests that attack canola plants. Also study the population density of aphids infesting canola plants and the effects of certain weather factors (daily maximum, minimum temperature and relative humidity R.H%). The most species (four species) of certain insect pests were found in the orders Hemiptera, Coleoptera, and Lepidoptera, which comprise 18 families in 10 orders. Each of the orders Orthoptera and Hemiptera are represented by three species. Two species represent the order Diptera. Each of the orders Thysanoptera, Neuroptera, Hymenoptera, and Acariformes had the fewest number of pest species (one species). Of the 24 species, 17 (70.83%) were pests injuring canola crops, and 6 (25.00%) were predators, while pollinators were represented by only one species (4.17%). In both seasons aphid insects began to appear on canola plants in the 1st week of December with few numbers (13.25 and 6.50 individuals/25 plant, respectively). Afterwards, the population of aphids increased gradually to reach a peak of abundance (52.00 and 39.75 individuals/25 plants), respectively, during the 4th week of February. Then the number of aphids began to decline until the 2nd week of April to reach 13.50 and 11.00 individuals/25 plants, respectively. The correlation coefficient observed that the population of aphids was shown to be insignificantly affected by the mean percentage of relative humidity and maximum and minimum temperatures in both seasons except that the mean percentage of humidity in the second season was positively significant.

Introduction

Canola (*Brassica napus* L.) is the third major source of producing edible oils in the world, preceded by soybean and palm oil (Kandil and Gia, 2012). Canola oil is considered one of the best vegetable oils for human nutrition, as it contains only 6% saturated fatty acids and 94% unsaturated fatty acids. It is widely used in Canada, Europe, America, India, and Japan. Canola oil represents 63% of all edible oils used in Canada, while soybean oil represents an estimated 24% and sunflower oil only 4% (Assadi *et al*., 2011 and Ghazani and Marangoni, 2016). Canola, modified from rapeseed in

Canada in 1974, has very low levels of erucic acid and glucosinolates, which makes it safer and more favorable for human consumption. High seed oil content (40–45%), protein (23–25%), healthy oil, and an extremely nutrient-dense animal feed are the characteristics of this crop (Anonymous, 2023). Out of all the main oil crops, canola oil has the fewest saturated fats. With high quantities of omega-3 fatty acids, which are linked to a lower risk of heart disease and lower blood cholesterol (Raymer, 2002). Edible oil supplies are highly insufficient for the domestic Egyptian consumption of oils, as imports recently exceeded 95% (FAOSTAT, 2021). Egypt's Ministry of Agriculture is expanding canola plant cultivation across the country due to its advantages, which include a high seed yield and relatively high oil content, low water requirements, and an annual winter crop with a short lifespan. There are numerous elements that influence canola output, but insect pests are the most significant one. As a result, the average yield is lower than the potential of the current cultivars. Insect pests are the most important factor influencing canola production, however, there are many more. Consequently, the average yield falls short of the current cultivars' potential (Tolba, 2020).

Under field conditions, canola plants are subjected to being attacked by many pests. The main pests are the crucifer flea beetle *Phyllotre cruciferae* (Goeze) (Coleoptera: Chrysomelidae) which is considered a leaf in seedling stage after germination (Shabeg *et al.*, 2018), aphids (Such as the cabbage aphid *Brevicoryne brassicae* (L.) (Hemiptera: Aphididae), the green peach aphid *Myzus persicae* (Sulzer) (Hemiptera: Aphididae) and the cowpea aphid, *Aphis craccivora* Koch (Hemiptera: Aphididae), which injured all parts of the plant in different stage growth (Temerak *et al*., 2014) and Syaid *et al.*, 2020), and diamondback moth *Plutella xylostella* (L) (Lepidoptera: Plutellidae), which, in the immature stage, or larvae, injures the leaves, buds, flowers and seed pods of canola.

Aphids cause significant losses to the rapeseed crop and have a large host plant population. It causes significant yield hammering by sucking on the phloem of various plant components, such as seed pods and inflorescence. So, it results in failure by distorting immature leaves and shoots (Sarwar *et al*., 2009 and 2011 and Tolba, 2020). In canola, aphids are typically seen in high numbers close to the top of each individual plant and range in color from pale green to grayish green. Because they release honeydew, infested plants frequently have a glossy appearance (Knodel and Beauzay, 2011 and Sarwar, 2013).

The current goal of this study was to examine canola plantations for pests and their natural enemies. Population density of aphids and their relationship with climatic factors.

Materials and methods

1. Survey of pests attacking canola plants:

Canola (Cultivar Pactol) grew over an area of almost half a feddan (2100m^2). Traditionally, the first half of November was when plants were planted in a block design that is entirely random. During the trial period, which ran from December 2022 to April 2024, no chemical control was employed, and standard agricultural procedures were followed. The single-plant examination, sweeping nets, and sampling techniques were employed.

1.1. Sweeping net:

A typical sweep net (35 cm in diameter and 70 cm in length) with a wooden handle (120 cm) was used to catch both flying and mobile insects on the plant components. After completing strokes, the captured insects were transferred to the lab for further study and documentation, and they were poured into a cyanide jar.

1.2. Plant examination:

To identify the causative agent, one hundred randomly selected plants were examined closely in the field. Insects were collected, and any suspected plants

exhibiting symptoms of disorder were taken to the lab. In all cases, encountered species of insect were classified primarily, according to their density (Insect number/ species of insect encountered categories).

- Highly Abundance (+++) when insect population is found in every count in relatively high numbers (Over 20 insects / sample).
- Abundance (++) when insects appeared in each sample but in relatively moderate numbers (From 5 to 20 insects / sample).
- Rare (+) when insects appear in a few numbers and a few counts (From 2 to 4 insects / sample).

The experts at the Plant Protection Institute's Department of Insect Collection and Identification at the Agricultural Research Centre in Dokki, Cairo, identified the insects that were surveyed.

2. Population density of aphids in relation to climatic factors on canola plants in Qalubia Governorate:

To investigate the pactol cultivar's aphid population density during a seasonal study. checked thirty days after growth. Aphids were counted in each of the four repetitions, which consisted of 25 plants per duplicate, and each plot measured approximately 10.5 m². The canola plants were chosen at random. From the moment of emergence till harvest, data was gathered every week. A randomized whole block design was used to create experimental space. The seasonal variation of the pests under investigation in connection with specific meteorological parameters (daily minimum and maximum temperatures and relative humidity) was the focus of this study. The Central Laboratory of Agriculture Climate (C. L. A. C.) in Giza, Egypt, provided the temperature and relative humidity data for the seasons under study.

Results and discussion

1. Survey of certain pests in canola fields during 2022/2023 and 2023/2024 seasons:

Data presented in Table (1) revealed the occurrence of species of certain insect pests belonging to 18 families in 10 orders. The results obtained were as follows:

1.1. Foliage feeders:

Including larvae of the cotton leaf worm, *Spodoptera littoralis* (Boisd), and the lesser cotton leaf worm, *Spodoptera exigua* (Hubn).

1.2. Root feeders:

Represented by adults and nymphs of (Mole circle) *Gryllotalpa gryllotalpa* L., larvae of black cutworm *Agrotis ipsilon* (Hubn) and larvae of the crucifer flea beetle, *Phyllotre cruciferae.*

1.3. Sucking pests:

Represented by adults of *Thrips tabaci* Lind and *Empoasca discipiens* paoli, larvae of *Liriomyza brassicae* Riley, nymphs and adults of the cowpea aphid, *Aphis craccivora* Koch, *the* cabbage aphid*, Brevicoryne prassicae*, the green peach aphid, *Myzus persicae* (Sulzer), the whitefly, *Bemisia tabaci* (Genn.), and larvae of the diamondback moth *Plutella xylostella* (L).

1.4. Predators:

Included by adults of *Syrphus corolla* F., *Orius* sp*., Coccinella undicimpunctat* L., *Coccinella spetempunctata* L. *Peaderus alfierii* Koch and larvae and adults of *Chrysoperla carnea* Steph.

1.5. Pollinators:

Represented by only one adult of *Vespa orientalis.*

Finally, data showed that order Hemiptera, Coleoptera, and Lepidoptera were represented by the greatest number of species (Four species). Order Orthoptera and Hemiptera represented by three species each. Diptera is represented by two species. The lowest number of pest species was presented by Thysanoptera, Neuroptera, Hymenoptera, and Acariformes only (One species for each). From the 24 species, 17 (70.83%) were pests injuring canola crops, 6 (25.00%) were predators, while pollinators were represented by only one species (4.17%) in Table (2).

Table (1): A partial taxonomic list of arthropod pests and the associated natural enemies inhabiting canola plants, Moshtohor region, Qalubia Governorate, during the 2022-2023 and 2023-2024 seasons.

Order	Family	Scientific name	stages	Statue	Plant part of presence	Frequency	Time of occurrence
Orthoptera	Acridiidae	*Acrotylus insubricus* (Scopli)	Nymph &Adult	Pest	leaves	++	January- April
		Heteraacris littoralis (Rumb.)	Nymph &Adult	Pest	leaves	++	January- April
	Gryllotalpidae	*Gryllotalpa gryllotalpa* (L.)	Nymph &Adult	Pest	Roots	+	February.-April
Thysanoptera	Thripidae	*Thrips tabaci* Lind.	Adult	Pest	Leaves	+++	December-April
Diptera	Agromyzidae	*Liriomyza brassicae* Riley	larvae	Pest	Leaves	++	December-April
	Syrphidae	Syrphus corolla F.	Adult	Predator	Leaves	+	December-April
Hemiptera	Aleyrodidae	*Bemisia tabaci* (Genn.)	Nymph &Adult	Pest	Leaves	+++	December-April
	Anthroconide	*Orius sp.*	Adult	Predator	Leaves	+	December-April
	Aphididae	*Aphis craccivora* Koch	Nymph &Adult	Pest	All plant	+++	December-April
		Brevicoryne prassicae	Nymph &Adult	Pest	All plant	+++	December-April
		Myzus persicae (Sulzer)	Nymph &Adult	Pest	All plant	+++	December-April
	Cicadellidae	*Empoasca discipiens* paoli	Adult	Pest	Leaves	++	January- April
	Pentatamidae	*Nezara veridula L.*	Nymph &Adult	Pest	Leaves	+	February.-April
Neuroptera	Chrysopidae	*Chrysoperla carnea* Steph.	Larvae &Adult	Predator	Leaves	+	January-April
Coleoptera	Chrysomelidae	*Phyllotre Cruciferae*	larvae	Pest	leaves	+++	December-March
	Coccinellidae	*Coccinella undicimpunctat* L.	Adult	Predator	Leaves	+++	December-April
		Coccinella spetempunctata L.	Adult	Predator	Leaves	+++	December-April
	Staphlinidae	*Peaderus alfierii* Koch	Adult	Predator	Leaves	+	December-April
Hymenoptera	Vespidae	*Vespa orientalis*	Adult	Pollinator	Leaves	+	January-April
Lepidoptera	Noctuidae	*Agrotis ipsilon (Rott.)*	Larvae	Pest	Roots	+	December-February
		Spodoptera littoralis (Boisd)	Larvae	Pest	Leaves	+	February -April
		Spodoptera exigua (Hubn.)	Larvae	Pest	Leaves	+	February -April
	Plutellidae	*Plutella xylostella* (L)	larvae	Pest	leaves	+++	December-April
Acari	Tetranychidae	*Tetranychus urticae* Koch.	Adult	Pest	leaves	+++	February -April

(+) Rare (++) Abundant (+++) Highly Abundance

Table (2): Numbers of insect and mite species, their families, and orders surveyed in a canola field at Moshtohor, Qalubia Governorate, during 2022-2023 and 2023-2024 seasons.

Orders	No. of		Insect species and enemies		
	Families	Species	Pest	Predator	Pollinator
Orthoptera	2	3	3	-	-
Thysanoptera	1	1	1	-	-
Diptera	2	2	1	1	-
Hemiptera	5	7	6	1	-
Neuroptera	1	1	-	1	-
Coleoptera	3	4	1	3	-
Hymenoptera	1	1	-	-	1
Lepidoptera	2	4	4	-	-
Acariformes	1	1	1	-	-
Total	18	24	17	6	1
%	-	-	70.83	25.00	4.17

2. Population density of aphids with relation to climatic factors on of canola plants in Qalubia Governorate:

In the first season, 2022-2023, data tabulated in Table (3) and Figure (1) showed that the aphid insects began to appear on canola plants in the 1st week of December with few numbers (13.25 individuals/25 plants). Afterwards, the population of aphids increased gradually to reach a peak of abundance (52 individuals/25 plants) during the 4th week of February. Then the number of aphids began to decline until the 2nd week of April to reach (13.5 individuals/25 plants).

The same trend in the second season, 2023-2024, in Table (4) and Figure (2) showed that the aphid insects began to appear on canola plants in the 1st week of December with few numbers (6.50 individuals/25 plants). Afterwards, the population of aphids increased gradually to reach a peak of abundance (39.75 individuals/25 plants) during the 4th week of February, Then the number of aphids began to decline until the 2nd week of April to reach (11.0 individuals/25 plants), Then the population started to decline and disappeared from the field during the 2nd week of April when the plants reached the ripening growth stage.

Data agrees with Mahmoud (2020) who found that the cabbage aphid started to take place in canola fields during the first week of December in both seasons and then increased to reach its peak on the 20th and 13th of February in the two seasons. Tolba (2020) showed that the activity of the green peach aphid was first recorded on 22 December 2016 and 2017 and reached its peaks during the first week of February and last week of January toward bud and flowering stages.

The population of aphids was shown to be insignificantly affected by simple correlation and simple regression values regarding the effects of abiotic variables (Mean percentage relative humidity and maximum and minimum temperatures) in both seasons except for mean percentage humidity in the second season, which was significantly positive (Table 5). In line with these findings, Akbar *et al*. (2019) found that the abundance of aphids showed non-significant association with mean temperatures and humidity. Mahmoud (2020) found there was no significant correlation between the aphid abundance with mean temperature and relative humidity.

Table (3): Population density of aphids/25 plants of canola field at Moshtohor, Qalubia Governorate during 2022-2023 seasons.

Date of observation	Mean No. of Aphids	Temperature			RH. %
		Max.	Mini.	average	
December 10	13.25±0.50	20.28	14.86	17.57	59.86
17	15.75±0.60	18.57	16.57	17.57	64.71
24	19.75±0.76	19.86	15.14	17.50	76.00
31	22.75±0.87	18.57	12.00	15.29	67.57
January 7	26.50±1.02	18.43	12.86	15.65	71.43
14	31.00±1.19	17.57	12.86	15.22	63.00
21	32.75±1.26	18.29	11.29	14.79	60.57
28	35.50±1.36	20.71	13.26	16.99	64.43
February 4	38.00±1.45	17.43	12.00	14.72	57.00
11	42.25±1.62	15.86	9.86	12.86	57.29
18	47.75±1.83	16.00	9.00	12.50	66.86
25	52.00±1.99	18.14	17.71	17.93	61.00
March 4	46.00±1.77	24.57	14.29	19.43	61.00
11	40.00±1.53	23.43	15.14	19.29	47.86
18	33.00±1.27	22.43	16.57	19.50	47.71
25	28.50±1.09	22.43	15.86	19.15	56.14
April 18	21.75±0.83	20.43	14.14	17.29	50.86
	13.50±0.52	27.43	17.29	22.36	36.29

Table (4): Population density of aphids/25 plants of canola field at Moshtohor, Qalubia Governorate during 2023-2024 seasons.

Date of observation	Mean No. of Aphids	Temperature			RH. %
		Max.	Mini.	average	
December 10	6.50±0.25	20.86	16.14	18.50	63.29
17	8.50±0.33	21.86	15.86	18.86	57.29
24	11.00±0.42	21.14	14.86	18.00	63.86
31	13.75±0.52	20.00	14.57	17.29	90.43
January 7	16.25±0.62	20.14	13.43	16.79	75.14
14	18.75±0.72	18.00	13.43	15.72	51.14
21	22.00±0.84	20.00	13.00	16.50	52.57
28	26.00±0.99	17.86	13.71	15.79	60.43
February 4	29.50±1.131	15.00	10.43	12.72	57.86
11	33.75±1.30	18.71	12.00	15.36	73
18	36.25±1.39	19.00	13.86	16.43	56.86
25	39.75±1.53	18.71	13.14	15.93	70.43
March 4	35.50±1.36	22.29	14.57	18.43	60.14
11	30.75±1.18	20.57	14.14	17.36	59.14
18	25.50±0.98	21.57	14.86	18.22	62.14
25	21.75±0.83	20.43	14.57	17.50	50.57
April 18	16.25±0.62	26.00	17.57	21.79	48.86
	11.00±0.42	25.00	18.00	22.00	85.57

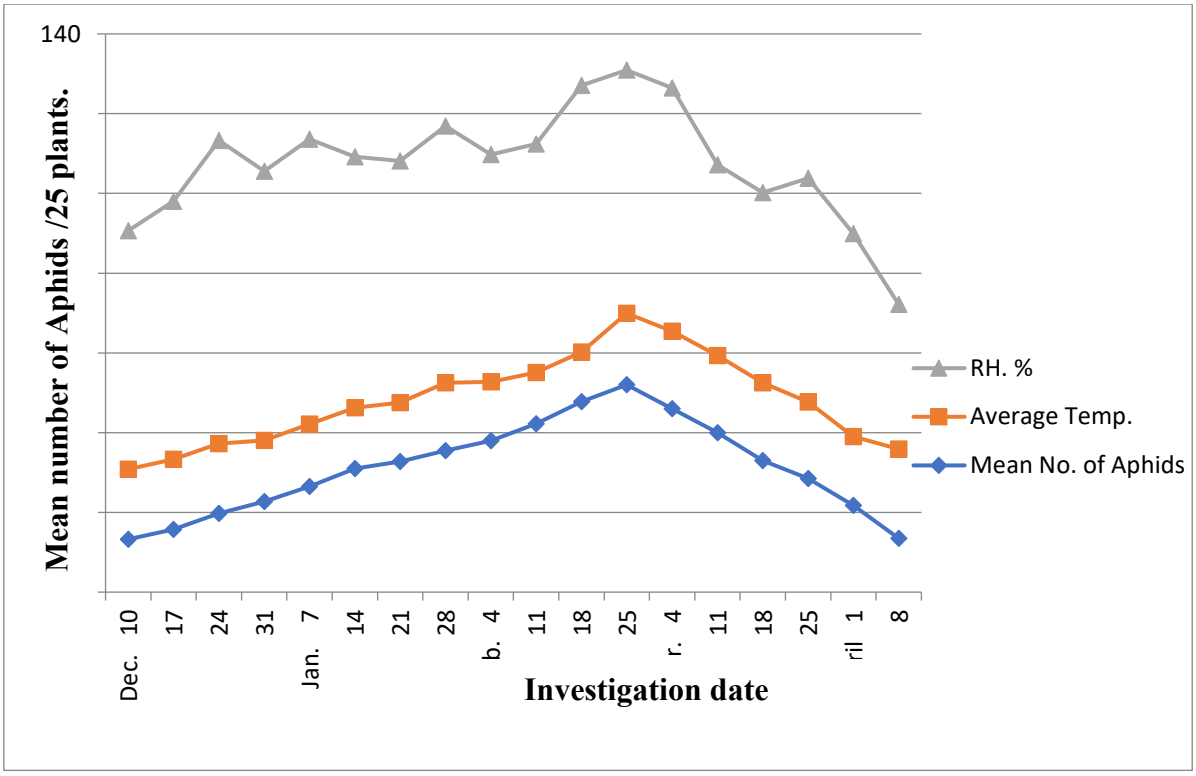

Figure (1): Population density of aphids/25 plants of canola field at Moshtohor, Qalubia Governorate during 2022-2023 seasons.

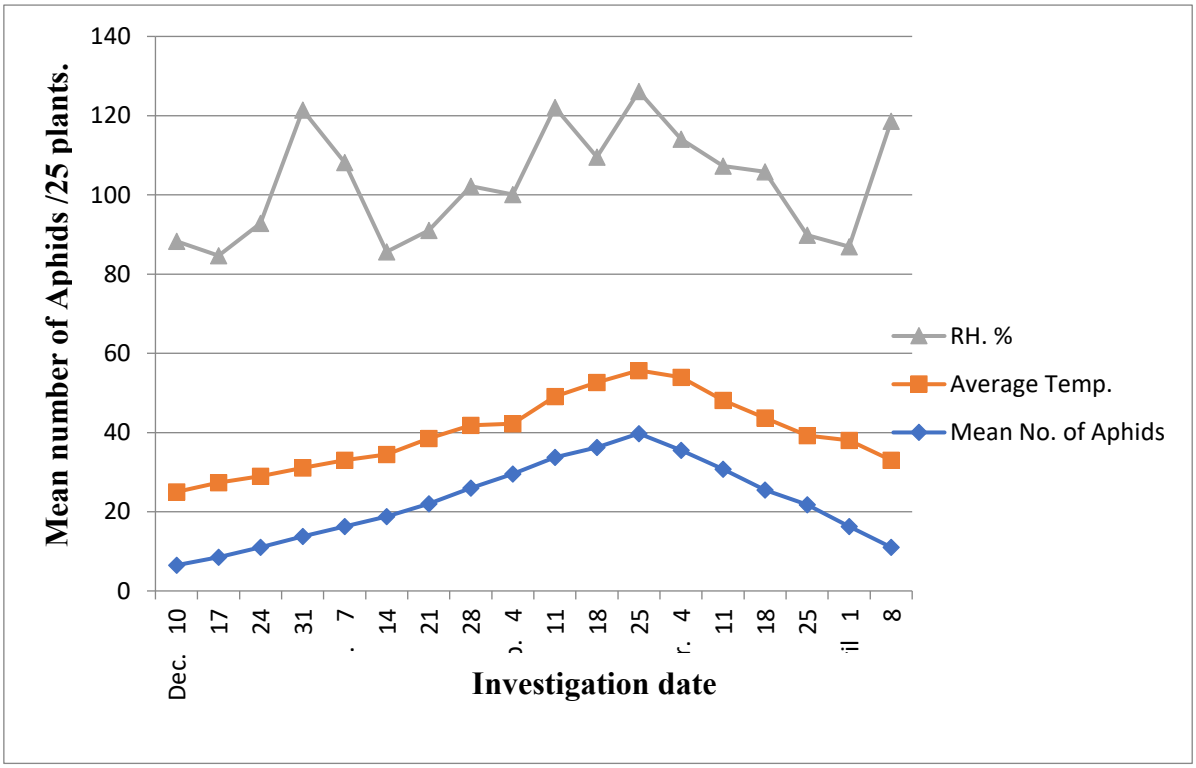

Figure (2): Population density of aphids/25 plants of canola field at Moshtohor, Qalubia Governorate during 2023-2024 seasons.

Table (5): The correlation between climatic factors and population density of aphids during 2022-2023 and 2023-2024 seasons in Qalubia Governorate.

Correlations		2022 - 2023	2023 – 2024
Mean number of Aphids		31.11	22.37
Maximum Temperature	R	-0.274	-0.436
	P	0.271	0.069
Minimum Temperature	R	-0.326	-0.598
	P	0.186	0.008
Average Temperature	R	-0.327	-0.516
	P	0.184	0.028
Relative Humidity mean	R	0.070	-0.158
	P	0.781	0.530

r =Correlation coefficient p= Probability

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