

## Effect of Sowing Date, Varietal Susceptibility and Egg-Parasitoid, *Trissolcus basalis* (Woll.) On the Population Size of *Nezara viridula* L. in Soybean Fields

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### ABSTRACT

This study aimed to evaluate the effect of sowing date, varietal susceptibility and egg-parasitoid *Trissolcus basalis* (Woll.) (Hymenoptera: Scelionidae) on the population size of *Nezara viridula* L. in soybean field at the Experimental Farm of Sakha Agricultural Research Station, Kafr El-Sheikh governorate during two growing seasons of soybean, *Glycine max* (L.); 2016 and 2017. Statistical analysis of data revealed that the early sown plants in the first season were more preferable to infestation by *N. viridula* and late sowing plants in the second season. The variety Giza 111 and Crawford appeared as susceptible (S), while Giza 35, Giza 21 and H30 appeared as low resistant (LR). The biggest peak of parasitism (88.19%) was recorded on 1<sup>st</sup> September Throughout 2016 season, while in 2017 season the highest peak (97.01%) was recorded on 24<sup>th</sup> July. Also, *T. basalis* was the only parasitoid emerged from eggs of *N. viridula*.

**Keywords:** *Nezara viridula*, Soybean, sowing date, varietal susceptibility, egg-parasitoid

### INTRODUCTION

The southern green stink bug, *Nezara viridula* L. (Hemiptera: Pentatomidae), is one of the economically important insect pest species. This insect is usually among the most serious pests associated with several crops (Todd 1981; Kogan and Turnipseed 1987). Soybean is susceptible to economic losses from stink bug feeding during the R3 (pods beginning to develop) to R6 (seeds fully formed) stages of development (Fehr *et al.* 1971; McPherson and McPherson 2000 and Nielson *et al.* 2011). Insecticides are most commonly used for stink bugs control, but other options for control are being explored, such as organic pesticides and biological control. With these methods, natural enemies are important in managing pest populations and reducing damage to the commodity. The egg parasitoid, *Trissolcus basalis* (Woll.) has proven effective against *N. viridula* in soybean (Mcpherson and Mcpherson 2000 and Ehler 2002). This work was designed to investigate the effect of sowing date, varietal susceptibility and egg-parasitoid, *T. basalis* on the population size of *N. viridula* in soybean fields.

### MATERIALS AND METHODS

The present work was conducted at the Experimental Farm of Sakha Agricultural Research Station, Kafr El-Sheikh governorate during two successive growing seasons of soybean, *Glycine max* (L.); 2016 and 2017. All soybean varieties used in this study were obtained from Food Legumes Research Section, Sakha Agric. Res. Station. All recommended cultural practices were followed till harvest without insecticide application. Sampling started four weeks after sowing date and continued weekly until harvest.

#### 1- Effect of sowing date on the population size of *Nezara viridula* L. adults and nymphs in soybean fields

To evaluate the effect of three sowing dates of soybean; 5<sup>th</sup> May, 15<sup>th</sup> May and 30<sup>th</sup> May on the population density of the green stink bug during two study seasons, an area of about 400m<sup>2</sup> was divided into four plots each of 100m<sup>2</sup>. Plots were sown with Giza 111 variety for the three considered sowing dates. Weekly sample of 20 plants was chosen at random from

the four plots (5 plants each) and the insect numbers (adults and nymphs) were directly counted in the field by naked eye and /or lens.

#### 2-Relative susceptibility of soybean varieties to *Nezara viridula* L.infestations under field conditions

Susceptibility of five soybean varieties; Crawford, Giza21, Giza111, Giza35 and Hybrid 30 was evaluated in the field during 2016 and 2017 seasons to infestation with the green stink bug. The experimental area was divided into 15 plots (5 varieties x 3 replicates) each of 42m<sup>2</sup>. The seeds were sown by mid-May in a complete randomized block design with three replicates for each variety. Weekly samples of 5 plants were taken at random from each plot. The numbers of the adults and nymphs of *N. viridula* were directly counted on the soybean plants in the field by naked eyes and / or lens. The classification of the susceptibility degree (SD) of each variety was determined according to the general mean (X) of the insects and the standard deviation (sd) was calculated according to Chiang and Talekar (1980). The variety that had mean number of insects more than X +2sd was considered highly susceptible (HS); between X and X +2sd susceptible(S); between X -1sd and X low resistant (LR); between X -2sd and X -1sd moderately resistant (MR) and less than X -2sd was highly resistant (HR).

#### 3- Parasitism of *Nezara viridula* L. egg-masses by the egg parasitoid, *Trissolcus basalis* (Woll.) in soybean fields

The goal of the experiment was to evaluate the role of the egg parasitoid, *T. basalis* in suppressing population of green bug, *N. viridula* insect under natural infestation conditions. The experimental area (400m<sup>2</sup>) was divided into three plots, each of 120m<sup>2</sup>. Plots were planted with Giza 111 soybean variety by the first week of May during the two seasons of study.

Egg-masses of *N. viridula* were collected weekly from soybean fields during the two study seasons of 2016 and 2017. Egg-masses were kept under laboratory conditions of 27 + 1Co and 70 + 3% R H. Egg masses were kept in petri dishes provided with pieces of moistened cotton wool till hatching. The emerged parasitoids were identified at the laboratory of Biological Control Research Department of plant protection Institutes, Dokki, Egypt. The numbers of

eggs per mass, parasitized eggs and emerged parasitoids were counted and recorded.

## RESULTS AND DISCUSSION

### 1-Effect of sowing date on the population size of *Nezara viridula* L. adults and nymphs in soybean fields

In the first season of 2016, data summarized in Table (1) cleared that *N. viridula* population was firstly existed on June 9<sup>th</sup>, June 30<sup>th</sup> and July 7<sup>th</sup> for the first, second and third sowing dates, respectively. The population of *N. viridula* increased gradually recording the highest number by 12.0, 9.8 and 10.5 insects / 5 plants on September 1<sup>st</sup>, 22<sup>nd</sup> and August 25<sup>th</sup> for the

first, second and third date, respectively. In the second season (2017), data cleared that *N. viridula* started to infest soybean plants of the three sowing dates in the third week of June (19<sup>th</sup> of June). The population of *N. viridula* increased gradually forming the highest number on 21<sup>st</sup> August, 4<sup>th</sup> September and 4<sup>th</sup> September with means of 12.3, 11.3 and 12.5 insects / 5 plants for the first, second and third date, respectively. After that, the insect population decreased till completely disappeared at the end of the season. Statistical analysis revealed that the early sown plants in the first season were more preferable to infestation by *N. viridula* and late sowing plants in the second season.

**Table 1. Mean number of *Nezara viridula* L. (adults and nymphs) / 5 soybean plants at three sowing dates during two successive seasons; 2016 and 2017 at Kafr El-Sheikh Governorate.**

Sampling date	Sowing date in season of 2016			Sampling date	Sowing date in season of 2017		
	5 <sup>th</sup> May	15 <sup>th</sup> May	30 <sup>th</sup> May		5 <sup>th</sup> May	15 <sup>th</sup> May	30 <sup>th</sup> May
Jun. 9	0.5	0.0	0.0	Jun.5	0.0	0.0	0.0
16	0.8	0.0	0.0	12	0.0	0.0	0.0
23	0.8	0.0	0.0	19	1.5	3.8	0.5
30	2.8	1.5	0.0	26	2.0	1.0	0.8
Jul. 7	1.0	1.3	0.3	Jul.3	8.0	1.5	1.0
14	4.0	1.5	0.0	10	5.5	0.5	1.3
21	3.3	2.0	0.0	17	3.0	3.3	2.5
28	7.3	3.8	0.0	24	2.8	10.0	4.8
Aug.4	4.3	4.0	1.0	31	9.3	10.0	8.3
11	3.0	2.3	0.5	Aug.7	11.5	9.8	9.5
18	0.8	2.8	6.5	14	10.5	10.8	9.3
25	6.8	5.5	10.5	21	12.3	11.0	10.8
Sept.1	12.0	5.5	6.8	28	11.8	11.0	10.0
08	6.3	5.8	7.0	Sept. 4	9.5	11.3	12.5
15	3.3	7.3	5.0	11	4.0	8.8	12.3
22	1.5	9.8	4.0	18	2.8	6.0	12.0
29	0.0	1.3	1.3	25	0.0	3.5	7.3
Oct. 6	0.0	0.0	0.5	Oct. 2	0.0	0.0	3.3
Mean ±SE*	3.6 ± 0.18 a	3.4 ± 0.26 ab	2.7 ± 0.10 b	Mean ±SE*	5.9 ± 0.08 b	6.4 ± 0.04 a	6.6 ± 0.15 a

For every season, means followed by the same letter are not significantly different at 5% by Duncan's multiple range tests. SE\*= Stander error

Gore *et al.* (2006) found that the earliest planting date of soybean had the lowest densities of stink bugs, whereas the latest planting date had the highest densities of stink bugs. Also, Omoloye *et al.* (2015) found that the population of *N. viridula* was significantly higher at the late planting date of soybean.

### 2- Relative susceptibility of soybean varieties to *Nezara viridula* L. infestation under field conditions

The results shown in Table (2) clear the seasonal mean and resistance status of soybean varieties to *N. viridula* infestation during 2016 and 2017 seasons. Generally, it was apparent that the population density of *N. viridula* was higher in the second season than in the first one. Statistical analysis showed significant differences among soybean varieties to *N. viridula* infestation during the two study seasons. In the first season, the variety Giza 111 and Crawford harbored the highest numbers of the insects, being 3.8 and 3.5 nymphs and adults / 5 plants, respectively, while Giza 35 exhibited the lowest mean number (1.7 insects). The

rest varieties received moderate population without significant differences. During the second season also, Crawford and Giza 111 harbored the highest numbers being 6.3 and 6.2 insects / 5 plants, while H30 exhibited the lowest number (5.4 insects). Based on the general mean of both seasons, the variety Giza 111 and Crawford harbored the highest numbers of insects (5.0 and 4.9), while the other varieties exhibited low number without significant differences among them, as the mean number varied from 3.6 to 3.9 insects. According to the susceptibility degree, the tested varieties could be classified into two groups. The variety Giza 111 and Crawford appeared as susceptible (S), while Giza 35, Giza 21 and H30 appeared as low resistant (LR).

These results agree with those of, Mohamed (2004), who showed that Giza 21 was less susceptible to infestation with *N. viridula* in 2001 and 2002 seasons. Also, the current results are similar to those of Khattab *et al.*, (2012) who evaluated Crawford and Giza 111 as susceptible to *N. viridula*.

**Table 2. Seasonal mean numbers of *Nezara viridula* L. and resistance status of soybean varieties during 2016 and 2017 season at Kafr El-Sheikh Governorate.**

Variety	Season 2016	Season 2017	General mean	Resistance status
Giza 111	3.8 a	6.2 a	5.0 a	S
Giza 35	1.7 b	5.9 b	3.8 ab	LR
Giza 21	2.0 b	5.8 b	3.9 ab	LR
Crawford	3.5 a	6.3 a	4.9 a	S
Hybrid 30	1.8 b	5.4 c	3.6 b	LR

In each column, means followed by the same letter are not significantly different by Duncan's multiple range tests at 5%.  
S = susceptible, LR = low resistant

**3-Parasitism of *Nezara viridula* L. eggs by the egg-parasitoid, *Trissolcus basalis* (Woll.) in soybean fields**

Data presented in Table (3) show that parasitism of *N. viridula* eggs, in 2016 season, was firstly recorded by 30<sup>th</sup> June, being 22.54%. In July, the parasitism increased ranging between 29.47 and 56.96%, with a monthly average of 44.32%. The monthly averages of parasitism were 50.79 and 77.12% in August and September, respectively. Throughout 2016 season, the first peak of parasitism (56.96%) was recorded on 14<sup>th</sup>

July, followed by second one (82.27%) on 11<sup>th</sup> August, while the biggest peak (88.19%) was recorded on 1<sup>st</sup> September. In 2017 season, parasitism was firstly recorded on 26<sup>th</sup> June with 36.29%, and increased progressively to exhibit the highest peak (97.01%) on 24<sup>th</sup> July. Monthly averages of *N. viridula* parasitism were lowest in June (9.07%), and highest (83.40%) in September.

These results are in agreement with those of Colazza and Bin (1995) in Italy, who reported that *T. basalis* was the only egg parasitoid attacking *N. viridula* egg masses in soybean fields causing 20-50% parasitism. Also, Jones *et al.* (1996) reported that all emerging parasitoids from egg masses of green stink bug in soybean fields were *T. basalis*, and the parasitism of eggs ranged from 0% during July to 11.1% in August, 1975 and reached 50% during August 1976. Shepard *et al.* (1994) mentioned that the percentage of *N. viridula* eggs in the field was variable among years and crops. Also, Kalafalla *et al.* (2005) reported that the highest rate of parasitism of *N. viridula* eggs by *T. meyallocephalus* was recorded during July and August for the three seasons and this was synchronized with the increase of temperature at these months.

**Table 3. Parasitism of *Nezara viridula* L. eggs by the egg-parasitoid, *Trissolcus basalis* (Woll.) in soybean fields during 2016 and 2017 seasons.**

Sampling date	2016 season			Sampling date	2017 season		
	No. of <i>N. viridula</i> eggs	No. of emerging parasitoid	% parasitism		No. of <i>N. viridula</i> eggs	No. of emerging parasitoid	% parasitism
Jun. 9	0	0	0.0	Jun. 5	0	0	0.0
16	0	0	0.0	12	0	0	0.0
23	0	0	0.0	19	108	0	0.0
30	173	39	22.54	26	124	45	36.29
Monthly average parasitism			5.64				9.07
Jul. 7	236	88	37.29	Jul. 3	219	64	29.22
14	230	131	56.96	10	236	96	40.68
21	190	56	29.47	17	296	264	89.19
28	224	120	53.57	42	201	195	97.01
				31	275	250	90.91
Monthly average parasitism			44.32				69.40
Aug. 4	263	216	82.13	Aug. 7	244	72	29.51
11	220	181	82.27	14	271	114	42.07
18	308	49	15.91	21	209	103	49.28
25	302	69	22.85	28	302	267	88.41
Monthly average parasitism			50.79				52.32
Sept. 1	288	254	88.19	Sept. 4	280	214	76.43
8	256	162	63.28	11	309	273	88.35
15	216	182	84.26	18	240	240	85.41
22	242	176	72.73				
Monthly average parasitism			77.12				83.40

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تأثير ميعاد الزراعة، حساسية الأصناف وطفيل البيض ترايسولكس باسلس على تعداد البقعة الخضراء في حقول فول الصويا

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أجريت هذه الدراسة لتقييم تأثير ميعاد الزراعة، حساسية الأصناف وطفيل البيض ترايسولكس باسلس على تعداد البقعة الخضراء في حقول فول الصويا في المزرعة البحثية بمحطة سخا للبحوث الزراعية بمحافظة كفر الشيخ خلال موسمين متتاليين لفول الصويا ( ٢٠١٦/٢٠١٧ ). أوضحت نتائج التحليل الإحصائي أن نباتات الميعاد المبكر في الموسم الأول وكذلك نباتات الميعاد المتأخر في الموسم الثانى كانت هى المفضلة للإصابة بالبقة الخضراء. أظهر الصنفان جيزة ١١١ و كراوفورد درجة حساسية للإصابة (S) ، في حين أن الأصناف جيزة ٣٥ و جيزة ٢١ و هجين ٣٠ أظهر مقاومة منخفضة (LR). سجلت أكبر ذروة للتطفل على بيض البقعة الخضراء (٨٨.١٩٪) في ١ سبتمبر خلال موسم ٢٠١٦ ، بينما في موسم ٢٠١٧ سجلت أعلى ذروة (٩٧.٠١٪) في ٢٤ يوليو.. وكان طفيل ترايسولكس باسلس هو الطفيل الوحيد الخارج من كتل بيض البقعة الخضراء المتطفل عليها.