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Insect pests and the associated natural enemies in the cultivation of canola in El-Minia Governorate

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Abstract:

The present studies were oriented during 2016-2017 and 2017-2018 growing seasons of canola plants at Malawi, El-Minia Governorate. Results indicated that the presence of 26 species of arthropods belonged to 22 families and 14 orders. From the species collected, 5 species are considered the main pests causing great damage, 4 slightly harmful, and 8 beneficial arthropods as well as unidentified species of true spiders. The identified species were listed and classified to pests, parasitoids, predators, pollinators and visitors.

Introduction

Canola is one of the newly introduced oil crops in Egypt to contribute in reducing oil shortage; especially it could be cultivated in soils affected by salinity. Rapeseed has a bright future in Egypt because of its ability to grow in the new reclaimed lands under wide soil variation as drought and salinity as revealed by some Egyptian (Kandil *et al.*, 1996). Literature review for the pests inhabiting canola plants in certain countries of the world i. e. India, Pakistan, USSR, China, Italy, Canada, Poland, Bulgaria, UK, Australia, Turkia, Germany, Barazil, North America, USA, Denmark, Estonia, South Africa and Egypt, illustrated that the main pests of canola plants were certain species of insects belonging to different orders (Lamb, 1989). Various authors in certain parts of the world i. e. Warner *et al.*, 2000; Carcamo *et al.*, 2001; Mosiane *et al.*, 2003; Hansen, 2004; Pontoppidan *et al.*, 2005 and Ahmed, 2006 discussed pests inhabiting canola from the economic point of view.

The present study aims to survey the pests and the associated natural enemies inhabiting canola plants and to determine their abundance and dominance degrees in an attempt of planning successful control programme for these pests under Malawi, El-Minia Governorate condition.

Materials and methods

The present studies were conducted at the experimental farm of Malawi, Agricultural Research Station during the period from 2016-2017 and 2017-2018 canola growing seasons. An area of about one feddan (4200 m^2) was

divided into equal plots. Each plot [1/400 of feddan (6 rows / plot)] was cultivated with canola (baktol variety) in a randomized complete block design. All recommended agricultural practices were performed, and no chemical treatments were used during the study period.

1. Survey of pests and the associated natural enemies inhabiting canola:

In order to survey the pests and the associated natural enemies inhabiting canola plants, sweep-net technique and whole plant examination were used as sampling methods.

1.1.Sweep net sampling:

The sweep-net consisted of a wooden handle 100cm in length; the rim was about 38cm in diameter and 75cm deep. Ten sweeps repeated ten times were taken weekly. Each collected sample was emptied into labeled cage and transferred to the laboratory. Specimens were anaesthetized by Chloroform and examined under stereomicroscope. Number of species and number of individuals of each species was recorded and unidentified species were kept in vials containing 75% ethyl alcohol for later identification. Samples were taken weekly and continued throughout the growing season until the end of the season. Samples were taken, whenever possible, from the same plot but never from the same plant. The number of species and the numbers of individuals each species within each sample were counted and recorded at each inspection date.

1.2. Whole plant sampling:

Weekly samples of 50 canola plants were taken early in the morning (8.00-10.00 Am) at random from the area. The number of adults of the insect's pests and associated natural enemies were carefully counted. The number of the immature stages of the insect pests and mites were counted using a binocular microscope. Inspection was made from the beginning of the vegetative stage to flowering and fruiting stage up to the end of season. Specimens of unknown spices were kept in glass vials contain 75% ethyl alcohol for later identification.

2. Statistical analysis:

Dominance (%) and abundance (%) degrees of the identified species were calculated according to the formula of Facylate (1971).

2.1. Dominant degrees (D):

D = t/T x 100, where

(t) = total number of each species during the collecting period. (T) = total number of all species during the collecting period.

2.2. Abundant degrees (A):

A = n / N x 100, where,

(n) = total number of samples in which each species appeared.

(N) = total number of samples taken all over the season.

Results and Discussion

1.Survey of pests and their associated predators recorded on canola plants:

Data presented in Table (1) showed a partial taxonomic list of arthropod pests and the associated natural enemies recorded by whole plant and sweeping sampling from canola plants cultivated in Malawi Agricultural Research Station during 2016-2017 and 2017-2018 growing seasons. Results indicated that the presence of 26 species of arthropods belonged to 22 families and 14 orders as well as some species of true spiders (unidentified). From the species collected, 5 species are considered as abundant pests causing great damage, 4 species are considered as pests' species

slightly harmful, 8 beneficial arthropods as well as unidentified species of true spiders and 3 species are considered as pollinators and visitors.

1.1. Pests:

Intensive and extensive observations indicated that the collected species can be classified as piercing-sucking pests, leaf feeders, and leaf miners. In general 6 orders (Orthoptera, Thysanoptera, Hemiptera, Lepidoptera, Diptera and Acari) and 11 families (Acridiidae, Gryllotalpidae, Gryllidae, Thripidae, Miridae, Pentatomodae, Aleyrodidae, Aphidadae, Cicadellidae, Noctuidae, Agromyzidae, as well as four families of Acari order (Tetranychidae) were recorded inhabiting canola plants during 2016- 2017 and 2017-2018 growing seasons. Species belonging to order Lepidoptera were collected as larvae by direct observations on the plants and presented by family Noctuidae. Two species were belonged to this order, *Agrotis ipsilon* (Rott.) and *Spodoptera littoralis* (Boisd.) (Noctuidae). Three species of order Orthoptera were recorded during the present study. These species were grasshopper, *Heteraacris littoralis* (Rumb.) and *Acrotylus insubricus* (Scopli) which pertaining to family Acridiidae. The mole cricket, *Gryllotalpa gryllotalpa* L., (Family: Gryllotalpidae) and *Gryllus domestich* (L.) (Family: Gryllidae) have no serious damage to the crop. Collected species belonging to the group of arthropods, which pierce the tissue and suck the sap of canola plants are belonging to order Hemiptera , Heteroptera and Thysanoptera as well as the two-spotted spider mite of the order Acari. The most important serious pricing sucking pests were the plant bug, *Campylomma impicta*, Stink bug, *Nezara veridula* L. (Pentatominae); whitefly, *Bemisia tabaci* (Genn.) (Aleyrodidae); cabbage aphid, *Brevicorene prassicae* L.*; green* peach aphid, *Myzus persicae* (Sulzer.) (Aphididae); the leafhopper, *Empaosica* spp. (Cicadellidae) and the onion thrips, *Thrips tabaci* (Thripidae) as well as the two-spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae). Laboratory examination of the randomly collected canola leaves revealed the presence of the twospotted spider mite *T. urticae* which causes heavy infestation to the canola leaves throughout the whole growing season.

These results are in accordance with those obtained by El-Dabi (1999) and Amro (2008) who reported a taxonomic list of arthropode pests and predators recovered from some plantation. However, Ahmed (2003), Hagrass *et al*. (2008), Ghallab *et al*. (2011), Abd El-Wahab *et al*. (2012) and Gameel (2013), Metwally *et al*.(2013) reported that *B. tabaci; A. gosspyii; T. tabaci; Empoasca* spp. are the most important piercing sucking insects of cucumber crops. Two spotted spider mite, *T. urticae* was found to be as an economic pest infesting cucurbit plants (Farrag *et al.*, 1982; Abou-Taka and Zahdy, 1990; El-Maghraby *et al*., 1994; Ali, 1995 and Abou El-Saad, 2015).

1.2. Natural enemies:

This group of beneficial insects included parasitoids and predators.

1.2.1. Predators:

As shown in Table (1), nine species were identified as entomophagous in addition to true spider (unidentified). They are belonging to 6 orders (Dermaptera, Hemiptera, Neuroptera, Coleoptera and Diptera as well as some of the unidentified species of true spiders. Results also indicated that these species are belonging to 6 families (Labiduridae, Anthocoridae, Chrysopidae, Coccinellidae, Staphylinidae and

Syrphidae). The green lacewing, *Chrysoperla carnea* (Stephens) ; the hover fly, *Syrphus corolla* Fabricius and the lady beetles, *C. undecimpunctata*, were the most abundant predator species. Species such as *Orius* sp., *P. alferii* and some unidentified species of true spiders were collected occasionally and in scarce numbers.

1.2.2. Parasitoids:

Two species of parasitoids were recorded and identified attacking aphid species infesting canola plants belonging to the order Hymenoptera and the family Aphidiidae namely: *Diaeretiella rapae* (Mclntoch) and *Praon necans* Mackauer.

1.2.3. Pollinators and visitors:

Among the survived insects, certain species, pertaining to the orders Diptera and Hymenoptera, were recorded and classified as visitor and pollinator insects. These include 3 species of order Diptera, belonging to three Families, Drosophilidae and Muscidae. However, *Vespa orientales* classified as a visitor to canola plants. The previously results showed that, onion thrips, *T. tabaci*, whitefly, *B. tabaci* and cotton aphid, *B. prasicae* and *M. persicae* in addition to the two-spotted spider mite, *T. urticae* are the most important piercing-sucking arthropod pests infesting canola plants. The most important pricing sucking insects, *T. tabaci, B. tabaci, B. prasicae* and *M. persicae* were recorded as common pests infesting canola plants in many parts of the world as recorded by Abd El-Kareim, 1980; Mukhamediev and Akhmedov, 1984; Omar *et al.*, 1988; Hilije *et al*., 1993; Mineo *et al*., 1994; Tonhasca *et al*., 1994; Kamel *et al*., 2000; Gameel and Sayed, 2008 and Younes *et al.*, 2010. The common spider mite, *T. urticae* was found to be as an economic pest infesting canola plants (Farrag *et al*., 1982; Perring, 1987; El-Maghraby *et al*., 1994; Ali, 1995; Kamel *et al.*, 2000 and Balkema *et al.*, 2003). The present results are generally agreeing with those of El-Maghraby *et al.* (1994); Ali (1995) and Bachatly and Sedrak (1997).

2.Dominance and abundance degrees of sucking pests and the associated predators on canola plants:

2.1. Pests:

The field studies through the period extended from2016- 2017 and 2017-2018 seasons; show that seven species were the most serious pests on canola plants. These species were: Stink bug, *N. veridula*; whitefly, *B. tabaci* ; cabbage aphid, *B.brassicae;* green peach aphid, *M. persicae*; the leafhopper, *Empaosica* spp. and the onion thrips, *T. tabaci* as well as the two-spotted spider mite, *T. urticae.* In 2017 season, data in Table (2) show that *B.brassicae*, and *M. persicae* seems to be the most important economic pests as indicated by the highest value of dominance and abundance degrees (39.97 and 36.59% and 90.00 and 85.00%). However, *T. tabaci* had the relatively high abundance degrees (80.00%) with low dominance degrees (16.99%) indicating that this species could be of economic importance if the environmental conditions changed in their favour. Meanwhile, the species of *B. tabaci. Emposica* spp. and *N. viridula* which had low values of abundance and dominance degrees (30.00 and 0.009%, respectively) is expected to be of little economic importance as it may cause a minor role as a pest in cantaloupe plantations. As for dominance and abundance degrees of aphid species infesting canola plants during 2017-2018 season. Data in Table (3) show that also *B. tabaci* seems to be the most important economic pests as indicated by the highest value of dominance and abundance degrees (98.73 and 100%). However, both *A. gossypii* and *M. persicae* had

moderately abundance degrees (70.00%) with also low dominance degrees (0.194 and 0.012%) indicating that these species could be of economic importance if the environmental conditions changed in their favor. Meanwhile, the species of *Empoasca* spp. and *T. tabaci* which had low values of abundance and dominance (50.00 and 30.0% and 0.004 and 0.189%, respectively) are expected to be of little economic importance as they may cause a minor role as pests in cantaloupe plantations.

In general, from the above-mentioned results it could be concluded that *B. tabaci* and *T. urticae* seem to be the most important economic pests infesting cantaloupe as indicated by the highest value of dominance and abundance degrees. However, the high abundance degrees of *M. persicae* and *A. gossypii* which had low dominance degrees indicate that these species could be of economic importance if the environmental conditions changed in their favour. Meanwhile, the species of *Empaoascae* and *T. tabaci* which had low values of abundance and dominance are expected to be of little economic importance as they may cause a minor role as pests in cantaloupe plantations in Mallawi, El-Minia.

2.2. Predators:

Data presented in Tables (2) and (3) showed that there are four species of predators recorded on canola plants through the period extended from 2016-2017 to 2017- 2018 seasons. These species were: lion aphid, *Chrysoperla carnea* Steph, eleven spotted lady beetle, *Coccinella undecimpunctata* (L.) , *Paederus alferii* Koch. and *Syrphus corolla* F. In 2016-2017 season, the *C. undecimpunctata* seemed to be the most important economic predator as indicated by the highest value of dominance degree (70.69%). However, high abundance degrees of *P. alferii* (80.00%) which had low dominance (7.76%), also, moderately abundance degrees (35.00%) of *C. carnea* and *S. corolla* which had low dominance degrees (10.34% and 7.76%) indicated that this species could be of a little economic importance. indicated that these species could be of a little economic importance. During 2018 season, data in Table 3 show also that the *C. undecimpunctata* seemed to be the most important predators as indicated by the relatively high value of dominance and abundance degrees (93.86% and 85.00%). However, *P. alferii* and *C. carnea* which had lower values of dominance degrees (4.24% and 1.23%) are expected to be of little economic importance.

Although the predators, *C. carnea* and *C. undecimpuncta*ta seem to be the

most numerous predators recovered in this survey (Tables, 2 and 3), the lower dominance degrees of predators than those of pests indicate that the natural enemies may be subjected to unfavorable conditions, which affect their efficiency in managing pests existed in the experimental area. Modifying the environment in favor to natural enemies should be studied.

The present investigations were carried out during two successive of canola growing seasons (2016 – 2017 and 2017 – 2018). Owing to field survey studies three species of aphids were detected on canola plants. These species were: Cabbage aphid, *B. brassicae*; green peach aphid, *M. persicae* and turnip aphid, *Lypaphis erysimi* (Kalrenbach). Previous studies in Egypt and abroad showed that canola plants are subjected to attack by these aphid species (Sarwar,2013 and Ahmed , 2006). In general, data show that *B. brassicae* seems to be the most important economic pests infesting canola as indicated by the greatest value of dominance and abundance degrees. However, the high abundance degrees (79.17%) of *M. persicae* which had low dominance degrees (9.98%) indicates that this species could be of economic importance if the environmental conditions changed in their favour. Meanwhile, the species of *L. erysimi* which had low values of abundance and dominance (58.33 and 8.19%, respectively) is expected to be of little economic importance as they may cause little role as a pest in canola plantations. The cabbage aphid has become one of the three primary pests of winter-seeded canola in Egypt. Cabbage aphid pressure just prior to and during bloom aborts flower buds, deforms developing pods, and generally saps vigor from plants resulting in yield losses of up to 40 percent in untreated fields. Colonies of more than 300 aphids per raceme are common each season. These aphid species were distributed throughout all the temperate and warm temperate regions of the world. Also, were considered of the most damaging and consistently present pests on cabbage crops (Theunissen, 1989) and caused direct damage, resulting from searching for food, which may induce plant deformation (Oatman and Platner, 1969), and indirect damage caused either by honeydew or by transmission of viruses (Chan *et al.,* 1991).

Table (1): A partial taxonomic list of arthropod pests and the associated natural enemies inhabiting canola plants, Malawi, El-Minia Governorate during 2016-2017 and 2017-2018 growing seasons.

Order	Family	Scientific name	Common name	الاسم العربي	Frequency	Notes
I – Pests						
Orthoptera	Acridiidae	*Heteraacris* (*Thisoicetrus*) *littoralis* (Rumb.)	Grasshopper	نطاط البرسيم المتشابه	**	S
		Acrotylus insubricus (Scopli)		نطاط ذو الجناح الاحمر	**	S
	Gryllotalpidae	*Gryllotalpa gryllotalpa* (L.)	Mole cricket	الحفار	*	S
	Gryllidae	*Gryllus domestic*	Field cricket	صرصور الغيط	*	S
Thysanoptera	Thripidae	*Thrips tabaci* Lind.	Onion thrips	تربس البصل	***	P+S
Hemiptera-Heteroptera	Miridae	*Campylomma impicta* (Wagnar)	Plant bug	بق النبات	**	P+S
	Pentatomidae	*Nezara veridula* L.	Stink bug	البقه الخضراء	*	P+S
	Aleyrodidae	*Bemisia tabaci* (Genn.)	Whitefly	الذبابه البيضاء	***	P
	Aphidadae	*Brevicorene prassicae* L.	Cabbage aphid	من الكرنب	***	P+S
		Myzus persicae (Sulzer.)	Green peach aphid	من الخوخ الاخضر	***	P+S
	Cicadellidae	*Empoasca* discipiens Paoli.	Leaf hopper	الجاسيدز	**	P+S
Lepidoptera	Noctuidae	*Agrotis ipsilon* (Rott.)	Cut worm	الدوده القارضه	*	S
		Spodoptera littoralis (Boisd.)	Egyptian cotton leaf worm	دوده ورق القطن	*	S
Diptera	Agromyzidae	*Agromyza pussilla* Meig	Leaf miners	صانعه الانفاق	*	P
Acari	Tetranychidae	*Tetranychus urticae* Koch	Two spotted spider mite	اكاروس العنكبوت الاحمر	***	P
II – Parasitoids						
Hymenoptera	Aphidiidae	*Diaeretiella rapae* (Mclntoch)	Aphid parasitoid	*طفيليات من*	**	P
		Praon necans Mackauer				
III – Predators						
Dermaptera	Labiduridae	*Labidura riparia* Pall.	Giant earwig	ابره العجوز	*	S
Hemeptera - Heteroptera	Anthrocoridae	*Orius* sp.	Flower bug	بق الاوريس	*	P
Neuroptera	Chrysopidae	*Chrysoperla carnea* (Steph.)	Lace wing	اسدالمن	*	S
Coleoptera	Coccinellidae	*Coccinella undecimpunctata* L.	eleven-spotted lady beetle	ابو العيد١١	***	P+S
	Staphylinidae	*Paederus alferii* Koch		الرواغة	*	P+S
Diptera	Syrphidae	*Syrphus corolla* F.	Hover fly	ذبابه السرفيس	*	P+S
True spider		Unidentified species	True spider	عناكب حقيقية	*	P+S
IV – Pollinators and visitors						
Diptera	Dorsophilidae	*Drosophila* sp.	Vinegar fly	ذبابه الدروسوفلا	*	S
	Muscidae	*Musca domestica* L	House fly	الذبابه المنزليه	**	S
Hymenoptera	Vespidae	*Vespa orientales*	Oriental hornet	دبور البلح الاحمر	*	S

Frequency = * = Rare, ** = Common, *** = Abundant Notes = P = Plant sampling, S = Sweeping

Table (2): Dominance and abundance degrees of the pests and the associated predators inhabiting canola plants, Malawi, El-Minia Governorate during 2016-2017 season,

Species	Dominance		Abundance (%)
	Mean No. / plant	(%)	
Pests			
B. tabaci	186	3.71	70.00
B. brassica	2004	39.97	90.00
Empoasca spp.	103	2.05	60.00
M. persicae	1835	36.59	85.00
N. viridula	23	0.46	70.00
T. tabaci	852	16.99	80.00
T. urticae	11	0.23	3.57
Total	5014	100.00	-----
Predators			
C. carnea	12	10.34	35.00
C. undecimpunctata	82	70.69	25.00
P. alferii	13	11.21	80.00
S. corolla	9	7.76	20.00
Total	116	100.00	-----

Table (3): Dominance and abundance degrees of the pests and the associated predators inhabiting canola plants, Malawi, El-Minia Governorate during 2017-2018 season,

Species	Dominance		Abundance (%)
	Mean No. / plant	(%)	
Pests			
B. tabaci	128	1.79	55.00
B. brassica	2544	35.68	80.00
***Empoasca* spp.**	348	4.88	75.00
M. persicae	2966	41.59	85.00
N. viridula	49	0.69	55.00
T. tabaci	1084	15.20	85.00
T. urticae	12	0.17	30.00
Total	7131	100.00	-------
Predators			
C. carnea	11	1.23	35.00
C. undecimpunctata	841	93.86	85.00
P. alferii	38	4.24	65.00
S. corolla	6	0.67	15.00
Total	896	100.00	------

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