Ecological Studies on Some Insect Pests Infesting Rosemary Plants and Their Associated Predators at Abo-Kabir District Sharkia Governorate

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ABSTRACT

The present studies were carried out to survey and evaluate the population densities of some insect pests infesting rosemary plants and their associated predators during the two successive seasons of 2013 and 2014 at Abo-Kabir district , Sharkia Governorate. The obtained results are summarized as follow : Seven insect species belonging to seven families and four orders were recorded as insect pests on rosemary plants. *Bemisia tabaci* (Genn.), *Aphis gossypii* Glover, *Empoasca decipiens* (Paoli) and *Thrips tabaci* Lind. were the most dominant species and recorded 53.95, 19.01, 13.08 and 8.14 % of the total insects numbers, respectively. *Bemesia tabaci* showed four peaks on 1st August , 22nd August , 19th September and 17th October in the first season and on 24th July , 21st August , 2nd October and 20th November in the second one. *A.gossypii* had two peaks on 1st August and 29th August in the first season and three peaks on 7th August , 4th September and 25th September in the second season .Temperature and relative humidity influenced *B.tabaci* populations by 4.4337 and 72.9724 % in the first and second seasons , respectively. Temperature and relative humidity affected *A. gossypii* population by 33.91 and 44.68 % during the two successive seasons , respectively .Five predaceous insect species belonging to five families and four orders were surveyed. *Paederus alfierii* (Koch), *Coccinella undecimpunctata* L. and *Chrysoperla carnea* (Steph.) were the most dominant species inhabiting rosemary plants and representing 52.12, 24.00 and 10.35% of the total number of predators, respectively.
Keywords : Rosemary , survey , insect pests , predators.

INTRODUCTION

Medicinal and aromatic plants occupied an important position in both Egypt and abroad, for their multiple uses. The demand for these plants is increasing continuously in many important fields e.g. medicinal cure, perfume production, soap and cosmetics, refreshing beverages and nutrition such as mint, sweet basil, rosemary, thyme and others. Also, they are used as spices such as, cumin, coriander, fennel fruits and in natural flavor and aroma additives in food industries, that in addition to its using as insecticides (Abou Zaid, 1988 and Rayad, 2002).

These plants are subjected to infesting with several insect pests species which may cause destructive effects and yield losses. Therefore, it is necessary and valuable to study such insect pests that cause economic damage in both quantity and quality of these products to try decreasing their hazards as possible. A number of investigators have surveyed the insects inhabiting different medicinal and aromatic plants (Hammad & Mohsen 2000, Afsah 2005, Banjo *et al.*, 2006, Abd El-Megid, 2007,Abd El-Moneim *et al.*,2011 and Bernal *et al.*,2012).

The present work was conducted to contribute a better knowledge about the following objectives:
1. Survey the insect pests infesting rosemary plants and their associated predators.
2. Seasonal abundance of the main insect pests and their predators in relation with prevailing temperature and relative humidity.

MATERIALS AND METHODS

Field experiments

The present investigation was carried out at Abo-Kabir district,Sharkia Governorate, Egypt, during 2013 and 2014 growing seasons to survey the insect pests infesting rosemary (*Rosmarinus officilanis* L) and their associated predators.

An area of about 500 m^2 was prepared and divided into three replicates (each about 150 m^2).Rosemary seedlings were transplanted on 10th April 2013.

The experimental area was designed according to a complete randomized block design .Normal agricultural practices were applied and no pesticidal treatments were used during the period of investigation. Sampling technique.

Two sampling techniques were used for surveying and counting inhabitant plants, i.e. direct plant sampling and use of insect sweep net method.

Plant samples

Weekly samples of 20 tillers/replicate were collected randomly from different levels of plant height and continued to the end of the experimental period .All the collected samples were kept in tightly closed paper bags and transferred to the laboratory where they were carefully examined by using a binocular microscope .The stages of each insect species associated with samples were counted and recorded. Unknown immature stages of the predators were reared individually till adult emergence according to Hammad and Mohsen (2000) and Afsah (2005).

Daily records of temperature and relative humidity during the period of the investigation were obtained from the Meteorological station in Abo-Kabir district, Sharkia Governorate. Values of simple correlation (r), partial regression (b) and coefficient of determination (C.D.) were calculated according to Snedecor and Cochran (1987).

Sweep net

An insect sweep net with a diameter of 30 cm and 70 cm in depth was used. Sweep was conducted weekly and each sample consisted of 20 double strokes. These samples were taken by walking diagonally across the

experimental area. Caught insect species were transferred to plastic sacs containing pieces of cotton saturated with ether for anesthetizing the collected insects. The plastic sacs were well tied by rubber bands and taken to the laboratory for counting, identification and recording according to Hassanein *et al*. (1995) and Abd El-Megid (2007).

RESULTS AND DISCUSSION

1. Survey and population densities of insect pests on rosemary plants.

Seven insect species belonging to seven families and four orders were recorded as indicated in Table (1). The main insect species were *Bemisia tabaci* (Genn.), *Aphis gossypii* Glover, *Empoasca decipiens* (Paoli) and *Thrips tabaci* Lind. *B. tabaci* was the most dominant species and comprised 52.59%, followed by *A. gossypii, E. decipiens* and *T. tabaci* with values of 19.30 , 13.26 and 8.45% of the total number of insect pests, respectively in the first season (2013). The same trends were found in the second season (2014), were the

relative densities of *B. tabaci* were 56.85 %, while *A. gossypii, E. decipiens* and *T. tabaci* recorded 18.41, 12.70, 7.47 %, respectively. Moreover direct counting proved to be the most effective method for the estimating of *B. tabaci*, *A. gossypii,* while sweep net was effective for collecting *E. decipiens* and *T. tabaci*. Different species were recorded on rosemary plants by Ismail (2001) who found that *Acrolytus insubricus* (Scop.), *Homorcoryphus nitidulus* (Scop.), *Galeatus scropticus* Saund, *Myzus persicae* Sulzer, *Cosmolyce baeticus* L. and *Tropinota Squalidae* (Scop.) were the most dominant species on rosemary plants . Also, Sharma *et al*.(2014) recorded *Nezara viridula* (Linn.), *Dysdersus Cingulatus* (Fabr.), *Helicoverpa armigera* and Drosich *mangiferae* (Green) as the main pests on rosemary plants in India, and Negasu *et al*. (2016) reported that cottony cushion scale *Icerya purchasi* Mackell was the major pest on rosemary plants with 25% infestation rate and they added that *I. purchasi* was widely distributed in most of the survey areas in Ethiopia.

Table 1.Total numbers of insect pests recorded on rosemary plants at Abo-Kabir district, Sharkia Governorate during 2013 and 2014 growing seasons.

| Insect species | 2013 | | | | 2014 | | | | General | |
	P.S.	S.N.	Total number	%	P.S.	S.N.	Total number	%	Total number	%
Bemisia tabaci (Genn.) (Homoptera: Aelyrodidae)	4298	1226	5524	52.59	2086	690	2776	56.85	8300	53.95
Aphis gossypii Glover(Homoptera:Aphididae)	1483	543	2026	19.30	510	389	899	18.41	2925	19.01
Empoasca decipiens (Paoli)(Homoptera: Cicadellidae)	146	1247	1393	13.26	72	548	620	12.70	2013	13.08
Thrips tabaci Lind.(Thysanoptera:Thripidae)	281	607	888	8.45	80	285	365	7.47	1253	8.14
Nezara viridula L.(Hemiptera:Pentatomidae)	11	471	482	4.59	0	147	147	3.01	629	4.09
Spodoptera littoralis (Boisd) (Lepidoptera: Noctuidae)	35	91	126	1.20	11	37	48	1.00	174	1.13
Vanessa cardui (Linn.) (Lepidoptera :Nymphalidae)	0	64	64	0.61	0	28	28	0.57	92	0.60
General Total	6254	4249	10503	100	2759	2124	4883	100	15386	100

P.S. = Plant sample   S.N. = Sweep net

2. Population density of the main insect pests on rosemary plants and their relationships with some climatic factors.

Bemisia tabaci (Genn.)

Data presented in Table (2) indicated that the initial infestation with *B. tabaci* took place on 20th June by three individuals/sample. The infestation increased gradually and reached its maximum on 1st August, 22nd August, 19th September and 17th October by 273, 464, 192 and 374 individuals/sample at mean temperature of 29.86, 28.43, 28.57 and 22.57 ⁰ C and 53.29, 54.00, 51.00 and 52.14 % R.H., in the first season. In the second season *B. tabaci* started to appear on rosemary plants on 26th June with four individuals/samples. The peaks were occurred on 24th July, 21st August, 2nd October and 20th November with numbers of 160, 97, 91 and 218 individuals/samples at means of 28.71, 29.43, 25.14 and 19.43 ᵒ C and 55.00, 54.86, 53.71 and 63.43 % R.H., consecutively. The mean number of *B. tabaci* in the first season (165.31 individuals/samples) was relatively higher as compared with that in the second one (80.23 individuals/samples). In general, the *B. tabaci* population was higher in the first season than that in the second one. Such findings are agreed with the

results of Ahmad (1990) and Hassanien *et al*. (1995), as they found that the highest population abundance of *B. tabaci* was recorded during August and September.

Statistical analysis of data compiled in Table (3) indicated that there were negative insignificant and significant correlations between the weekly number of *B.tabaci* and means of temperature in both seasons, whereas (r) values were -0.2672 and -0.8185* in the first and the second seasons, respectively .Relative humidity showed positive insignificant and significant effects, with (r) values of 0.2566 and 0.6113* in the two seasons respectively. Temperature and relative humidity influenced the whitefly population by 4.4337% in the first season and 72.9724% in the second one.

Aphis gossypii Glover

As shown in Table (4) it is cleared that rosemary plants were free from infestation with cotton aphid in the first month of inspection in both growing seasons .In the first season the initial incidence of *A. gossypii* occurred on 4th July with 13 individuals/samples. Afterwards, the insect population density fluctuated to show that two peaks of abundance .The first peak was on 1st August with 125 individuals/sample at means of 29.86 ᵒC and 53.29 % R.H. The second peak took place

on 29th August with 122 individuals/sample at 29.67 °C and 56.67 % R.H. In the second season the first appearance of the insect was on 3rd July with three individuals/sample. *A. gossypii* had three peaks on 7th August, 4th September and 25th September with 53, 42 and 31 individuals/sample at mean temperature of 29.71, 29.57 and 27.89 ° C and 50.14, 49.71 and 47.22%, respectively. The mean numbers of the cotton aphid were 57.04 and 19.62 individuals/samples during the two growing seasons, respectively .These results took the same trend with those of Abou- Elhagag (1983), Ahmad (1990) and Al-Shannaf (1994) who found that *A. gossypii* appeared on roselle plants from mid-June to early December with one to four peaks of activity. They added that the highest population density

of *A. gossypii* occurred in August, September and October.

The results tabulated in Table (5) obviously demonstrated that there were positive significant correlation between *A. gossypii* population and mean temperature in both seasons, whereas (r) values were 0.4458[*] and 0.5506[*], respectively. Relative humidity showed positive insignificant effects, with (r) values of 0.1708 in the first season and 0.0267 in the second one. Temperature and relative humidity affected *A. gossypii* population by 33.91 and 44.68 % in 2013 and 2014 growing seasons, respectively.

Table 2. Population density of *Bemisia tabaci* (Genn.) on rosemary plants by plant sample method during 2013 and 2014 growing seasons.

Sampling Date	No. of insects / sample	2013 Corresponding means of		Sampling Date	No. of insects / sample	2014 Corresponding means of	
		Temp. °C	R.H.%			Temp. °C	R.H.%
Jun.,6,2013	00	28.71	39.43	Jun.,5.2014	00	26.71	39.57
13	00	27.57	45.14	12	00	26.71	51.71
20	03	27.71	49.43	19	00	29.14	40.86
27	09	28.67	48.78	26	04	27.11	47.44
Jul.,4	24	27.14	58.57	Jul.,3	37	28.70	54.86
11	53	27.71	60.57	10	88	29.86	51.00
18	226	27.86	57.86	17	132	27.57	55.29
25	270	28.40	51.50	24	160	28.71	55.00
Aug.,1	273	29.86	53.29	31	158	30.00	49.67
8	230	28.71	54.14	Aug.,7	52	29.71	50.14
15	263	29.29	59.29	14	45	29.00	56.43
22	464	28.43	54.00	21	97	29.43	54.86
29	138	29.67	56.67	28	55	30.20	56.80
Sep.,5	142	28.00	59.71	Sep.,4	60	29.57	49.71
12	176	27.71	53.43	11	74	28.14	54.00
19	192	28.57	51.00	18	81	28.43	50.42
26	181	24.78	55.22	25	85	27.89	47.22
Oct.,3	150	23.57	50.29	Oct.,2	91	25.14	53.71
10	172	23.29	58.43	9	48	23.71	57.86
17	374	22.57	52.14	16	61	23.43	56.20
24	339	21.29	62.29	23	65	24.29	43.14
31	216	21.67	72.00	30	68	21.00	59.33
Nov.,7	175	22.29	65.43	Nov.,6	95	21.00	51.00
14	127	21.29	70.71	13	136	21.14	56.86
21	60	19.57	63.43	20	218	19.43	63.43
28	41	21.67	43.56	27	176	17.67	63.78
Total	4298			Total	2086		
Mean	165.31			Mean	80.23		

Table 3. Effect of weekly means of temperature and relative humidity on the population density of *Bemisia tabaci* (Genn.) on rosemary plants during 2013 and 2014 growing seasons.

Climatic factors	Simple correlation (r)		Partial regression (b)		Coefficient of determination	
	2013	2014	2013	2014	2013	2014
Mean Temp.	-0.2672	-0.8185[*]	-3.0585	-13.4691	0.6383	22.2868
Mean R.H.%	0.2566	0.6113[*]	1.4603	9.2700	0.8151	27.8156
Interaction Tempx R.H.					2.9803	22.8700
Total C.D.					4.4337	72.9724

* P> 0.05 significant

Table 4. Population denisty of *Aphis gossypii* Glover on rosemary plants by plant sample method during 2013 and 2014 growing seasons.

Sampling Date	No. of insects / sample	2013 Corresponding means of		Sampling Date	No. of insects / sample	2014 Corresponding means of	
		Temp. °C	R.H.%			Temp. °C	R.H.%
Jun.,6,2013	00	28.71	39.43	Jun.,5.2014	00	26.71	39.57
13	00	27.57	45.14	12	00	26.71	51.71
20	00	27.71	49.43	19	00	29.14	40.86
27	00	28.67	48.78	26	00	27.11	47.44
Jul.,4	13	27.14	58.57	Jul.,3	3	28.70	54.86
11	71	27.71	60.57	10	6	29.86	51.00
18	90	27.86	57.86	17	10	27.57	55.29
25	108	28.40	51.50	24	26	28.71	55.00
Aug.,1	125	29.86	53.29	31	49	30.00	49.67
8	104	28.71	54.14	Aug.,7	53	29.71	50.14
15	110	29.29	59.29	14	47	29.00	56.43
22	112	28.43	54.00	21	45	29.43	54.86
29	122	29.67	56.67	28	40	30.20	56.80
Sep.,5	75	28.00	59.71	Sep.,4	42	29.57	49.71
12	69	27.71	53.43	11	27	28.14	54.00
19	66	28.57	51.00	18	27	28.43	50.42
26	62	24.78	55.22	25	31	27.89	47.22
Oct.,3	60	23.57	50.29	Oct.,2	28	25.14	53.71
10	58	23.29	58.43	9	26	23.71	57.86
17	46	22.57	52.14	16	17	23.43	56.29
24	40	21.29	62.29	23	14	24.29	43.14
31	38	21.67	72.00	30	9	21.00	59.33
Nov.,7	35	22.29	65.43	Nov.,6	7	21.00	51.00
14	33	21.29	70.71	13	1	21.14	56.86
21	28	19.57	63.43	20	2	19.43	63.43
28	18	21.67	43.56	27	00	17.67	63.78
Total	1483			Total	510		
Mean	57.04			Mean	19.62		

Table 5. Effect of weekly means of temperature and relative humidity on the population density of *Aphis gossypii* Glover on rosemary plants during 2013 and 2014 growing seasons.

Climatic factors	Simple correlation (r)		Partial regression (b)		Coefficient of determination	
	2013	2014	2013	2014	2013	2014
Mean Temp.	0.4458[*]	0.5506[*]	-2.9675	2.1783	3.9928	28.5954
Mean R.H.%	0.1708	0.0267	-1.7122	-0.5637	7.4466	5.0469
Interaction Tempx R.H.					22.4704	11.0348
Total C.D.					33.91	44.68

* P> 0.05 significant

3.Survey and population densities of predatory insects.

Results summarized in Table (6) indicated that five predaceous species belonging to five families and four orders were recorded. The orders have been arranged descendingly according to their general relative densities as follows :Coleoptera (76.12%), Neuroptera (10.35%), Diptera (8.82%) and Hymenoptera (4.71%). Coleopterous species were *Paederus alfierii* (Koch) and *Coccinella undecimpunctata* L. while Neuroptera, Diptera and Hymenoptera were represented only by one species, viz. *Chrysoperla carnea* (Steph.), *Metasyrphus corollae* (Fabr.) and *Polistes gallicae* L., respectively.

P. alfierii was the most dominant species, accounting 52.12 % of the whole recorded predators . It was followed by *C. undecimpunctata* , *C. carnea, M.corollae* and *P. gallicae* , with values of 24.00, 10.35, 8.82 and 4.71 %, respectively. Moreover, sweep net technique proved to be the effective method for collecting adults of the all previously mentioned predators. These results are in agreement with those Ismail (2001) who reported that *C .carnea* and *P. gallicae* were the most important predaceous species on rosemary plants infested with insect pests.

Table 6. Survey and population densities of insect predators on rosemary plants at Abo-Kabir district, Sharkia Governorate during 2013 and 2014 growing seasons.

Order Family	Species	Recorded Stage	2013				2014				General	
			P.S.	S.N,	Total number	%	P.S.	S.N,	Total number	%	Total number	%
Coleoptera Staphylinidae	*Paederus alfierii* (Koch.)	A	50	265	315	54.78	17	111	128	46.55	443	52.12
Coccinellidae	*Coccinella undecimpunctata* L.	L&P&A	21	115	136	23.65	9	59	68	24.73	204	24.00
Total %											647	76.12
Neuroptera Chrysopidae	*Chrysoperla carnea* (Steph.)	E&L&A	12	40	52	9.04	5	31	36	13.09	88	10.35
Total %											88	10.35
Diptera Syrphidae	*Metasyrphus corollae* (Fabr.)	L&P&A	00	48	48	8.35	00	27	27	9.82	75	8.82
Total %											75	8.82
Hymenoptera Vespidae	*Polistes gallicae* L.	A	00	24	24	4.18	00	16	16	5.81	40	4.71
Total %											40	4.71
General Total			83	492	575	100.00	31	244	275	100.00	850	100.00

A=Adults   P=Pupae   L=Larvae   E=Eggs   N=Nymphs
P.S.=Plant sample   S.N.=Sweep net

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دراسات إيكولوجية على بعض الآفات الحشرية التى تصيب نباتات الروزمارى والمفترسات المرتبطة بها في منطقة أبوكبير ـ محافظة الشرقيه

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أجريت دراسات لحصر أهم الآفات الحشرية التي تصيب نباتات الروزماري و المفترسات الحشرية المصاحبه لها بمنطقة أبوكبير-محافظة الشرقيه خلال موسمي ٢٠١٣و٢٠١٤ ويمكن تلخيص النتائج المتحصل عليها علي الوجه التالي : ١- تم تسجيل سبعة أنواع حشريه تتبع سبع عائلات و أربع رتب كآفات حشريه علي نباتات الروزماري . كانت الذبابه البيضاء و من القطن و نطاط أوراق البطاطس و تربس البصل هي الأكثر سياده علي الروزماري ممثلة ٥٣,٩٥ , ١٩,٠١ , ١٣,٠٨ , ٨,١٤ % من الأعداد الكليه للآفات الحشريه المسجله, علي التوالي .٢- أظهر تعداد الذبابه البيضاءأربع ذروات للنشاط في ١ أغسطس , ٢٢ أغسطس , ١٩ سبتمبر , ١٧ أكتوبر في الموسم الأول للدراسه , وكذلك في الموسم الثاني أظهرت أربع ذروات في ٢٤ يوليو , ٢١ أغسطس , ٢ أكتوبر , ٢٠ نوفمبر . كان لمن القطن ذروتين للنشاط في ١ أغسطس , ٢٩ أغسطس في الموسم الأول وفي الموسم الثاني أظهرت الحشره ثلاث ذروات في ٧ أغسطس , ٤ سبتمبر , ٢٥ سبتمبر . ٣- أثرت الحرارة و الرطوبة النسبية علي تعدادات الذبابة البيضاء بنسبتي ٤,٤٣٣٧ , ٩٧٢٤ , ٧٢ % في الموسم الأول والثاني علي التوالي . وأثرت الحرارة والرطوبة النسبية علي تعدادات من القطن بنسبتي ٣٣,٩١ , ٤٤,٦٨ % خلال موسمي الدراسه، علي التوالي. ٤- تم حصر خمسة أنواع مفترسات حشريه تتبع خمس عائلات و أربع رتب علي نباتات الروزماري. ووجد أن الحشره الرواغه وحشرة أبي العيد ذو ١١ نقطه وحشرة أسد المن الأخضر هي أكثر الأنواع سيادة علي الروزماري بنسب ٥٢,١٢ , ٢٤,٠٠ , ١٠,٣٥ %, علي التوالي.