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Population trends of certain canola arthropods with notes of its resistance to some sap feeding insect pests

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ABSTRACT

Canola plantations are considered as an important reservoir of several arthropod pests and natural enemies. Two canola cultivars (Serw and Bactol) were cultivated during 2011/2012 growing season at Assiut Governorate. Sixteen arthropod species belonging to 12 families and 6 orders, rather than the predatory true spider were recorded. The collected species were divided into: 7 phytopahgous; 5 predators; 2 parasitoids and 2 beneficial species. The cabbage aphid Brevicoryne brassicae L.; the peach aphid Myzus persicae (Sulz.) and their parasitoids Diaeretiella rapae (McIntoch) and Praon nicans (Mackauer) in addition to thrips, Thrips tabaci Lind. constituted the most frequent, dominant and abundant species inhabiting canola plantations. The phytophagous group constituted more than 85%, while the predatory one's constituted less than 14%. The abovementioned species were found to be active from the last week of February till harvesting after (April 9). Concerning the aphid parasitism, the first appearance of aphid parasitized mummies by D. rapae and/or P. nicans was recorded in the second half of March. The greatest parasitism percentage was recorded on April 9 with an average of 79.5% and 77.58% on Serw and Bactol cultivars, respectively. Both of the tested cultivars were appeared as susceptible (S) to onion Thrips T. tabaci and showed different resistance categories to aphid species. This study needs more attention by plant breeders to transfer genes responsible for resistance to the newly produced and/or improved cultivars.

Keywords: Canola, Arthropod pests, Natural enemies.

INTRODUCTION

Canola (Canadian oil low acid) refers to a wide range of cultivars among three rapeseed species, *Brassica napus* L., *B. rapa*, and *B. juncea* genetically selected to have less than 2% of erucic acid in the oil and less than 30 µmol per gram glucosinolates in the oil-free meal. In South America, canola has been proposed as a valuable spring crop and special emphasis has been given to its potential as a possible biodiesel crop. In the US, canola is cultivated as winter crop on the Northern Great Plains and as a summer crop in the Central Great Plains. In addition, canola has a high capacity of nitrogen accumulation and prevents nitrogen loss from leaching [1]. Knowledge about canola production in Egypt is still lacking. However, few investigations have been concerned with the canola insect pests. Canola aphid species and thrips were considered among the serious canola insect pests which can cause severe damage to canola plants and consequently reduce its yield income.

Several authors reported that the most dominant aphid species infesting canola plantations were the cabbage aphid *Brevicoryne brassicae* L., the green peach aphid *Myzus persicae* (Sultz.), and the tunrip aphid *Lipaphis erysimi* (Kalrenbach). Some of them studied the population fluctuations of canola aphid[2,3,4,5]. However, few investigators have been concerned with the varietal resistance of canola against aphid species [6,7]. On the other hand, there have been a few reports of thrips in canola. Thrips infested flowers tend to result in curled and distorted pods, which in turn, are predisposed to drop prematurely. The presence of thrips on canola was documented in the 1980's [8]. In this approach, [9] determined the seasonal occurrence and abundance of thrips on rapeseed in west Tennessee (USA). However, [10] clarified the role of the plant characteristics in the resistance of white cabbage to onion thrips.

Therefore, the present investigation has been conducted to determine the faunistic composition, dominance and abundance percentages and population fluctuations of the major species inhabiting canola plantations. Also, identification of the resistance status of the common canola cultivars to their major arthropod pests has been conducted.

MATERIALS AND METHODS

1- Experimental area:
Experiments were carried out at the experimental farm of the Faculty of Agriculture, Assiut University, during 2012 growing season. The experimental area (Ca. 1/4 feddan) was divided into plots. Each plot was 1/400 of feddan (6 rows/plot). Two local canola cultivars (Serw and Bactol) were planted (4 replicates/each) at 1st December, 2011 in completely randomized block design. Regular conventional agricultural practices were normally applied and insecticides were completely prevented.

2- Sampling technique:
By using the sweeping net and the direct count methods, samples of 5 double strokes and 5 canola leaves were picked up weekly 45 days after plantation till harvesting at random from each experimental plot. They kept in polyethylene bags until they were thoroughly examined in the laboratory by using stereomicroscope. Collected specimens were preserved. All specimens were identified by the specialists of the taxonomy department of the Plant Protection Research Institute of the Agricultural Research Center (A.R.C.) Dokki, Giza, Egypt.

3 – Study outlines:
3.1- Faunistic composition of arthropod pests and associated natural enemies:
Direct count method has been used to determine the faunsitic composition and the population trends of arthropod pests and associated natural enemies inhabiting canola plantations. To indicate the dominance degrees of the captured species, the formula of Facylate [11] have been used, as followed:

$$D = \frac{t}{T} x100,$$

Where
D= Dominance percentage
t= Total number of each species during the collecting period.
T= Total number of all species collected during the collecting period.

In order to study the patterns of abundance of the selected species the formula of Facylate [11] have been used too; as followed:

$$A = \frac{n}{N} x100, \text{ Where}$$

A= Abundance percentage.
n= Total number of samples in which each species appeared.
N= Total number of samples taken all over the season.

3.2- Population fluctuations of the major species inhabiting canola plants:
The cabbage aphid, *B. brassicae* ; the green peach aphid, *M. persicae* and the turnip aphid, *L. erysimi* and their associated parasitoids *D. rapae* and/or *P. nicans* in addition to thrips ,*T. tabaci* were selected to study their annual population activity.

3.3- Impact of hymenopterans parasitoids on the incidence of canola aphids:
The relationship between the incidence of the abovementioned aphid species and the Hymenopterous parasitoids were estimated. The parasitism percentage is calculated as follows:

$$\%\,\text{Parasitism} = \frac{\text{mean numbers of mummies}}{\text{mean numbers of mummies} + \text{mean numbers of aphids}} x100$$

3.4- Resistance status of canola cultivars to their major insect pests:
This experiment was conducted to study the susceptibility degree of the common canola cultivars (Serw and Bactol) to their major insect pests. Samples were taken by using the direct count method as previously mentioned. Numbers of *B. brassicae; M. persicae* and *T. tabaci* were counted. Classification of the susceptibility degree of canola cultivars based on the general mean (X) and the standard deviation (SD) as reported by [12,13]. This method enabled the classification of cultivars into 5 categories. The cultivars that harbored mean numbers more than X+2SD considered highly susceptible (HS); between X and X+2SD, susceptible (S); between X and X-1SD, low resistant (LR); between X-1SD to X-2SD, moderately resistant (MR) and less than X-2SD, were considered highly resistant (HR).

Data obtained were statistically analyzed by using F-test. The means were compared according to Duncan's Multiple Range Test [14].

RESULTS AND DISCUSSION

1- Faunistic composition of arthropod pests and associated natural enemies:
Canola plantations are considered as an important reservoir of several insect pests and associated natural enemies. Data presented in Table (1) exhibited the presence of 16 arthropod species belonging to 12 families and 6 orders, rather than the predatory true spiders. Within the collected species 7 phytophagous species were presented by (43.75%); 5 predatory species by (31.25%); 2 parasitoid species by (12.50%) and 2 harmful and/or beneficial species by (12.50%). The cabbage aphid *B. brassicae* and the peach aphid *M. persicae* and their parasitoid species in addition to onion thrips *T. tabaci* constituted the most frequent species inhabiting canola plantations. However, the rest of harmful and/or beneficial species were rarely appeared in the experimental area.

In this approach, [5] recorded 24 arthropod species belonging to 19 families and 14 orders. Within her collection 5 species were considered main pests causing great damage; 7 slightly harmful; 2 visitors and 10 were considered to be beneficial species. Difference in the amount of the collected species could be due to the collection methodology.

Table 1. A partial taxonomic list of arthropods collected from canola plantations by using sweeping net and direct count during 2012 growing season at Assiut Governorate.

Order & Family	Scientific name	Status	Frequency
Thysanoptera			
Thripidae (cotton/onion thrips)	*Thrips tabaci* Lindeman	Phytphagous	More frequent
Hemiptera-Heteroptera			
Pentatomidae (Stink bugs)	*Nezara viridula* (Linnaeus)	Phytophagous	Rare
Anthocoridae (Minute pirate bugs)	*Orius* spp.	Predator	Rare
Miridae (Plant bugs or leaf bugs)	*Campylomma impicta* Wagner	Phytophagous (Predator in part)	Rare
Homoptera			
Aleyrodidae	*Bemisia tabaci* Lindeman	Phytophagous	Rare
Cicadellidae (leaf hopers)	*Empoasca* spp.	Phytophagous	Rare
Aphididae (Aphids)	*Brevicoryne brassicae* L.	Phytophagous	More frequent
	Lipaphis erysimi (Kalrenbach)	Phytophagous	Rare
	Myzus persicae (Sulz)	Phytophagous	More frequent
Neuroptera			
Chrysopidae	*Chrysoperla carnea* Steph.	Predator	Rare
Coleopteran			
Staphylinidae (Horse showe crab beetles)	*Paederus alfierii* Koch	Predator	Rare
Coccinellidae (ladybird beetles)	*Scymnus interruptus* Mars	Predator	Rare
	Stethorus punctillum Weise	Predator	Rare
Hymenoptera			
Aphidiida	*Diaeretiella rapae* (McIntoch)	Parasitoid	More frequent
	Praon necans Mackauer	Parasitoid	More frequent
Apidae	*Apis mellifera* L.	Beneficial	Rare
Araneidae			
(True spiders)	Unidentified true spiders	Predators	Rare

Table 2. Dominance and abundance percentages of the major insect pests and their associated natural enemies collected from canola plantations by using direct count on 5 canola leaves during 2012 growing season at Assiut Governorate.

Taxon.	Serw cultivar				Bactol cultivar			
	Total numbers	Dominance %	Presence	Abundance %	Total numbers	Dominance %	Presence	Abundance %
Phytophagous species								
Brevicoryne brassicae L.	197	19.22	8	61.54	204	19.67	7	53.85
Myzus persicae (Sulz)	266	25.95	9	69.23	343	33.08	9	69.23
Lipaphis erysimi(Kal)	3	0.29	2	15.38	39	3.70	1	7.69
Thrips tabac L.	559	54.54	9	69.23	451	43.49	7	53.85
Total	1025	90.71	-	-	1037	85.99	-	-
Entomophagous species								
Parasitoids (adults)	0	0	0	0	7	3.98	1	7.69
Parasitoids (mummies)	105	100	5	38.46	169	96.02	6	48.15
Total	105	9.29	-	-	176	14.51	-	-
Grand total	1130	100	-	-	1213	100	-	-

Table 3. Population fluctuations of the major sap feeding pests infesting canola plantations during 2012 growing season at Assiut Governorate.

Date	Plant age	Mean number/5 canola leaves ± SD							
		Serw cultivar				Bactol cultivar			
		1	2	3	4	1	2	3	4
Jan., 16	45	0.00c ±0.00	0.00e ±0.00	0.00 ±0.00	0.00e ±0.00	0.00c ±0.00	0.00d ±0.00	0.00b ±0.00	0.00d ±0.00
Jan., 23	52	0.00c ±0.00	0.00e ±0.00	0.00 ±0.00	0.00e ±0.00	0.00c ±0.00	0.00d ±0.00	0.00b ±0.00	0.00d ±0.00
Jan., 30	59	0.00c ±0.00	0.00e ±0.00	0.00 ±0.00	0.00e ±0.00	0.00c ±0.00	0.00d ±0.00	0.00b ±0.00	0.00d ±0.00
Feb., 6	66	0.00c ±0.00	0.00e ±0.00	0.00 ±0.00	0.00e ±0.00	0.00c ±0.00	0.00d ±0.00	0.00b ±0.00	0.00d ±0.00
Feb., 13	73	0.00c ±0.00	1.00c ±0.00	0.00 ±0.00	0.00e ±0.00	0.00c ±0.00	3.33d ±1.24	0.00b ±0.00	0.00d ±0.00
Feb., 20	80	0.00c ±0.00	0.00c ±0.00	0.00 ±0.00	1.00c ±0.00	0.00c ±0.00	0.00d ±0.00	0.00b ±0.00	0.00d ±0.00
Feb., 27	87	0.00c ±0.00	5.00cde ±0.81	0.00 ±0.00	31.67c ±4.19	0.00c ±0.00	13.00e ±2.44	0.00b ±0.00	6.33d ±2,62
March, 5	94	2.00c ±0.82	2.67de ±0.47	0.00 ±0.00	11.67d ±0.44	1.00c ±0.00	0.00d ±0.00	0.00b ±0.00	1.33d ±0.47
March, 12	101	1.66b ±4.10	16.00b ±5.35	0.00 ±0.00	40.00b ±4.08	3.67c ±0.41	16.67bc ±6.64	1.33b ±0.47	19.00a ±5.88
March, 19	108	18.33a ±5.31	35.67a ±11.44	1.00 ±0.00	30.00c ±8.16	14.33b ±3.29	32.33a ±0.47	11.67a ±2.35	58.00a ±8.83
March, 26	115	11.00b ±0.82	11.00bc ±2.16	0.00 ±0.00	55.33a ±8.18	15.00b ±4.08	22.00d ±5.35	0.00b ±0.00	46.67b ±5.55
Apr., 2	122	12.33b ±0.47	7.00cde ±1.41	0.00 ±0.00	15.33d ±0.47	23.33a ±7.54	15.67c ±2.67	0.00b ±0.00	14.33c ±4.71
Apr., 9	129	11.33b ±1.88	10.33bcd ±0.47	0.00 ±0.00	1.67e ±0.47	10.67b ±1.24	11.33c ±0.94	0.00b ±0.00	4.67d ±1.29
Total		55.67	88.66	1.00	186.66	68.00	114.33	13.00	150.33
Mean		4.28	6.82	0.07	14.35	5.23	8.79	1.00	11.56
f-value		22.5**	15.968**	ns	54.56**	18.59**	32.72**	46.83**	55.06**

1- *Brevicoryne brassica;* 2- *Myzus persicae;* 3- *Lipaphis erysimi;* 4- *Thrips tabaci*

** Means followed by the same letter in each column are not significantly different at 0.05 level of probability by Duncan's multiple range test.*

2- Population fluctuations of the major species inhabiting canola plants:

Aphids and Thrips were recorded previously as the most dominant and abundant arthropod pests inhabiting canola plantations. Cabbage aphid *B. brassicae*; Peach aphid *M. persicae* and mustard aphid *L. erysimi* in addition to the onion thrips, *T. tabaci* were selected to determine their population fluctuations on canola leaves as reported in Table (3). The obtained data showed that, except of *L. erysimi* the selected species were found to be active on both canola cultivars from the last week of February at the plant age (87 days old), till harvesting at April 9. The cabbage aphid *B. brassicae* and the peach aphid *M. persicae* exhibited one peak on March 19 on Serw cultivar with an average of

18.33 and 35.67 individual/5 canola leaves, respectively. High significant difference between inspection dates was recorded (F= 22.595** and 15.698**) for both species, respectively. Similar results were obtained on Bactol cultivar. The onion thrips, *T. tabaci* registered one peak on both canola cultivars with an average of 55.33 and 58.00 individuals/5 canola leaves during March 19 and March 26, respectively. Also, high significant difference between the inspection dates as well as the plant age were recorded (F= 54.569** and 55.065**), respectively.

To determine the dominance and abundance percentage of the major arthropods inhabiting the tested canola cultivars, 5 canola leaves were examined and data were presented in Table (2). It is clear that *T. tabaci* ranked the first and constituted 54.54% of the phytophagous species inhabiting Serw cultivar. With high abundance percentage (more than 60%), it followed by *M. persicae*, *B. brassicae* by 25.95% and 19.22%, respectively. Similar results were obtained from Bactol cultivar. In general the dominance of the phytophagous species constituted more than 85.00%, while the predatory one's constituted less than 14.00%, on the two examined canola cultivars. In the same area of study, [5] stated that *B. brassicae* seems to be the most important economic pest infesting canola as indicated by the greatest value of dominance and abundance degrees (81.88 and 100%). In Oklahoma and Kansas (USA), [15] used traditional sampling methods and novel protein mark recapture methods to determine natural enemy abundance and movement within Oklahoma winter canola. Their obtained data has already shown that natural enemies belonging to Coccinellidae and Chrysopidae occur in winter canola at very high numbers and that canola appeared to be functioning as an attractant for both of these predatory groups.

In most of the collected investigations *B. brassicae* took the first dominant and abundant ranks and followed by *M. persicae* and *L. erysimi*. In this work, differences in the incidence of these aphid species could be due to the collection methodology. It is sought that *M. persicae* preferred canola leaves constituents and/or nutrition components more than other plant parts. Conversely, *B. brassicae* preferred the inflorescences, apical meristem and pods, whereas they feed on another groups of nutrition components. In this approach, [16] determined the incidence of mustard aphid and its correlation with the flowering time and oil content in some *Brassicae* species. However, the occurrence of the cabbage aphid *B. brassicae* has been studied in more details by [17]. They stated that *B. brassicae* is the most destructive pests. It forms large colonies on stems and inflorescence cause severe damage and reduce seed yield loss of 9-77%. Also, they stated that aphids cause an 11% reduction on seed oil content. In respect to plant age and/or stage, [18] reported that the population of aphid on canola was below the economic threshold level from November 2003 to January 2004, after its increase to the economic threshold level. In the same approach, [19] reported that the population of *B. brassicae* and *L. erysimi* was higher from the end of February to early mid March. Also, they reported that *B. brassicae* was higher than *L. erysimi* during their study period. They suggested that *B. brassicae* ranked as the most abundant pest while *L. erysimi* has a potential to become the second important pest in their experimental area in Pakistan.

In respect to the impact of canola stage on aphid population, [20] reported that aphid infestation can occur at two stages of canola crop cycle; during autumn/winter establishment stage and again during spring when crop are flowering and pudding. Their investigation aimed to investigate the management of aphids in canola crops during the flowering-early pudding period under moisture stressed (drought) conditions. They concluded that canola should be sown as early as practice within the sowing window to avoid both yield and oil penalties included by a contribute of aphid pressure and spring moisture stress.

3- Impact of hymenopterans parasitoids on the incidence of canola aphids:

Identify and assess species of aphids as the major canola insect pest and identify and assess the impact of beneficial insects as biological control agent, must be in consideration. Within the appropriate control methods of canola pests is the use of entomophagous species i.e. predators and/or parasitoids.

Mean numbers of the collected aphid species; mean numbers of mummies (parasitized aphids) and parasitism percentages were calculated in Tables (4 & 5). The first appearance of aphid mummies parasitized by *Diaeretiella rapae* (McIntoch) and/or *Praon necans* Mackauer was recorded in the second half of March in both canola cultivars. The greatest percentage of parasitism was recorded at April, 9 with an average of 79.5% and 77.58 on Serw and Bactol cultivars, respectively. So that, in can be sought that canola cultivars could not have any attractive and/or repellent substances to the aphid parasitoids.

The earlier, [21] determine the population of cabbage aphid *B. brassicae* and its parasitoids and hyperparasitoides by using the actual counting in the sprouts field and by sticky and water traps. He stated that the aphid populations in the field was started by immigrant allates which were found flying too early to be synchronized with the sprouts plants. Also, he stated that *B. brassicae* was found to be attacked by one primary parasite *D. rapae*. The maximum percentage of mummies being 27.8% because of high hyperparasitism (especially by *Alloxysta brassicae* Ash.). On the other hand, *D. rapae* was not able to maintain at high rate of parasitism to curb the aphid population growth. In

the same approach, [22] used entomological sweep net and plant sacking to determine the occurrence of *D. rapae* parasitizing *L. erysimi* and *B. brassicae* in canola fields. They reported that aphids were more abundant during the flowering phase and located in the stems of the inflorescence and development fruits.

Table 4. Mean numbers of aphid species inhabiting canola plants (Serw cultivar) and relation to their parasitoids by using leaves direct count during 2012 growing season at Assiut Governorate.

Sampling date	Plant age (days)	Mean numbers of individuals/5 canola leaves					% parasitism
		Aphid species				Parasitoid mummies	
		B. brassicae	*M. persicae*	*L. erysimi*	mean		
Jan., 16	45	0.00	0.00	0.00	0.00	0.00	0.00
Jan., 23	52	0.00	0.00	0.00	0.00	0.00	0.00
Jan., 30	59	0.00	0.00	0.00	0.00	0.00	0.00
Feb., 6	66	0.00	0.00	0.00	0.00	0.00	0.00
Feb., 13	73	0.00	1.00	0.00	0.33	0.00	0.00
Feb., 20	80	0.00	0.00	0.00	0.00	0.00	0.00
Feb., 27	87	0.00	5.00	0.00	1.66	0.00	0.00
March, 5	94	2.00	2.66	0.00	1.55	0.00	0.00
March, 12	101	10.67	16.00	0.00	8.89	0.00	0.00
March, 19	108	18.33	35.66	1.00	18.33	4.66	20.27
March, 26	115	11.00	11.00	0.00	7.33	1.00	12.00
April, 2	122	12.33	7.00	0.00	6.44	1.66	20.49
April, 9	129	11.33	10.33	0.00	7.22	28.00	79.50
Total		65.67	88.66	1.00	51.78	35.00	
Mean		5.05	6.82	0.07	3.98	2.69	

Table 5. Mean numbers of aphid species inhabiting canola plants (Bactol cultivar) and relation to their parasitoids by using leaves direct count during 2012 growing season at Assiut Governorate.

Sampling date	Plant age (days)	Mean numbers of individuals/5 canola leaves					% parasitism
		Aphid species				Parasitoid mummies	
		B. brassicae	*M. persicae*	*L. erysimi*	mean		
Jan., 16	45	0.00	0.00	0.00	0.00	0.00	0.00
Jan., 23	52	0.00	0.00	0.00	0.00	0.00	0.00
Jan., 30	59	0.00	0.00	0.00	0.00	0.00	0.00
Feb., 6	66	0.00	0.00	0.00	0.00	0.00	0.00
Feb., 13	73	0.00	3.33	0.00	1.11	0.00	0.00
Feb., 20	80	0.00	0.00	0.00	0.00	0.00	0.00
Feb., 27	87	0.00	13.00	0.00	4.33	0.00	0.00
March, 5	94	1.00	0.00	0.00	0.33	0.00	0.00
March, 12	101	3.67	16.67	1.33	7.22	1.66	18.69
March, 19	108	14.33	32.33	11.66	19.44	4.00	17.06
March, 26	115	15.00	22.00	0.00	12.33	3.66	27.89
April, 2	122	23.33	15.67	0.00	22.33	21.66	49.24
April, 9	129	10.63	11.33	0.00	7.32	25.33	77.58
Total		68.00	114.33	13.00	65.12	56.33	
Mean		5.23	8.79	1.00	5.00	4.33	

4- Resistance status of canola cultivars to their major insect pests:

Resistance status of the tested canola cultivars against canola aphids *B. brassicae* and *M. persicae* in addition to the onion thrips *T. tabaci* was recorded in Table (6). Dependent on the mean numbers of each insect pest and the general mean numbers, three of the five resistance categories were recorded. The tested canola cultivars (Serw and Bactol) were appeared as susceptible cultivars (S) to *T. tabaci*. The same cultivars showed some sort of resistance to the cabbage aphid *B. brassicae* and appeared as moderately resistant (MR) cultivars. On the other hand, Serw cultivar appeared as low resistant (LR) cultivar to the peach aphid *M. persicae*, while Bactol cultivar appeared as (S) cultivar to the same pest. Differences in the resistance status of the tested canola cultivars to the abovementioned pests could be attributed to the presence of some nutritional inhibitors in some canola plant parts. It is sought that canola leaves harbored some undesirable nutritional materials for *B. brassicae*. In the same time harbored desirable nutrition for *M. persicae*.

Resistance status of some canola cultivars to the peach aphid *M. persicae* has been studied in more details [23]. However, a single trial was obtained about the plant traits associated with resistance to thrips, *T. tabaci* in cabbage (*Brassicae oleracea* var. *capitata*) [24]. In a comparison between five oilseed rap varieties to the cabbage aphid *B. brassicae* in the greenhouse, [25] investigated the antibiosis mechanism for the resistance at 4-6 phonological leaf stages. They determine the antibiosis phenomenon by studying the percentage survival of the nymphs, duration of their development time, fecundity and finally calculated relevant intrinsic rate of natural increase.

Table 6. Susceptibility degree of the common canola cultivars to Thrips and Aphid species during 2012 growing season at Assiut Governorate.

Taxo.	General mean numbers/5 canola leaves			
	Serw cultivar		Bactol cultivar	
	Mean number	Susceptibility degree	Mean number	Susceptibility degree
Thrips tabaci	186.7	S	150.33	S
Brevicaryne brassicae	65.67	MR	68.00	MR
Myzus persicae	88.66	LR	114.3	S
Total	340.9		323.7	
Mean	113.7		110.89	

S= Susceptible.; MR= Moderately resistant.; LR= Low resistant.

In general it can be concluded that: within sixteen arthropod species infesting canola, thrips and aphids were the most frequent species and can cause severe damage to canola. These species constituted the highest dominance and abundance percentages. The highest population densities of these species were recorded during the second half of March and the plant age of 108-125 days old. The highest parasitism percentage on aphid was appeared at the beginning of April. The tested canola cultivars were appeared as susceptible (S) to *T. tabaci*, while showed some sort of resistance against the cabbage and peach aphids. The presence of any category of resistance against aphid species could be attributed to one or more of susceptibility categories (Antixenosis, antibiosis and/or tolerance).

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