MedCrave
Step into the World of Research

Open Access Journal of Science

Research Article

Open Access

CrossMark

Bio-control of *Eurygaster integriceps (Hemiptera: Scutelleridae)* using its egg parasitoid, *Trissolcus grandis (Hymenoptera: Scelionidae)* in wheat fields of West Azarbaijan, Iran

Abstract

The egg parasitoid, *Trissolcus* grandis (Hymenoptera: *Scelionidae*) is one of the most prominent and known egg parasitoid of the Sunn pest, *Eurygaster integriceps* (Heteroptera: *Scutelleridae*) in Iran. This study was conducted to evaluate the efficacy of T. grandis on Sunn pest eggs under field conditions. Trials were carried out through mass rearing and inundative releases of *T. grandis* in the wheat fields. Releases were performed by a laboratory colony of the parasitoid that collected naturally from Sunn pest eggs. *T. grandis* was mass-reared in 2015-2016 at the laboratory of Plant Protection Research Department, West Azarbaijan Agricultural and Natural Resources Research Center, Urmia, Iran. The egg parasitoid was released into wheat fields of West Azarbaijan Province in Northwest of Iran to examine their impact on Sunn pest population from 2015 to 2016. Based on our results, efficiency of *T. grandis* increased between 11.04 and 22% in release areas. The results suggest that *T. grandis* has appropriate efficacy on Sunn pest, which may have a promising potential to be used in the integrated Sunn pest management programs.

Keywords: *Eurygaster integriceps*, biological control, *Trissolcus grandis*, mass release, wheat, feeding, economic losses, weather conditions, farmers, digestive enzymes, moisture availability, eggs, Sunn pest eggs

Volume 2 Issue 3 - 2018

Maryam Fourouzan, Mohammad Ali Farrokh-Eslamlou

Plant Protection Research Department, West Azarbaijan Agricultural and Natural Resources Research Center, Iran

Correspondence: Maryam Fourouzan, Plant Protection Research Department, West Azarbaijan Agricultural and Natural Resources Research Center, AREEO, Urmia, Iran, Email Maryam_fourouzan@yahoo.com

Received: April 23, 2018 | **Published:** June 15, 2018

Introduction

Wheat, (*Triticum aestivum* L.) is one of the most significant nutrient for human being, constitutes approximately 20% of the calories obtained from the food throughout the world.[3] The sunn pest, *Eurygaster integriceps* Puton (Hemiptera: *Scutelleridae*) is one of the most serious pests of wheat and barley in many Middle-Eastern countries and Iran.[7–11] Nymphs and adult bugs cause damage to host plants and decrease yields by feeding on leaves, stems and grains. Additionally, by feeding the protein of the grain and injecting digestive enzymes during feeding, it decreases the qualities of the flour.[11] Economic losses caused by Sunn pest feeding are highly variable and depend on the density of the bug population, weather conditions, crop moisture availability, and the susceptibility of the cultivar.[8] The Sunn pest is difficult to control and over the years farmers have relied extensively on the use of broad spectrum pesticides. Because of many problems associated with the extensive use of chemical insecticides to control the pest, the use of bio-control agents such as parasitoids and predators attracted scientist interests.[2] Egg parasitoids (Hymenoptera: *Scelionidae*) especially *Trissolcus* spp., are prime candidates for biological control and they could successfully reduce the pest population.[10] Sixteen species of *Trissolcus* have been recognized on Sunn pest eggs which four species including *T. grandis* Thomson, *T. vassilievi* Mayr, *T. semistriatus* Nees and *T. basalis* Wollaston have the most egg parasitism rates.[4] This research was conducted to assay the efficacy of *T. grandis* on Sunn pest eggs under field conditions in Iran.

Materials and methods

Collection of E. integriceps adults for obtaining eggs

Mass rearing of *T. grandis* was performed using Sunn pest eggs in Iran. Therefore, adults of *E. integriceps* were collected from infested wheat fields and reared on wheat plants in the Laboratory of West Azarbaijan Plant Protection Research Institute, Iran (Figure 1). The adults were collected by sweeping nets from wheat fields at the beginning period of their migration towards newly planted wheat fields at West Azarbaijan Province. Collected adults were placed in boxes containing wheat plants at 25±2°C, 65±10% RH and a photoperiod of 14: 10 (L: D) for at least 48 hours. Then, the temperature was increased to 26±2°C and *E. integriceps* maintained to feed and lay eggs. Egg-masses (1 egg mass=ca.14 eggs) of *E. integriceps* were collected every two days and transferred to a deep freeze at -21°C for 4 hours to kill the embryos. Then, the collected eggs stored in the fridge until they were submitted to the parasitoid.[6]

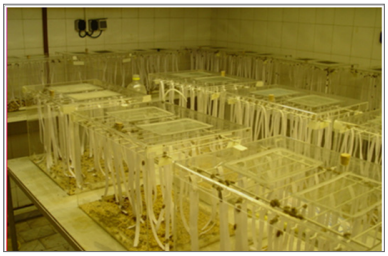


Figure 1 Rearing of *E. integriceps* in laboratory conditions.

Mass-rearing of Trissolcus grandis

T. grandis females were applied to initiate the mass culture of the parasitoid, without a need to maintain a parasitoid culture in the laboratory throughout the year.[12] Thus, the scelionid parasitoids were collected from newly planted wheat fields in West Azarbaijan Province. The parasitoid adults were transferred to the laboratory and then *T. grandis* species was separated. The parasitoid was placed in cotton-plugged glass tubes and streaked inside with a 10% honey-water as a food source. *E. integriceps* egg-masses, stored in the deep freezer, were introduced to *T. grandis* and kept in an incubator at 26±1 °C, 65±10% RH and a photoperiod of 14 L: 10 D (Figure 2). After enough parasitoid number emergences, about 100 *E. integriceps* eggs were introduced for parasitization (1: 3 (male: females)). Males were separated easily from females depending on their antennal characteristics. Parasitized eggs were incubated up to the pupal stage in their host eggs under the same conditions.

Figure 2 Collection of *T. grandis*.

Parasitoid release

Before releasing, Sunn pest adult density per m^2 was estimated by collecting 20 samplings from the wheat field, using 0.25 m^2 frame.[5] Inundative releases of the egg parasitoid were carried out in the wheat fields from mid-April to the end of May during the 2015-2016, when Sunn Pest population was maximal. About 100 numbers of Sunn pest eggs parasitized by *T. grandis* in the pupa period were placed in 10 release bags. They were hung on wheat leaves on the experimental plots. At each release, an average of 10000 parasitized Sunn pest eggs were used to evaluate the efficiency of the parasitoid per 10000 square meters.

Efficacy of releases

To evaluate the efficacy of *T. grandis* inundative releases on *E. integriceps* population and to estimate % parasitism per plot, 25 egg-masses from each of the release plots and the control, (where at least 2 km far away from each other) were collected, transferred to the laboratory for investigation and/ or kept under observation. Abbot formula[1] was applied for correction of data. Rates of *T. grandis* in release and control plots were estimated. To determine the Sunn pest nymphs' population, 20 samplings were collected by using 0.25 m^2 frame.

Statistical analysis

The percentages of parasitized eggs in the release and control wheat fields were statistically compared to each other using T- test. Also, parasitoid efficacy was determined and corrected by Abbot Formula.

Results and Discussion

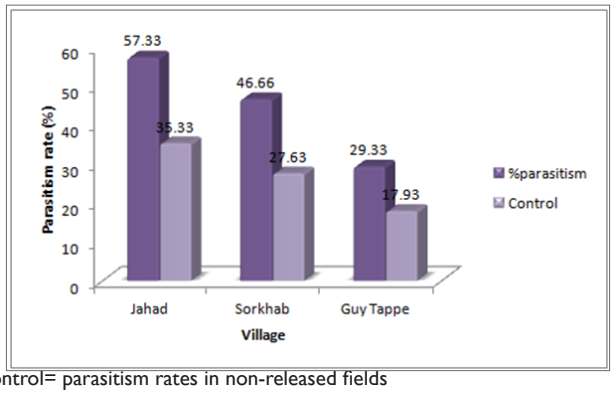
According to Figure 3, releasing the wasp led to 57.33% parasitism of Sunn pest eggs in Jahad village and the least parasitism is belonging to Guy Tappe village (% parasitism=29.33). There was a moderate parasitism in Sorkhab village (% parasitism=46.66). During 2015-2016, the numbers of Sunn pest nymphs were 4, 7 and 11 individuals per m^2 in the releases field in Jahad, Sorkhab and Guy Tappe villages, respectively (Table 1). Respective numbers in the controls were 15, 17 and 21 individuals per m^2, respectively. Statistical analysis exhibited significant difference between Sunn pest nymphs' numbers in release and control fields (Table 1). As a result, egg parasitoids of *E. integriceps* may obtain high levels of parasitism under natural conditions; therefore they are suitable candidates for biological control programs.[14] Hence, it is clear that releasing *T. grandis* in the fields in combination with other Sunn pest management strategies can decrease the pest density and application of pesticides along with conserving natural resources. Similarly, Vardaroğlu[13] noted that Sunn pest management in Iran was performed by releasing 10000 *T. semistriatus* in the fields at the rate of 2-4 Sunn pest/ m^2. 100 million individuals were reared and released and the cost was 1.6 ABD dollars versus 7.5 ABD dollars in case of using DDT or Gamexan. Zomorrodi[15] found that biological control tactic in Iran was carried out using *Microplialurus semistriatus* Nees and *T. vassilievi*. In 1955, 207 million parasitoids were reared by using 4200 kg of overwintered Sunn pest adults and released 10000 parasitoids/ hectare, at the rate of 1 wintered adult / m^2. Parasitism rate reached 60-90% and no damage occurred in comparison with the control fields in Isfahan.[9] reported that positive results were obtained in 1963 for the management of Sunn pest in the Isfahan region in Iran, *T. semistriatus* and *T. grandis* were released periodically in the fields, at the rate of 1 wintered adult/ m^2.[12] demonstrated that in the release wheat fields, the parasitism among Sunn pest eggs increased from 0.7 to 28.3%, depending on releasing densities. By releasing 1950 Sunn pest parasitized eggs with *T. semistriatus* in 0.1 hectare wheat field, parasitism rate increased from 8 to16%. Their results are consistent with our results.

Table 1 Mean numbers of E. integriceps nymphs in release and control wheat fields in Iran during 2015-2016

Parasitoid		Number of nymphs/m^2				
Release plots	**Control**	**Release plots**	**Control**	**P**	**F**	**Sd**
Jahad	Jahad	4±0.31*	15±1.02	0	1.052	
Sorkhab	Sorkhab	7±0.39*	17±1.09	0	5.6	38
Guy Tappe	Guy Tappe	11±0.42*	21±1.19	0	7.32	

*Significant differences (P >0.05) were found among the regions

Citation: Fourouzan M, Farrokh-Eslamlou MA. Bio-control of Eurygaster integriceps (*Hemiptera: Scutelleridae*) *using its egg parasitoid, Trissolcus grandis (Hymenoptera: Scelionidae*) in wheat fields of West Azarbaijan, Iran. *Open Access J Sci.* 2018;2(3):150–152. DOI: 10.15406/oajs.2018.02.00071



Control= parasitism rates in non-released fields

Figure 3 % parasitism of Trisolcus grandis on Sunn pest eggs in Jahad, Sorkhab and Guy Tappe villages.

%parasitism= parasitism rates in released fields.

Conclusion

According to our results, parasitism plays a key role in biological control of Sunn pest. This could help reduce insecticide usage against the Sunn pest and hence there will be a reduced need for chemical pesticides. It is notable that since the wheat is an important source of energy, it is a necessity to achieve safe producing of wheat cultivars and finally, obtain to healthy food and environment. Generally, results suggest that *T. grandis* could be one of the most import candidates among natural enemies of Sunn pest which promise great potential of the species for biological control of the Sunn pest.

Acknowledgements

None.

Conflict of interest

Author declares that there is no conflict of interest.

References

1. Forrester JV, Dick AD, McMenamin P. The Eye: *Basic Sciences in Practice*. 2nd ed. Philadelphia: WB Saunders; 2001.
2. Brown N. The change in shape and internal form of the lens of the eye on accommodation. *Exp Eye Res*. 1973;15(4):441–459.
3. Pedrigi RM, David G, Dziezyc J, et al. Regional mechanical properties and stress analysis of the human anterior lens capsule. *Vision Res*. 2007;47(13):1781–1789.
4. Bron A, Tripathi R, Tripathi B. *Wolff's anatomy of the eye and orbit.* 8th ed. London: Chapman and Hall; 1997.
5. Manns F, Prel JM, Denham D, et al. Optomechanical response of human and monkey lenses in a lens stretcher. *Invest Ophthalmol Vis Sci*. 2007;48(7):3260–3268.
6. Drecoll EL, Kaufman PL, Wasielewski R, et al. Morphology and accommodative function of the vitreous zonule in human and monkey eyes. Invest Ophthalmol Vis Sci. 2010;51(3):1554–1564.
7. Hart WM. Adler's Physiology of the Eye: *Clinical Application*. 9th ed. St. Louis: Mosby; 1992.
8. Koretz JF, Bertasso AM, Neider MW, et al. Slit-lamp studies of the rhesus monkey eye: II. Changes in crystalline lens shape, thickness and position during accommodation and aging. *Exp Eye Res*. 1987;45(2):317–320.
9. Heys KR, Cram SL, Truscott RJW. Massive increase in the stiffness of the human lens with age: the basis of presbyopia? *Mol Vis*. 2004;10:956–963.
10. Weeber HA, Eckert G, Pechhold W, et al. Stiffness gradient in the crystalline lens. *Graefes Arch Clin Exp Ophthalmol*. 2007;245(9):1357–1366.