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Predatory Mite Fauna Associated with Some Agricultural Pests at Beheira Governorate, Egypt

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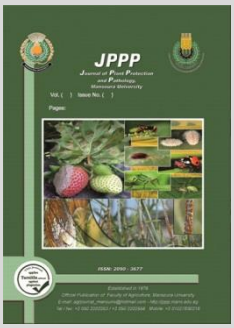

ABSTRACT

A study was conducted during 2021 and 2022 years to throw some light on the incidence of predatory mite fauna associated with some agricultural pests attacking seven host plants in Kom-Hammada District, Beheira Governorate (West Delta), Egypt. A total of thirteen mite species belonging to families Phytoseiidae, Cheyletidae, Stigmaeidae and Bdellidae were identified. They are listed along with their preys from phytophagous mites, insects and plant habitat in which they were collected. The most dominant collected species were the phytoseiids *Typhlodromips swirskii* Athias-Henriot; *Phytoseiulus persimilis* Athias-Henriot; *Euseius scutalis* Athias-Henriot and *Typhlodromus pyri* Prichard. The dominance of these mites were detected. They can be considered potentially useful in suppressing the associated prey mites and insects. The phytoseiid *Neoseiulus bakeri* Hughes; the stigmaeid *Agistemus exertus* Ganzoles and the cheyletid *Hemicheyletia bakeri* Ehara were less dominant implying that their impact on prey population is less important. The remaining collected mite species were rare.

Keywords: Acari, predatory mites, phytophagous mites, biological control.

INTRODUCTION

Attention has been focused in recent years on the possibility of using predaceous mites in the biological control of pests. The plant inhabiting predatory mites mostly belong to families Stigmaeidae, Cheyletidae and Phytoseiidae. The predatory mites in the family Phytoseiidae occupied the first rank in their dispertion and abundance, where they are useful in the biological and integrated control of some crop pests around the world (Sabelis, 1982). Several Egyptian investigations were carried out to evaluate some phytoseiid species as bio-agents, to introduce the most efficient species in an integrated programme system. (El-Badry, 1967; Gameel, 1971; El-Halawany & Kandeel, 1985; Donia *et al*., 1995; Momen and El-Borolossy, 1997; Zaher *et al*., 2001; Basha, 2001; Basha *et al*., 2002; Mostafa, 2004; El- Garhy, 2008**;** Awad *et al*., 2019; Waked, 2020 and Basha *et al*.,2021). This study was carried out to provide a database on the predatory mite fauna associated with some agricultural pests at Beheira Governorate (West Delta), Egypt, together with the faunal composition of predaceous species.

MATERIALS & METHODS

The present study was carried out at Kom-Hammada district, Beheira Governorate, Egypt during 2021and 2022 years to explore the diversity of predatory mite fauna associated with some agricultural pests attacking seven host plants *viz*. common bean, *Phaseolus vulgaris* (L.); grapevine, *Vitis vinifera* (L.); guava, *Pisidum guajava* (L.); lemon, *Citrus limon* (L.) Osbeck; mango, *Mangifera indica* (L.); mulberry, *Morus alba* (L.) and okra, *Abelmoschus esculentus*(L.) Moench.

A total of twenty live leaf samples (25 leaves each) were randomly taken from each of the investigated host plant throughout the period of study, placed separately in polyethylene bags, labeled and brought to the laboratory for further examination and extraction of mite.

In the laboratory, leaves were examined under a stereomicroscope. Collected mite individuals were counted and placed in lactophenole solution. Associated pests on each host plant were recorded. Predatory mite individuals were picked and mounted on glass slides in Hoyer's medium. The mounted specimens were kept in an oven at 40ºC for seven to ten days and dried specimens were then labelled and numbered serially for identification. The prepared permanent slides were identified under research microscope. Based on the taxonomic features identification of mite individuals were done up to species level using standard taxonomic keys (Summers and Price, 1970; Krantz, 1978; Zaher, 1986 and Chant and McMurtry, 1994). Identified predatory mite families were categorized using the criterion of percent frequency occurrence (Wallwork, 1970).

$$\%\text{Frequency occurrence (\% FO)} = \frac{\text{Number of samples containing a family}}{\text{Total number of collected samples}} \times 100$$

The collected mite species are classified as constant (C); accessory (A) or accidental (Ac) if they occurred in >50, 25-50 or < 25% of the total number of samples, respectively.

According to Palyvos *et al*., 2008 dominance indicates the percentage of individuals of a given taxon compared with the total number of individuals of all taxa found. Three categories are recognized for the dominance of mite species and classified as dominant (D), influent (In) or recdent (R) if they constitute > 10, 5-10 or < 5% of the total number of individuals, respectively.

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RESULTS AND DISCUSSION

Frequency occurrence of predatory mite families:

Members of the families Cheyletidae, Stigmaeidae, Phytoseiidae and Bdellidae proved to be the most wide spread predaceous mites on the investigated host plants as they were found in association with various agricultural pests. Percent frequency occurrence percent of these families found in this study was shown in Table (1). Phytoseiid species occupied the first rank in the present distribution and proved to be the most frequent predaceous mites as they surveyed on all of the studied host plants. This family was classified as Constant (C), where it gained the highest mean frequency occurrence value (70.28%). On the contrary the lowest mean frequency occurrence value (3.71%) was recorded with Bdellidae family, that showed limited occurrence and scored as accidental (AC). Moderate values of frequency occurrence were recorded with families Cheyletidae and Stigmaeidae averaging 26.18 and 36.00% of the total collected samples, respectively. No stigmaeids were observed on mango trees. Based on criterion percent of frequency occurrence percent these two families were classified as accessory (A).

Table1. Frequency occurrence percent of predatory mite families associated with some agricultural pests during 2021 and 2022.

Mite Family	Associated phytophagous mites/insects	Plant habitat	FO%
I. Order: Mesostigmata Canestrini 1- Phytoseiidae Berlese	*Tetranychus urticae, Bemisia tabaci, Thrips tabaci, Aphis gossypii*.	Common bean, *Phasoelus vulgaris* L.	72.00 C
	B. tabaci, Chrysomphalus aonidum, Aonidiella auranti, T. tabaci, Icerya aegyptiaca, T. urticae, Tenupalpus granati.	Grapevine, *Vitis vinifera* L.	68.00 C
	B. tabaci, C. aonidum, A. aurantii, T. tabaci, I. aegyptiaca, Brevipalpus obovatus, T. urticae.	Guava, *Pisidum guajava* L.	76.00 C
	I. aegyptiaca, C. aonidum, A. aurantii, Eutetranychus orientalis	Lemon, *Citrus limon* L.	56.00 C
	B. tabaci, C. aonidium, A. aurantii, I. aegyptiaca, T. tabaci, Oligonychus mangiferus.	Mango, *Mangifera indica* L.	64.00 C
	I. aegyptiaca, B. tabaci, T. urticae, T. tabaci	Mulberry, *Morus alba* L.	80.00 C
	B. tabaci, T. tabaci, A. gossypii, T. urticae, Empoasca sp.	Okra, *Abelmoschus esculentus* L.	76.00 C
Total collected samples			70.28 C
II. Order: Prostigmata Kramer 1- Cheyletidae Leach	*T. urticae, B. tabaci, T. tabaci , A. gossypii*.	Common bean, *P. vulgaris* L.	24.00AC
	B. tabaci, C. aonidum, A. aurantii, T. tabaci, I. aegyptiaca, T. urticae, T. granti	Grapevine, *V. vinifera* L.	36.00 A
	B. tabaci C. aonidum, A. aurantii, T. tabaci, I. aegyptiaca, B. obovatus, T. urticae.	Guava, *P. guajava* L.	32.00 A
	I. aegyptiaca, C. aonidum, A. aurantii, E. orientalis.	Lemon, *C. limon* L.	16.00 AC
	B. tabaci, C. aonidium, A. aurantii, I. aegyptiaca, T. tabaci, O. mangiferus.	Mango, *M. indica* L.	28.00 A
	I. aegyptiaca, A. tabaci, T. urticae, T. tabaci	Mulberry, *M. alba* L.	20.00 AC
	B. tabaci, T. tabaci, A. gossypii, T. urticae, Empoasca sp.	Okra, *A. esculentus* L.	28.00 A
Total collected samples			26.18 A
2- Bdellidae Duges	*T. urticae, B. tabaci, T. tabaci, A. gossypii*.	Common bean, *P. vulgaris* L.	00.00
	B. tabaci, C. aonidum, A. aurantci, T. tabaci, I. aegyptiaca, T. urticae, T. granti.	Grapevine, *V. vinifera* L.	00.00
	B. tabaci C. aonidum, A. aurantii, T. tabaci, I. aegyptiaca, B. obovatus, T. urticae.	Guava, *P. guajava* L.	12.00 AC
	I. aegyptiaca, C. aonidum, A. aurantii, E. orientalis.	Lemon, *C. limon* L.	00.00
	B. tabaci, C. aonidium, A. aurantii, I. aegyptiaca, T. tabaci, O. mangiferus.	Mango, *M. indica* L.	16.00 AC
	I. aegyptiaca, A. tabaci, T. urticae, T. tabaci	Mulberry, *M. alba* L.	00.00
	B. tabaci, T. tabaci , A. gossypii, T. urticae, Empoasca sp.	Okra, *A. esculentus* L.	00.00
Total collected sample			3.71 AC
3-Stigmaeidae Oudemans	*T. urticae, B. tabaci, T. tabaci , A. gossypii*	Common bean, *P. vulgaris* L.	44.00 A
	B. tabaci, C. aonidum, A. aurantci, T. tabaci, I. aegyptiaca, T. urticae, T. granti.	Grape vine, *V. vinifera* L.	48.00 A
	B. tabaci C. aonidum, A. aurantii, T. tabaci, I. aegyptiaca, B. obovatus, T. urticae.	Guava, *P. guajava* L.	44.00 A
	I. aegyptiaca, C. aonidum, A. aurantii, E. orientalis	Lemon, *C. limon* L.	28.00 A
	B. tabaci, C. aonidium, A. aurantii, I. aegyptiaca, T. tabaci, O. mangiferus.	Mango, *M. indica* L.	00.00
	I. aegyptiaca, A. tabaci, T. urticae, T. tabaci	Mulberry, *M. alba* L.	52.00 C
	B. tabaci, T. tabaci , A. gossypii, T. urticae, Empoasca sp.	Okra, *A. esculentus* L.	36.00 A
Total collected samples			36.00 A

Frequency of occurrence: Collect mite species are classified as constant (C); accessory (A) or accidental (Ac) if they occurred in >50, 25-50 or < 25% of the total number of samples, respectively.

Dominance of predatory mite species:

A total of thirteen species of predatory mites belonging to families Phytoseiide (9 species); Cheyletidae (2 species); Stigmaeidae (one species) and Bdellidae (one species) were surveyed.

Dominance of these mite species found in this study is shown in Table (2). Members of the family Phytoseiidae formed the majority of these predators, of which the phytoseiids *Typhlodromips swirskii* Athias-Henriot; *Phytoseiulus persimilis* Athias-Henriot; *Euseius scutalis* Athias-Henriot and *Typhlodromus pyri* Prichard appeared to be the most dominant predatory mite species. These species were classified as dominant (D) as they found with values of 22.69; 20.31; 13.58 and 12.09% of the total collected individuals, respectively. Each of the phytoseiid *Neoseiulus bakeri* Huges; stigmaeid *Agistemus exertus* Gonzales and the cheyletid *Hemicheyletia bakeri* Ehara were scored as influent (In) as they recorded in 6.86; 6.01 and 5.07% of the total collected individuals. As shown in Table (2), remaining species, the phytoseiids *Cydnoseius vitis* Mostafa; *Bawus talbii* Athias-Henriot; *Propriosiopsis sharkeinsis* Basha& Yousef; *Neoseiulella neovinifera* Basha & Mostafa; the cheyletid *Cheletogenes ornatus* (Canestrini & Fanzago) and the bdellid *Spinibdella bifurcata* Ateyeo were rare and classified as recdent (R).

The predaceous mite families most frequently in this study were Phytoseiidae followed by Stigmaeidae, Cheyletidae and Bdellidae. The most dominant species were the Phytoseiids *T. swirskii*; *P. persimilis*; *E. scutalis* and *T. pyri*. Field observations of the samples collected showed these predators to thrive on the associated prey species, *Bemisia tabaci*; *Chrysomphalus aonidum*; *Aonidella aurantii*; *Icerya aegyptiaca*; *Aphis gossypii*; *Thrips tabaci*; *Empoasca* sp.; *Tetranychus urticae*; *Eutetranychus orientalis*; *Oligonychus mangiferus*; *Tenuipalpus granati* and *Brevipalpus obovatus*. These predators were quite often on both vegetable crops and fruit trees indicating their wide spread as they found in several habitats onto which the predators could be found, this is a probable reason for their occurrence in the field throughout the year. A second group predators which were less often encountered than the species mentioned above, but also commonly found consisted of the phytoseiid *N. bakeri* and the stigmaeid *A. exertus*. The stigmaeid *A. exertus* was often found in the field thriving on the scale insects *A. aurantii*, *C. aunidum* and mealy bugs *I. aegyptiaca*. The remaining predators were only occasionally.

The total number of phytoseiid species so far reported from different plants in other studies carried out in Egypt is greater than those reported in this study (Hassan, 2000; Mostafa, 2004 and Basha *et al*., 2007).

Moreover, the present study showed that a rich predatory mite fauna occurs on the investigated host plants in association with various agricultural pests. The potential of some groups of predators found in this study especially phytoseiid species that have been found to play a significant role as natural enemies of some agricultural pests has been studied (Basha, 2001; Basha *et al*., 2002; Basha, 2005; Basha *et al*., 2006; Basha *et al*., 2008; El-Garhy, 2008; and Basha *et al*., 2021).

Table2. Dominance of predatory mite species on seven host plants in Beheira Governorate.

Mite species	Host plant							Dominance in the total collected individuals
	Common bean	Grapevine	Guava	lemon	Mango	Mulberry	Okra	
I. Family: Phytoseiidae								
1- *Bawus talbii* Athias-Henriot	00.00	3.57 R	7.41 In	0.00	9.09 In	2.30 R	00.00	3.20 R
2- *Cydnoseius vitis* Mostafa	00.00	10.71 D	3.70 R	5.88 In	00.00	3.45 R	1.96 R	3.67 R
3- *Euseius scutalis* Athias-Henriot	17.78 D	14.29 D	14.81 D	8.82 In	13.64 D	8.04 In	17.65 D	13.58 D
4- *Neoseiulella neovinifera* Basha & Mostafa	00.00	3.57 R	3.70 R	0.00	00.00	00.00	00.00	1.04 R
5- *Neoseiulus bakeri* Huges	8.89 In	00.00	7.41 In	8.82 In	00.00	9.19 In	13.73 D	6.86 In
6-*Phytoseiulus persimilis* Athias-Henriot	26.67 D	17.86 D	14.81 D	14.71 D	18.18 D	26.44 D	23.53 D	20.31 D
7- *Propriosiopsis sharkeinsis* Basha& Yousef	00.00	10.71 D	00.00	00.00	00.00	00.00	00.00	1.53 R
8- *Typhlodromips swirskii* Athias-Henriot	22.22 D	21.43 D	18.52 D	23.53 D	27.27 D	18.39 D	27.45 D	22.69 D
9- *Typhlodromus pyri* Prichard	11.11 D	07.14 In	7.41In	20.59 D	13.64 D	14.94 D	9.80 In	12.09 D
II. Family: Cheyletidae								
1- *Hemicheyletia bakeri* Ehara	4.44 R	3.57 R	11.11 D	11.76D	00.00	4.60 R	0.00	5.07 In
2- *Cheletogenes ornatus* Canestrini & Fanzago	00.00	00.00	00.00	00.00	9.09 In	5.75 In	0.00	2.12 R
III. Family: Bdellidae								
1-*Spinibdella bifurcate* Ateyeo	00.00	00.00	3.70 R	00.00	9.09 In	00.00	0.00	1.83 R
IV. Family: Stigmaidae								
1- *Agistimus exertus* Gonzales	8.89 In	7.14 In	7.41 In	5.88 In	00.00	6.90 In	5.88 In	6.01 In

Dominance: Mite species are classified as dominant (D), influent (In) or recdent (R) if they occurred > 10, 5-10 or < 5% of the total number of individuals.

CONCLUSION

The predators found in this work should be conserved so that they can exert natural suppression of phytophagous mites and small insects that are agricultural pests, minimizing the need for use of chemical pesticides. The phytoseiid fauna can be considered for implementation in future integrated pest management in Egypt.

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فونا الأكاروسات المفترسه المصاحبة لبعض الأفات الزراعية فى محافظة البحيرة بمصر

هند عبدالعزيز النشرتى

قسم وقاية النبات – كلية الزراعة – جامعة الزقازيق – الزقازيق - مصر

الملخص

أجريت هذه الدراسة خلال عامى ٢٠٢١ , ٢٠٢٢ لإلقاء بعض الضوء على تواجد فونا الأكاروسات المفترسة المصاحبة لبعض الأفات الزراعية التى تصيب سبعة من العوائل النباتية فى مركز كوم حمادة بمحافظة البحيرة (غرب الدلتا) بمصر, أسفرت الدراسة عن وجود ثلاثة عشر نوعا من الأكاروسات المفترسة تابعة للفصائل Phytoseiidae، Cheyletidae ، Stigmaeidae ، Bdellidae حيث وضعت قائمة لكل منها مع فرائسها من الأفات الزراعية و العائل النباتى الذى جمعت من عليه. كما أوضحت الدراسة أن أنواع الأكاروسات التابعة لفصيلة Phytoseiidae كانت الأكثر سيادة وانتشارا على تلك المحاصيل. وقد حققت أنواع الأكاروسات *Typhlodromips swiriski* ، *Phytoseiulus persimilis* ، *Euseius scutalis* ، *Typhlodromus pyri* المرتبة الأعلى بين الأنواع المفترسة الأخرى والتى قد يكون لها دور واضح فى قمع تعدادات فرائسها من الأكاروسات و الحشرات نباتية التغذية والحشرات مبشرة بدورها الواعد فى مجال المكافحة البيولوجية لبعض الأفات الزراعية تحت الظروف المصرية. كما أن الحلم *Neoseiulus bakeri* والحلم *Agistemus exertus* أقل سيادة مما يدل ضمنا على أن تأثيرهما على تعدادات فرائسها أقل أهمية بينما بقية الأنواع الأخرى التى جمعت كان تواجدها بصورة نادرة.

الكلمات الدالة: الأكاروسات , الأكاروسات المفترسة , الأكاروسات النباتية , المكافحة الحيوية.