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Dispersal of the Egg Parasitoid *Trissolcus basalis* (Wollaston) (Hymenoptera: Scelionidae) on Eggs of the Southern Green Stink Bug *Nezara viridula* L. In Sweet Potato Fields

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Abstract: An experiment was conducted in Dakahlia governorate on sweet potato field during 2020 to study the dispersal of *Trissolcus basalis* (Wollaston), an egg parasitoid of the southern green stink bug *Nezara viridula* (L.). Dispersal was determined by placing stink bug egg masses in potato field, releasing *T. basalis* at the center of the field then collecting the egg masses and holding them to determine the percentage of parasitized eggs, successful parasitism and sex ratio. *Trissolcus basalis* located egg masses with no preference for direction or distance from the release point. Release of about 400 individuals of *T. basalis* adults in 50×50 m in the field at the first release meanwhile, release of about 600 individuals of *T. basalis* in the second release. The percentage of parasitized eggs to the all egg masses in each direction were 70, 65.6, 80.3 and 59.3% in the east, west, north and south directions after the first release, respectively. Average parasitism by *T. basalis* of southern green stink bug egg masses in all directions ranged from 87 to 91.2% after the second release. Almost eggs in each mass were parasitized at different distances from the central release point within a sweet potato field. There were significant differences between percentage of parasitized eggs and successful parasitism at the different distances after the first release. Meanwhile, no significant differences in percentage of parasitized eggs and successful parasitism at the different distances accept in sites away 20m from the central release point were detected after the second release. In conclusion, it can be release *T. basalise* by any density because of the high efficiency of this parasitoid in locating southern green stink bug egg masses.

Key words: *Trissolcus basalis* · *Nezara viridula* L. · Dispersal · Sweet potato · *Ipomoea batates*

INTRODUCTION

Trissolcus basalis (Wollaston) is the most important natural enemy of *N. viridula* eggs, as it plays an important role in the regulation of the insect pest population. However, egg parasitism of *N. viridula* is the most effective mortality factor in most affected regions of the world [1-10]. It is well established and adapted in Egypt and is credited with the control of *N. viridula*. Releases of the egg parasitoid, *T. basalis* have successfully suppressed outbreaks of the green stinkbug [4, 11]. Also several introductions of *T. basalis* have been made in hotspot locations in Austrulia and in other countries to Control southern green stink bug [12-13].

Trissolcus basalis is considered to be an effective biocontrol agent in New Zealand, Australia, and the United States, all places where it was deliberately introduced [14]. In 1949 *T. basalis* was released in New Zealand in an effort to control damage caused to crops including sweet corn and green beans by *N. viridula* [15]. However, within field spread of this parasitoid has not been studied, and the number of *T. basalis* necessary to control the southern green stink bug populations has largely been postulated through post release surveys of *T. basalis* parasitism [16].

Therefore, this study was conducted to obtain information on how *T. basalis* disperses within sweet potato (*Ipomoea batates*) fields after release from a central point. In addition, to evaluate the need number of *T. basalis* to provide the southern green stink bug control.

MATERIALS AND METHODS

Host Cultures: Pairs of *N. viridula* adults were collected by sweep net from sweet potato fields at Al-Baranouf basin, Barq Al-Ezz village Dakahlia governorate and caged in 30 plastic containers for each plant (15 cm x 30 cm)

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covered with muslin for ventilation. Adults were fed with sweet potato leaves. Food was changed daily. Egg masses were collected daily to prevent cannibalism by adults.

Parasitoid Culture: *Trissolcus basalis* was cultured in the laboratory from *N. viridula* parasitized egg masses which collected from farm of Faculty of Agriculture, Mansoura University. Parasitoids were maintained in Petri-dishes supplied with sugar solution for food. The culture was kept at 28±2.0°C and 75.0±5.0 relative humidity with 14 hours light: 10 hours dark photoperiod. The host egg masses were exposed to the parasitoid for 24 h, then removed and placed in another Petri-dish for incubation. After the adult emergence, they were counted and sexed. The remaining eggs were dissected and eggs which perceptibly mature or immature forms of the parasitoid were identified and considered to be parasitized. Percentage of parasitized eggs and successful parasitism were calculated.

Experiment Protocol: Two sequence releases were conducted to study the within-field dispersal of *T. basalis* in sweet potato. One month old sweet potato plants were used, and no insecticides were applied. Dispersal was determined by placing the southern green stink bug egg masses in sweet potato fields on five different dimensions from the release point in four directions (east, west, north and south), the distance between each dimension and the other was 4m. Releasing *T. basalis* at the center of field, and collecting the egg masses for holding in the laboratory to determine parasitism. Egg masses obtained from colony-reared stink bugs were stored at 4°C until ready for use. Egg masses with 60 in the first experiment and 100 or more eggs in the second experiment were glued (Elmeris Glue-All) to small rectangular strips of cardboard. Empty egg Cholions were excluded from the counts. One week prior to *T. basalis* release, a survey was made using the sweep net to find out whether the parasitoid was present in the field where the experiment was located or not after making sure that there was no density of the parasite in the field of experiment. Egg masses were placed in field by stapling cardboard strips with egg masses to the undersides of sweet potato leaves. After 1 wk, egg masses were collected, and each was placed into individual labeled test cages and covered with line nylon mesh. The egg masses were held inside a rearing incubation 28±2.0°C and 75.0±5.0 relative humidity with 14 hours light: 10 hours dark photoperiod to allow parasitoids to emergence.

Data Analysis: Data were analyzed using analysis of variance (ANOVA) and means were separated using Duncan's Multiple Range Test [17].

RESULTS AND DISCUSSION

Effect of Sequence Release of *T. basalise* on *N. viridula* Egg Masses: After release of *T. basalise* from the release point about 400 and 600 adult females were available to disperse and find egg masses in the first and second release. Out of 60 egg masses were placed in each dimension after the first release of *T.basalise*. Meanwhile, out of 100 egg masses were placed in the second release. The percentage of parasitized eggs to the all egg masses in each direction were 70, 65.6, 80.3 and 59.3% in the east, west, north and south directions after the first release, respectively (Table 1). Average percentage of parasitism caused by *T. basalis* of southern green stink bug egg masses in all directions ranged from 87 to 91.2% after the second release (Fig. 1). The date in the same Table also indicated that the percentage of parasitized eggs in each direction were higher after the second release than the first release. There was no significant difference ($P < 0.05$) between percentage parasitism in any direction except along the south were parasitism dropped to 87 % after the second release. The highest parasitism for the parasite was found in the north direction.

The incidence of parasitism at different intervals away from the release site is shown in Fig. 2. There was some indication that parasitism was increased at 4m and 12 m meanwhile, it declining (86.5 and74.75%) at 16 and 20 m away from the second release site, respectively. This figure also indicated that almost eggs in each mass were parasitized at different distances from the central release point within a sweet potato field. This observation is similar to the findings of Justo, *et al.* [11] who reported that there was some indication that parasitism was declining (65%) at 16 m away from the release site.

The Percentage of Parasitized Eggs, Successful Parasitism and Sex Ratio: Data presented in Table (2) assured significant differences between percentage of parasitized eggs and successful parasitism at the different distances after the first release. Meanwhile, no significant differences in percentage of parasitized eggs and successful parasitism at the different distances accept in sites away 20m from the central release point were detected after the second release. The female sex ratio was 3:1 (females: males) to the parasites egg masses in all distances. There were no significant differences between

Table 1: Parasitism on egg masses of the southern green stink bug *N. viridula* placed with sweet potato field after release of *T. basalis* in different direction at Dakahlia governorate

			Total egg masses parasitized in different directions							
			East		West		North		South	
Sequence of release	*T. basalis* released (no)	Egg masses exposed	No.	%	No	%	No	%	No	%
The first	400	300	210[b]	70	197[c]	65.6	241[a]	80.3	178[d]	59.3
The second	600	500	455[a]	91	446[a]	89.2	456[a]	91.2	435[a]	87

Means followed by the same letter in a row between the different directions are not significantly different at the 5% level of probability (Duncan's Multiple Range Test)

Table 2: Percentage of parasitized eggs, successful parasitism and sex ratio of *T. basalis* for egg masses in different distances after the first and second release

	Distances from release point (Meter)				
	4 m	8 m	12 m	16 m	20 m
Parameter	First release				
Parasitized eggs%	96.6[a]	80.8[b]	83.3[ab]	49.5[c]	33.7[d]
Successful parasitism %	96.6[a]	97.9[a]	83.3[b]	45.8[c]	32.5[d]
Sex ratio	79.1[a]	72.1[a]	75[a]	72.7[a]	70.5[a]
	Second release				
Parasitized eggs%	96.75[a]	93.75[a]	96.25[a]	86.5[ab]	74.75[b]
Successful parasitism %	96.75[a]	92.75[a]	96.00[a]	85.00[ab]	72.5[b]
Sex ratio	77.5[a]	72.5[a]	76.8[a]	75.0[a]	70.6[a]

Means followed by the same letter in a row between the different distances are not significantly different at the 5% level of probability (Duncan's Multiple Range Test)

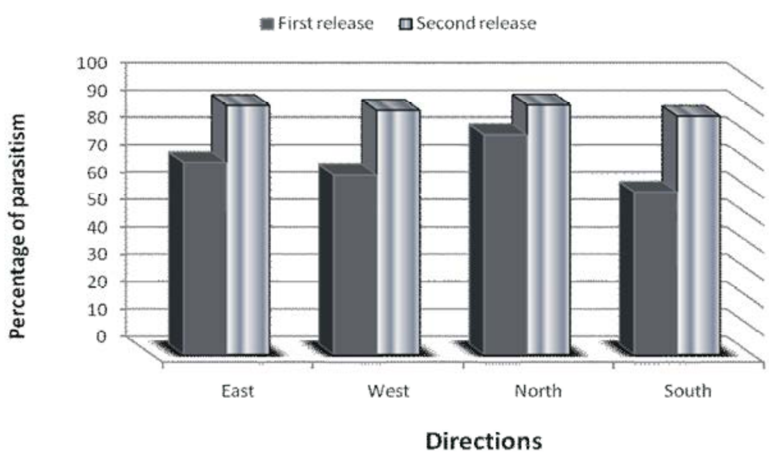

Fig. 1: Percentage of parasitism caused by *T. basalis* on egg masses of *N. viridula* after the first and second release within a different direction

the sex ratio to parasites eggs in all distances after the first and second release. This results is similar to Hoffmann, *et al*. [16] found 79.9 % parasitism by *T. basalis* of all southern green stink bug eggs and 87.2% parasitism of the eggs per egg mass on egg masses placed in the field and in naturally occurring egg masses. The *T. basalise* female sex ratio was 4:1 (females: males) at 28 and 31°C, while it was 3:1 at 24°C. [18]. In addition Powell, *et al*. [19] reported that a parasitoid: host ratio or 1:60, with two releases of *T. basalis* should provide satisfactory control.

The present data suggested that it can be release *T. basalise* by any density because of the high efficiency of this parasitoid in locating southern green stink bug egg masses. This observation is similar to the findings of Sales [20] who reported that *T. basalis* females possess remarkable ability to orient and find southern green stink bug eggs. Using a stochastic model that simulates interactions of *T. basalis* with southern green stink bug. Powell *et al.* [19] reported that a parasitoid: host ratio or 1:60, with two releases of *T. basalis* should provide satisfactory control.

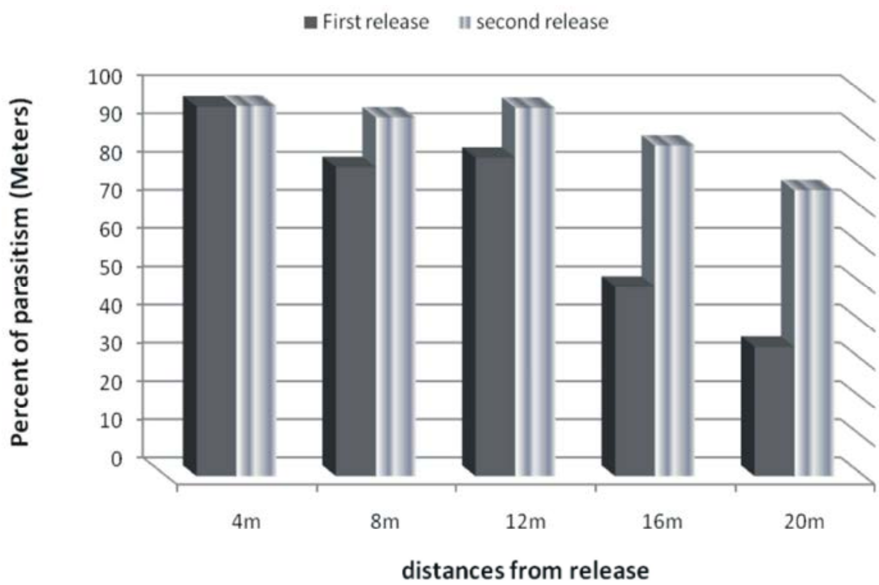

Fig. 2: Percentage of parasitism by *T. basalis* after two releases on egg masses of *N. viridula* placed at different distances from the central release point within a sweet potato field

REFERENCES

1. Awadalla, S.S. and L.M. Shanab, 1993. Parasitoid-host relationship between the parasitoid *Trissolcus* sp. (*Microphanarus megallocephalus* Ashm.) and its host, *Nezara viridula* L. J. Agric. Sci. Mansoura Univ., 18(8): 2441-2446.
2. Awadalla, S.S., 1996. Influence of temperature and age of *Nezara viridula* L. eggs on the Scelionid parasitoid, *Trissolcus megallocephalus* (Ashm.) (Hym., scelionidae). J. Appl. Ent., 120(7): 445-448.
3. Correa-Ferreira, B.S. and F. Moscardi, 1995. Seasonal occurrence and host spectrum of egg parasitoids associated with soybean stink bugs. Biol. Contr., 5: 196-202.
4. Correa-Ferreira, B.S. and F. Moscardi, 1996. Biological control of soybean stink bugs by inoculative releases of *Trissolcus basalis*. Entomol. Exp. Appl., 79: 1-7.
5. Ehler, L.E., 2002. An evaluation of some natural enemies of *Nezara viridula* in northern California. Bio. Control, 47: 309-325.
6. Lenteren, J.C. and V.H.P. Bueno, 2003. Augmentative biological control of arthropods in Latin America. Bio. Control, 48: 123-139.
7. Catalan, J. and M.J. Verdu, 2005. An evaluation of two egg parasitoids of *Nezara viridula* Bol. San. Veg. Plagas, 31: 187-197.
8. Khalafalla, E.M.E., R.E. El-Sufty, I.S. El-Hawary and M.A. Khattab, 2005. Parasitism of *Nezara viridula* L. eggs under field conditions at Kafr El-Sheikh Governorate. Egyptian J. Agric. Res., 83: 87-94.
9. Canton-Ramos, J.M. and A.J. Callejon-Ferre, 2010. Raising *Trissolcus basalis* for the biological control of *Nezara viridula* in greenhouses of Almeria (Spain). African J. Agric. Res., 5(23): 3207-3212.
10. Lijesthrom, G. and P. Camean, 1992. Parasitism of a population of the green stink bug *Nezara viridula* (L.) (Hemiptera: Pentatomidae) by the egg parasitoid *Trissolcus basalis* (Woll.) (Hymenoptera: Scelionidae). Revista. De. La. Facultad. De. Agronomia. La. Plata., 68: 71-76.
11. Justo, H.D.J., B.M. Shepard and K.D. Elsey, 1997. Dispersal of the egg parasitoid *Trissolcus basalis* (Hymenoptera: Scelionidae) in tomato. J. Agric. Entomol., 14: 139-149.
12. Jones, W.A., 1988. World review of the parasitoids of the southern green stink bug, *Nezara viridula* (L.) (Heteroptera: Pentatomidae). Ann. Entomol. Soc. Amer., 81: 262-273.
13. Clarke, A.R., 1990. The control of *Nezara viridula* L. with introduced egg parasitoids in Australia. A review of a landmark example of classical biological control. Aust. J. Agric. Res., 41: 1127-1146.

14. Cornell University College of Agriculture and Life Sciences, 2019. *Trissolcus basalis*. Retrieved 7 February.
15. Martin, N.A., 2018 Green vegetable bug egg parasitoid *Trissolcus basalis* Interesting Insects and other Invertebrates: New Zealand Arthropod Factsheet Series.
16. Hoffmann, M.P., N.A. Davidsun, L.T. Wilson, L.E. Ehler, W.A. Jones and F.G. Zalom, 1991. Imported wasp helps control southern green stink bug. Calif. Agric., 45: 20-22.
17. CoStat Software, 2004. CoStat. www. cohort. com. Monterey, California, USA.
18. Twafik, W.A., 2007. Evaluation of natural enemies as biological control agents for suppression hemipterous insects on some crops at Mansoura district. M.Sc. Thesis Faculty of Agriculture, Mansoura University, Mansoura, pp: 197.
19. Powell, J.E., M. Shepard and P.T. Holmes, 1983. A stochastic model of parasitism of the southern green stink bug by *Trissolcus basalis* (Wollaston). South Carolinla Agricu. Experiment Station Technical Bulletin No. 1088.7 pp.
20. Sales, F.M., 1979. Responsiveness and threshold for host-seeking stimulation of the female, *Trissolcus basalis* (Wollaston) by the eggs of the host, *Nezara viridilia* (L.) Fitossanidade, 3: 36-39.