



Survey and population dynamic of spiders infesting faba bean, with emphasis on acaricide effect on biological aspects of the spider *Kochiura aulica* (Araneae: Theridiidae)

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Abstract:

Spiders are beneficial predators and ancient animals. They are abundant and widespread in all ecosystems and constitute one of the most important components of global biodiversity. They are voracious predators and combined with their high abundance, may play an important role in the reduction of different pests populations. Spiders are among the most abundant predators recorded in faba bean (*Vicia faba* Harz) in Beni-Suef Governorate. Field trials were conducted in Beni-Suef Governorate during 2017 and 2018 to survey and population dynamic of some families and species of the spiders. Results indicated that recorded predaceous spiders were identified in 6 families as follows: Uloboridae (orb-weavers), Theridiidae (mostly space web weavers), Salticidae (jumping spiders), Thomisidae, Philodromidae (crab spiders) and Cheiracanthiidae. The high percentage mortality appeared in different species spider treated with recommend of Wonder 36%SC resulted after 7 days from treatment averaged 32.8 and 38.7% mortality for *Thomisus spinifer*, 30 & 60% mortality of *Theridion melanostictum*, followed by *Theridion spinitarse* (26.6 & 39.7%) mortality for female and male, respectively compared with (0.0%) in control. The effect of acaricide on the biological aspects of *Kochiura aulica* (Koch) (Araneae: Theridiidae) was studied under laboratory condition. The first and 2nd instar spiderling females and males were high affected when treated with recommended compound, the both instars filled to complete the duration. Whereas, high significantly prolonged the duration of the 3rd, 4th and 5th spiderlings female than untreated. The compound increased the duration female by 16.3 days on contrast decreased the duration male by 5.7 days compared with control. Female resulted from treated 3rd instar spiderlings deposited 17.0 eggs/ sac, compared with 26.6 eggs/ sac in control. The hatching percentages were 65.0 %, when female resulted from treated, compared with 96.0 in control. The results also revealed that Wonder was the most effective acaricide on duration, fecundity and hatching.

Introduction

Spiders (Araneae) are considered one of the most important natural control agents in a wide range around the world. Members of this order are different in size small, medium or big size, they are usually found hanging upside down in an irregular web suspended on plants or hidden in rocks or fissures in soil. Many of them use the threads that often hard to notice unless they occasionally glitter in the sun light or covered with dust (EL-Erksousy, 2003 and EL-Erksousy *et al.*, 2006). The true spiders recorded associated with different agricultural pests. All adult spiders are predaceous and play very important role in the decreased of numbers pest pulsations (Greenstone, 1999; Riechert, 1999; Whitehouse and Lawrence, 2001 and Huseynov, 2007). However, individual spider species lack many of the characteristics suggested as necessary for a successful biological control agent (Murdoch *et al.*, 1985). The significance of spider assemblages for biological control of pests is largely unknown and spiders have been the subject of very few investigations (Bishop, 1978 and 1980 and Bishop and Blood, 1981).

Therefore, The aim of this work is to study the effect of the recommended compound on different instars spiderling and studies on biological aspects of the predaceous spider, *Kochiura aulica* under laboratory conditions.

Materials and methods

1. Survey of predator spiders on faba bean:

Survey and abundance of predator spiders were conducted during the period of October until April for two seasons (2017–2018) at Beni-Suef Governorate in Middel Egypt. Samples were collected from 25 plants in four groups of faba bean. Predaceous spider species were collected from one location of cultivated faba bean (*Vicia faba*) and found on different the ages of plant and associated with flower and fruits. Spiders

were collected by hand picking or/ and shaken for each sample the spiders after then brought to the laboratory for identification. Samples were conducted weekly during the surveying period. The surveyed spiders were kept in glass vials containing 75% ethyl alcohol and droplets of glycerin. Identification of the collected spiders was available for adults only Sallam (2002). Identification of adult females is depending on shape of eyes and epigynal plate of female or on the palp in case of male.

2. Effect of acaricide on biological aspects of the spider *Kochiura aulica* :

2.1. Spider as a predator reared for treatment:

Spiders of the family Theridiidae were obtained from field by means of hand picking with collected from plants. The spider adults identified in the laboratory. Adult females and males were confined together in a test tube (20 cm long and 0.5 cm in diameter) and closed with a cotton pad. The female was observed daily until laying the egg sac and immature emergence. Each spiderling was isolated separately in a test tube with a surplus number of prey individuals. Thirty predator individuals (spiderlings) from each instar were noticed spray by recommended the compound were estimated for each stage of *K. aulica* males and females.

2.2. Chemical used:

Common name: Wonder 36% SC

Trade name: Chlorfenapyr, 36% SC

Chemical name: -Bromo-2-(4-chlorophenyl)- 1 ethox methyl- 5- tryfluem ethyl – H- pyrrolc- 3- carbonitrile

Rate of application: 180 cm³/ 200 L

2.3. Preparation the pesticides used:

The preparation of Wonder 36% SC was tested against different immature stages of *K. aulica* spiderling. Recommend concentration for compound was prepared as follow: (750ppm).

2.4. Effect of Wonder 36% SC compound on different immature stages of spiderlings:

Three replicates from each instars of spiderling for the recommend concentration were used, each replicate contained 30 individual (one day old), for each instars, they were placed in a jars (1/4kg.) and sprayed by recommend the acaricide. Another three replicates (20 individual (one day old)) from each, were sprayed by water as a check. Treated were placed in a jars (1/4kg.) under the previous conditions. After 1 to 7 days of each treatment to determine the reduction percentages by using Henderson and Tilton equation (1955).

2.5. Biological aspects:

To estimate the effect of the tested preparations compound against the biological aspects of the 3rd instar spiderling males and females predaceous spider; after treated 3rd instar spiderling with recommend Wonder compound, *K. aulica* was studied as follows: percent of mortality, spiderlings duration (days), mating and longevity (from adult emergence to death in days) and resulted from treated the third instar spiderlings of the spider females and males. In addition to pre-oviposition (days), oviposition (days) , post-oviposition (days) periods, number of egg sac/female and total number of egg/sac of the spider females.

3. Statistical analysis:

One way Anova was calculated by using SAS statistical software (SAS Institute, 2003). In addition, LSD (Fisher's Significant Difference Test) was chosen to identify the significant difference within group.

Result and discussion

1. Survey of predator spiders infesting faba bean:

Data presented in Table (1) recorded the number of families

collected from faba bean in Beni- Suif Governorate throughout 2017 and 2018 seasons. Resulted recorded 6 families collected from leaves or different parts of plant of faba bean. The collected predaceous family (Arachnida : Araneae) spiders were identified as follows: Theridiidae (mostly space web weavers), Salticidae (jumping spiders), Philodromidae (crab spiders), Thomisidae, Uloboridae (orb-weavers) and Cheiracanthiidae. The obtained results as shown in Table (1) found that the spider families and species are nocturnal collected comb footed spiders, the total number family estimated by 6 families as followed: 3 individuals in family Theridiidae, (*Theridion spinitarse* O. Pickard-Cambridge, *Kochiura aulica* Koch and *Theridion melanostictum* O. Pickard-Cambridge; one individual in different families was collected, Uloboridae (*Uloborius* sp), Thomisidae (*Thomisus spinifer* Blackwall), Philodromidae (*Thanatus albini* Audouin), Miturgidae [*Chieracanthium inclusum* (Hentz)] and Salticidae (*Euophrys granulata* Denis) .

Data in Table (1) showed that the population of spider families was generally different throughout 2017 and 2018 seasons. The overall total of spider (3 in family Theridiidae) throughout two seasons were 118 and 440 individual on *Vicia faba*, respectively, recorded the high percentage of totally collected spider family (individuals adults or immature stages) while the lowest families were 4 and 5 individuals in Uloboridae and 7 and 10 individuals adults in Miturgidae families, respectively, during two seasons. The most abundant species was noticed for associated wit *E. granulata* (40 and 43) individuals, associated with leaves and flower faba bean in two location.

Table (1): List of collected families and species of spider associated with faba bean at Beni- Suif Governorate during 2017 and 2018 seasons.

Spider families /plant	Collected species	No. collected	
		2017	2018
Theridiidae	<i>Theridion spinitarse</i>	9	110
	<i>Kochiura aulica</i>	6	112
	<i>Theridion melanostictum</i>	12	111
Philodromidae	<i>Thanatus albini</i>	21	40
Thomisidae	<i>Thomisus spinifer</i>	16	12
Uloboridae	<i>Uloborus</i> sp.	4	5
Salticidae	<i>Euophrys granulate</i>	43	40
Cheiracanthiidae	<i>Cheiracanthium inclusum</i>	7	10
Total families= 6	Total species= 8	118	440

From these data can be concluded that the total number of spider species *T.spinitarse*, *K. aulica* and *T. melanostitctum* and families Philodromidae and Salticidae were collected from Beni- Suif Governorate is higher during 2018 than were collected during 2017 season, in the previous studies associated with leaves and flower. Evans (1985) collected 33 spider species from 12 families infesting soybean, while, Bishop (1978 and 1980) collected 25 species from ten families infesting cotton. A review of Australian literature recorded in cotton farming systems lists 41 species from 13 families (Johnson *et al.*, 2000)

2. Effect of recommended Wonder compound on mortality of different species:

Data represented in Table (2) showed that mortality different species of spider after treated from 1 to 7 days. The high percent of mortality recorded after 24hr in all families and species and

the most species' affected were *T. melanostictum*, *T. spimitarse* and *T. spinifer* the percent mortality estimated by 20 and 25; 20 and 30 and 20 and 25 % mortality (for two species) females and males, respectively, the high total percentage mortality appeared in different species spider resulted after 7 days estimated by 32.8 and 38.7% mortality for *T. spinifer*, 30 and 60 % mortality for female and male of *T. melanostictum* respectively, compared with (0.0%) no mortality rerecorded in control, followed by, *T. spinitarse* (26.6 and 39.7) mortality for female and male, respectively, compared with (0.0%) in control. On the other hand the low total percentage mortality recorded with *T. albini* 10 and 25% mortality for female and male, respectively, compared with (5 and 5 %) in control, and (10 and 20.8%) mortality for female and male, respectively, compared with (0.0 and 4%) in control.

Table (2): Effect of recommended woner compound on percent of mortality different species of adult stage.

Spider families /plant	Species of spider treated	% Mortality after								Total mortality	
		24h		48h		72h		7days			
		♀	♂	♀	♂	♀	♂	♀	♂	♀	♂
Theridiidae	<i>Theridion</i>	20	25	0	0	0	7	6	7	27	20
	<i>Kochiura aulica</i>	12	12	0	0	5	2	2	2	17	12
	<i>Theridion</i>	20	30	0	5	5	10	5	10	30	20
Control		-	-	-	-	-	-	0	0	0	0
Philodromidae	<i>Thamoty albini</i>	5	10	0	5	0	5	5	5	10	25
Control		-	-	-	-	-	-	5	5	5	5
Thomisidae	<i>Thomisus</i>	20	25	6.2	6.6	0	0	6.6	7.1	32.8	38.7
Control		-	-	-	-	-	-	-	-	-	-
Uloboridae	<i>Uloborius sp</i>	5	10	11	2	0	0	5.5	6.2	21.5	18.2
Control		-	-	-	-	2	-	5	2	7	2
Salticidae	<i>Eudphrys</i>	5	10	0	5	0	5	5	5	15	25
Control		-	-	-	-	-	-	5	5	5	5
Cheiracanthiidae	<i>Cheiracanthium</i>	5	10	0	5.8	0	0	5	5	10	20.8
Control		0	0	0	1	0	0	0	3	0	4

3. Effect of recommended compound on some biological aspects of *Kochiura aulica*:

Data in Table (3) recorded that the first and 2nd instar spiderling females and males high affected when treated with recommended compound, the percent mortality estimated by 95% for 1st instar spiderling and 88% for 2nd instar spiderling and don't completed the development, compared with 3% in control, on the contrary, when the 3rd, 4th and 5th spiderlings treated with recommended compound the percent mortality estimated by 69, 49 and 20% mortality, respectively, compare with 2, 0 and 3 % in control.

Table (3) showed that the spider females and males have five spiderlings stages. The third and fifth spiderlings were longer in their duration than other spiderlings in both females and males, it averaged 26.6 and 21.6 days/ female and

15.3 and 14.0 days/ male when third and fifth spiderlings treated with recommended compound, respectively, compared with 15.0 and 15.0 days/ female and 25.6 and 23.0 days/ male for third and fifth spiderlings, respectively, in control, followed by 4th spiderlings in both sexes, respectively. As tabulated, the treated different instars spiderlings had higher duration (from 11 to 12 days) in female compared with spiderlings control.

The duration of the spiderlings increased when exposed to the recommended compound than untreated as shown in Table (3) and when exposed the first and 2nd instars of both females and males spiderlings to compound, the duration of the spiderlings high affected and no completed the duration, all the first and 2nd spiderling dead because its small size.

Table (3): Treated of different immature stages of *Kochiura aulica* with recommended Wonder compound under laboratory condition.

Spiderling	Conc.	% Mortality Trated	% Mortality control	Duration			Duration		LSD
				Female treated	Female control	LSD	Male treated	Male control	
1 st	Recommend used 1620 ppm	95	3	---	15.6±0.9	---	---	13.3±0.5	--
2 nd		88	3	--	19.0±1.6	---	--	16.6±0.9	----
3 rd		69	2	26.6±1.2b	15.6±0.3a	0.549	25.3±0.9a	25.6±1.3a	ns
4 th		49	0	16.3±1.4b	10.0±0.1a	1.022	19.6±1.3	18.0±1.2	0.311
5 th		20	3	21.6±1.6b	15.3±0.4a	1.141	24.0±2.1	23.0±1.5	ns

The means with the same letters at the same row are not significantly different at 0.05%

3.1. Spiderling stage:

It is clear that the tested compound cussed high significantly prolonged the duration of the female stages spiderling than that of the untreated check. Table (4) revealed that the duration of 3rd, 4th and 5th spiderlings were 24.3, 13.1 and 19.7 days/ females resulted from treated 3rd spiderling, compared with 15.6, 10.0 and 15.3 days/ female untreated

respectively, while the duration decreased in male to 23.3, 15.6 and 22.0 days / male treated compared with 25.6, 18.0 and 23.0 days/ male in control and 23.3, 15.6, respectively Also, data in Table (4) recorded that the compound increased the duration female by 16.2 days on contrast decreased the duration male by – 5.7 days compared with control.

Table (4): Biological effect of Wonder on biological aspects after treated 3rd instars spiderling.

Spiderling	Conc.	% Mortality	Duration			Total immature	Increased in duration times
			3 rd	4 th	5 th		
3 rd treated	Recommend used 1620 ppm	Female	24.3±1.2b	13.1±1.3b	19.7±1.6b	57.1±1.6b	+16.2
		Male	23.3±0.9a	15.6±1.3	22.0±2.1	60.9±4.6	- 5.7
Female		15.6±0.3a	10.0±0.1a	15.3±0.4a	40.9±2.7	---	
Male		25.6±1.3a	18.0±1.2	23.0±1.5	66.6±3.5	---	
3 rd control							

The means with the same letters at the same column are not significantly different at 0.05%

3.2. Oviposition period:

Table (5) showed that high significant differences occurred between pre-oviposition, oviposition and post oviposition periods for *K. aulica* when treated and untreated, these periods averaged 20.0, 21.3 days for pre-oviposition, in treated and control, respectively, while, prolonged to 65.0 days/ female treated compared with 45 days/ female untreated, also, the post oviposition increased to 28.3 days when

adult female treated compared with 20.0 days in control. Compared with 45 days/ female untreated, also, the post oviposition increased to 28.3 days when adult female treated compared with 20.0 days in control.

3.3. Number of deposited eggs/female:

Data in Table (5) revealed that the number of deposited eggs/sac was affected by treatment. This average was higher for female untreated. Also, data analyses showed a highly significant

differences between the average number of deposited eggs, whereas, female deposited 17.0 eggs/ sac in treated, compared with 26.6 eggs/ sac in control, high significant differences occurred between eggs/sac hatchability percentages resulted when female treated and untreated., the hatching percentages were 65.0 %, when female resulted and fed on the above mentioned prey treated, compared with 96.0 in control. Edward (1958) recorded 112 eggs in a single egg/sac produced by *C. inclusum*, while,

Peck and Whitcomb (1970) reported the occurrence.

3.4. Adult longevity:

Table (5) illustrated that longevity of spider females result from treated was longer about (17.3 days) which estimated by 113.3 days/ female compared with females untreated which was 96.0 days. On contrast, the adult male longevity decreased to 21.6 days when male resulted from treated, its longevity, was decreased (by 9 days) in case of spider males treated male compared with 30.6 days/ male longevity in control.

Table (5): Effect of Wonder compound on fecundity and longevity of *Kochiura aulica*.

Adults spiderling period	Treated	Control	LSD at 5%
Pre-oviposition	20.0±1.2b	21.0±3.1a	0.25
Oviposition	65.0±5.6b	45.0±12.4a	2.476
Post-oviposition	28.3±3.2b	20.0±1.7a	1.026
Longevity female	113.3±11.7b	96.0±1.2a	2.114
Longevity male	21.6±2.5b	30.6±3.1a	2.681
No of sac/ female	2-3	3-5	Ns
No of egg/sac/ female	17.0±2.5a	26.6±1.9b	1.31

The means with the same letters at the same row are not significantly different at 0.05%

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