

EVALUATION OF THE ROLE OF CERTAIN MORTALITY FACTORS OF *Coccinella undecimpunctata* L. (COLEOPTERA: COCCINELLIDAE) ON DIFFERENT CROPS AT KAFR EL-SHEIKH GOVERNORATE.

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ABSTRACT

The present study was carried out in both laboratory and the experimental field of Sakha Agricultural Research Station, Kafr El-Sheikh Governorate during two successive seasons (2008 and 2009) to evaluate the role of certain mortality factors in reducing the field populations of *Coccinella undecimpunctata* L. on different crops. The coccinellid predator was recorded to be parasitized by the two hymenopterous parasitoids, *Tetrastichus coccinellae* Kurdjumove (Eulophidae), and to be infected with bacteria *Bacillus* spp. and two species of fungi (*Penicillium* sp. and *Fusarium* sp.).

Overall crops during 2008, the highest percentage of the total population mortality was caused by parasitoids (49.88%) and the lowest by unknown mortality (2.24%), as well as the highest contribution in the total mortality was recorded by parasitoids and the lowest by unknown mortality. The mortality was caused by fungi came in the second rank (6.73%) and contributed to (10.71%) of total mortality. Mortality was caused by bacteria contributed with low percentage in the total mortality (6.35%). During 2009, on different crops, the highest percentage of the total population mortality was caused by parasitoids (48.27%) and the lowest by bacteria mortality (4.70%), as well as the highest contribution in the total mortality was recorded by parasitoids and the lowest by bacteria mortality. The mortality was caused by unknown came in the second rank (8.91%) and contributed to (12.90%) of total mortality. Mortality was caused by fungi came in the third rank and contributed with 10.39% in the total mortality.

Keywords: *Coccinella undecimpunctata*, mortality factors, parasitism, fungi, bacteria.

INTRODUCTION

Insect predators are widely distributed and considered as important natural enemies of pest insects in biological control and integrated pest management programs as they prey on a range of pests including aphids, scale insects, mealy bugs, spider mites and larvae of some species of Thysanoptera, Lepidoptera and Coleoptera (Ceryngier and Hodek, 1996). Coccinellids are one of the most important as biological control agent but they may be attacked by certain mortality factors which reduce their efficiency to a great extent. Among these, parasitoids, fungi, and bacteria. Coccinellids are attacked in all life stages by nearly 100 species of parasitoids, which primarily belong to the orders Hymenoptera and Diptera (Ceryngier and Hodek, 1996;

Riddick et al., 2009). Several species of the genus *Homalotylus* have been recorded as parasitoids of coccinellid larvae in the subfamilies Coccinellinae, Chilocorinae, and Scymninae (Ceryngier and Hodek, 1996). Many have wide host ranges and the percentage of parasitism can reach 90-95% within a population (Ceryngier and Hodek, 1996; Kenis et al., 2008). As well as pathogenic bacteria (Majerus et al., 1998), pathogenic fungi (Cottrell and Shapiro, 2003 and 2008; Roy et al., 2008). *Beauveria bassiana* (Balsamo) (Ascomycota: Hypocreales: Clavicipitaceae) is a generalist pathogen most often reported infecting phytophagous (Devi et al., 2008) and entomophagous coccinellids (Roy et al. 2008). A few reports indicate that phytophagous coccinellids are attacked by bacteria. Ping et al. (2008) reported that a WZ-9 strain of *Bacillus thuringiensis* Berliner was harmful to *Henosepilachna vigintioctomaculata* larvae but not adults. The objective of this study is to evaluate the role of certain mortality factors in reducing the populations of *C. undecimpunctata* occurring in clover, cucumber, okra and corn plantations.

MATERIALS AND METHODS

1. Sampling techniques:

1.1. Hand Collection:

At each sampling date, *C. undecimpunctata* individuals were randomly taken into glass tubes, especially from the higher parts of clover, cucumber, okra and corn plantations.

1.2. Sweep-net:

Adults of *C. undecimpunctata* were collected from the above mentioned crops using a sweep net in 50 double strokes was walking in diagonally. Collected predators were transferred to plastic bags; samples were transferred directly to the laboratory and separated.

2. Mortality factors of *Coccinella undecimpunctata*:

To study the percentage of parasitism, natural infection of fungi and bacteria and unknown mortality, random samples of predators (full grown larvae, pre- pupae and pupae) were taken weekly throughout summer season (duration of peak activity of predators) from fields with no insecticidal treatments. Samples were transferred directly to the laboratory and were housed separately in 9 cm diameter Petri dishes provided with filter paper in their bottoms, containing fresh leaves and fed on excess of aphids. Aphid prey was brushed of the plant leaves into the dish using a soft natural hair brush. Samples were kept under laboratory conditions until the emergence of predator adults, parasitoids or died by other mortality factors. The parasitoid species, fungi and bacteria were prepared for identification. The mortality percentages were calculated.

The parasitoids were identified at Entomology Laboratory at Rice Research and Training Center (RRTC), Sakha, Kafr El-Sheikh, Egypt. Fungi and bacteria species were identified by Microbiology Department, Faculty of Agriculture, Kafr El-Sheikh University.

RESULTS AND DISCUSSION

Efficiency of different mortality factors on *C. undecimpunctata* populations:

1. During 2008 season:

Specimens of parasitoid emerging from *C. undecimpunctata* were identified as *Tetrastichus coccinellae*. Whereas two species of fungi were (*Penicillium* sp. and *Fusarium* sp.) and three species of bacteria from genus *Bacillus*.

The average percentage of total parasitism, fungi mortality, bacteria mortality and unknown mortality and their percentage of contributions to the total population mortality of *C. undecimpunctata* on the different crops during 2008 are given in Table (1).

On clover:

The highest percentage of the total population mortality was caused by parasitoids (38.46%) and the lowest by unknown mortality (0.85%), as well as the highest contribution in the total mortality was recorded by parasitoids and the lowest by unknown mortality. The mortality was caused by bacteria came in the second rank (6.84%) contributing to (13.56%) of total mortality. Mortality was caused by fungi contributed with low percentage in the total mortality (8.46%).

On cucumber:

The highest percentage of the total mortality was caused by parasitoids (48.84%) and the lowest by unknown mortality (4.65%), as well as the highest contribution in the total mortality was recorded by parasitoids (57.54%) and the lowest by unknown mortality (5.48%). The mortality was caused by fungi came in the second rank (22.09%) contributing to (26.02%) of total mortality. Mortality was caused by bacteria contributed with low percentage in the total mortality (10.96%).

On okra:

The highest percentage of the total mortality was caused by parasitoids (43.58%) and the lowest by unknown mortality (5.13%), as well as the highest contribution in the total mortality was recorded by parasitoids (77.26%) and the lowest by unknown mortality (9.09%). The mortality was caused by fungi came in the second rank (7.69%) after that was caused by parasitoids and contributed with acceptable percentage (13.63%) in the total mortality. There was no mortality was caused by bacteria.

On corn:

There was no mortality was caused by any of bacteria or fungi. Whereas the highest percentage of the total mortality was caused by parasitoids (60.38%) and the lowest by unknown mortality (1.26%), as well as the highest contribution in the total mortality was recorded by parasitoids and the lowest by unknown mortality.

Overall crops during 2008, the highest percentage of the total population mortality was caused by parasitoids (49.88%) and the lowest by unknown mortality (2.24%), as well as the highest contribution in the total mortality was recorded by parasitoids and the lowest by unknown mortality.

The mortality was caused by fungi came in the second rank (6.73%) contributing to (10.71%) of total mortality. Mortality was caused by bacteria contributed with low percentage in the total mortality (6.35%).

Table (1): Mortality percentages by some factors and their contribution in the total population mortality of *C. undecimpunctata* on different crops during 2008 at Kafr El- sheikh region.

Crop	Mortality factor				Total population mortality
	Total Parasitism	Fungi	Bacteria	Unknown Mortality	
Clover					
Mortality %	38.46	4.27	6.84	0.85	50.43
Contribution %	76.26	8.46	13.56	1.69	100.00
Cucumber					
Mortality %	48.84	22.09	9.30	4.65	84.88
Contribution %	57.54	26.02	10.96	5.48	100.00
Okra					
Mortality %	43.58	7.69	0.00	5.13	56.41
Contribution %	77.26	13.63	0.00	9.09	100.00
Corn					
Mortality %	60.38	0.00	0.00	1.26	61.64
Contribution %	97.96	0.00	0.00	2.04	100.00
Overall					
Mortality %	49.88	6.73	3.99	2.24	62.84
Contribution %	79.38	10.71	6.35	3.56	100.00

2. During 2009 season:

The average percentage of total parasitism, fungi mortality, bacteria mortality and unknown mortality and their percentage of contributions to the total population mortality (T_M) of *C. undecimpunctata* on the different crops during 2009 are given in Table (2).

On clover:

The highest percentage of the total population mortality was caused by parasitoids (50.00%) and unknown mortality came in the second rank (19.12%) contributing to as well as the highest contribution in total population mortality was recorded by parasitoids (61.82%) and followed by unknown mortality (23.64%). The mortality was caused by bacteria and fungi had the same contribution with acceptable percentage in the total population mortality (7.27%).

On cucumber:

The highest percentage of the total population mortality was caused by parasitoids (34.86%) and the lowest by bacteria (10.09%), as well as the highest contribution in the total population mortality was recorded by parasitoids (43.67%) and the lowest by bacteria (12.64%). The mortality was caused by unknown mortality came in the second rank (18.35%) after that was caused by parasitoids. Mortality was caused by fungi was relatively low (16.51%) and contributed with acceptable percentage in the total population mortality (20.68%).

Table (2): Mortality percentages by some factors and their contribution in the total population mortality of *C. undecimpunctata* on different crops during 2009 at Kafr El- Sheikh region.

Crop	Mortality factor				
	Total Parasitism	Fungi	Bacteria	Unknown Mortality	Total population mortality
Clover					
Mortality %	50.00	5.88	5.88	19.12	80.88
Contribution %	61.82	7.27	7.27	23.64	100.00
Cucumber					
Mortality %	34.86	16.51	10.09	18.35	79.82
Contribution %	43.67	20.68	12.64	22.99	100.00
Okra					
Mortality %	32.74	6.09	5.19	3.89	50.65
Contribution %	64.64	12.02	10.25	7.68	100.00
Corn					
Mortality %	65.33	0.00	0.00	0.00	65.33
Contribution %	100.00	0.00	0.00	0.00	100.00
Overall					
Mortality %	48.27	7.18	4.70	8.91	69.06
Contribution %	69.89	10.39	6.81	12.90	100.00

On okra:

The highest percentage of the total population mortality was caused by parasitoids (32.74%) and the lowest by unknown mortality (3.89%), as well as the highest contribution in the total population mortality was recorded by parasitoids (64.64%) and the lowest by unknown mortality (7.68%). The mortality was caused by fungi came in the second rank (6.09%) after that was caused by parasitoids and contributed with acceptable percentage in the total population mortality (12.02%). Mortality was caused by bacteria contributed with relatively low percentage in the total population mortality (10.25%).

On corn:

The total population mortality was caused by parasitoids and there was no mortality was caused by any other mortality factors, as well as the whole contribution in the total population mortality was recorded only by parasitoids.

During 2009, overall crops, the highest percentage of the total population mortality was caused by parasitoids (48.27%) and the lowest by bacteria mortality (4.70%), as well as the highest contribution in the total mortality was recorded by parasitoids and the lowest by bacteria mortality. The mortality was caused by unknown came in the second rank (8.91%) contributing to (12.90%) of total mortality. Mortality was caused by fungi came in the third rank and contributed with 10.39% in the total mortality.

During the present study, the parasitoid, *T. coccinellae* contributed with the highest percentage in total population mortality amongst the different mortality factors. These results are in agreement with those of Ibrahim (1955) in Egypt, who reported that *T. coccinellae* seems to be well distributed on

populations of *C. undecimpunctata* at least in Delta. Hassanin and Hamed (1983) and Ragab (1995) concluded that the parasitoid, *T. coccinellae* seems to be one of the main factors that influence the efficiency of *C. undecimpunctata* in Egypt.

REFERENCES

- Ceryngier, P. and I. Hodek (1996). Enemies of the Coccinellidae. In: Hodek, I., Honk, A. (Eds.), *Ecology of Coccinellidae*. Kluwer Academic Publishers, Dordrecht, pp. 319–350.
- Cottrell, T. E. and D. I. Shapiro (2003). Susceptibility of a native and an exotic lady beetle (Coleoptera: Coccinellidae) to *Beauveria bassiana*. *Journal of Invertebrate Pathology*, 84: 137–144.
- Cottrell, T. E. and D. I. Shapiro (2008). Susceptibility of endemic and exotic North American ladybirds (Coleoptera: Coccinellidae) to endemic fungal entomopathogens. *European Journal of Entomology*, 105, 455–460.
- Devi, K. U. ; J. Padmavathi; C. Maheswara, R. U.; P. Khan A. A. and C. M. Murali (2008). A study of host specificity in the entomophagous fungus *Beauveria bassiana* (Hypocreales, Clavicipitaceae). *Biocontrol Science and Technology*, 18: 975–989.
- Hassanin, F. A. and A. R. Hamed (1983). Parasitoid of *Scymnus syriacus* Mars. and *Coccinella undecimpunctata* L. in Egypt (Coccinellidae, Coleoptera). *Proc. 5th Pest. Conf. Tanta Univ.*, (11): 347-350.
- Ibrahim, M. M. (1955). Studies on *Coccinella undecimpunctata aegyptiaca* Rche (Coleoptera, Coccinellidae) II. Biology and life-history. *Bull. Soc. Ent. Egypt*, 39: 395-423.
- Kenis, M.; H. E. Roy; R. Zindel and M. E. N. Majerus (2008). Current and potential management strategies against *Harmonia axyridis*. *BioControl*, 53, 235–252.
- Majerus, T. M. O.; M. E. N. Majerus; B. Knowles; J. Wheeler; D. Bertrand; V. N. Kuznetsov; H. Ueno and G. D. D. Hurst (1998). Extreme variation in the prevalence of inherited male killing microorganisms between three populations of *Harmonia axyridis* (Coleoptera: Coccinellidae). *Heredity*, 81: 683–691.
- Ping, S.; W. Q. Ying; H. Xian; L. X. Jun and W. Yong (2008). Identification of the cry gene in *Bacillus thuringiensis* strain WZ-9 and its toxicity against *Henosepilachna vigintioctomaculata*. *Chinese Journal of Agricultural Biotechnology*, 5: 245–250.
- Riddick, E.W.; T.E. Cottrell and K.A. Kidd (2009). Natural enemies of the Coccinellidae: Parasites, pathogens, and parasitoids. *Biological Control*, 51: 306–312.
- Ragab, M. E. (1995). Some ecological and biological aspects of *Tetrastichus coccinellae* Kurdjumov (Hymenoptera: Eulophidae), a parasitoid of some aphidophagous coccinellids in Egypt. *Proc. 1st International of pest control, Mansoura, Egypt, Vol I*: 35-42.

Roy, H. E.; P. M. J. Brown; P. Rothery; R. L. Ware and M. E. N. Majerus (2008). Interactions between the fungal pathogen *Beauveria bassiana* and three species of coccinellid: *Harmonia axyridis*, *Coccinella septempunctata* and *Adalia bipunctata*. *BioControl*, 53, 265–276.

تقييم دور بعض عوامل الموت للمفترس *L. Coccinella undecimpunctat* على محاصيل مختلفة في محافظة كفر الشيخ

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أجريت هذه التجربة في المزرعة البحثية بمحطة البحوث الزراعية بسخا محافظة كفر الشيخ في الفترة من ٢٠٠٨ وحتى عام ٢٠٠٩ بهدف دراسة تأثير بعض عوامل الموت في خفض تعداد مفترس أبو العيد ذو الأحدى عشرة نقطة .

وقد تم تسجيل الطفيل *Tetrastichus coccinellae* Kurdjumove ، على المفترس أبو العيد ذو الأحدى عشرة نقطة. كذلك أظهرت النتائج قابلية المفترس أبو العيد ذو الأحدى عشرة نقطة للإصابة بأنواع من بكتيريا من جنس *Bacillus* كذلك الاصابه بنوعين من الفطريات وهما (*Penicillium* sp. and *Fusarium* sp.)

أظهرت النتائج على المحاصيل الأربعة المدروسة (البرسيم ، الخيار ، الباميا والسزهر) أن أعلى نسبة موت للمفترس أبو العيد ذو الأحدى عشرة نقطة كان ٤٩,٨٨% في موسم ٢٠٠٨ بسبب الطفيليات يليها نسبة الموت الناتجة عن الاصابه بالفطر (٦,٧٣%) والبكتيريا (٣,٩٩%) وأخيراً نسبة الموت الناتجة عن عوامل غير معروفه (٢,٢٤%).

أما في موسم ٢٠٠٩ أظهرت النتائج على المحاصيل السابقة أن أعلى نسبة موت للمفترس أبو العيد ذو الأحدى عشرة نقطة كان ٤٨,٢٧% بسبب الطفيليات يليها نسبة الموت الناتجة عن عوامل غير معروفه (٨,٩١%) يليها نسبة الموت الناتجة الاصابه بالفطر (٧,١٨%) وأخيراً نسبة الموت الناتجة عن البكتيريا (٤,٧٠%).

قام بتحكيم البحث

كلية الزراعة - جامعة المنصورة
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