Spider, A Potential Biocontrol Agent in Insect Pest Management of Vineyard

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Abstract

Use of spiders as biological agents against crop pest is an important alternative to the chemical insecticides. Prey searching ability, wide host range, case of multiplication and polyphagus nature of spiders make them a biological suppresser. The present study explores the significance of spiders in control of insect pests of vineyard, main cash crop of the farmers of some villages of Tasgaon Tehsil, Dist. Sangli (M.S.). Total four different pests *viz.,* aphid, mealybug, leaf hopper and thrips, which mainly cause damage to the vineyard and six species of spiders *viz., Argiope anasuja, Leucauge decorate, Araneas mitificus, Thomisus spe., Telamonia dimidiate and Ageleana spe.,* which feed on above pests are selected for the study. Role of spiders as predators on these four selected pests is studied under laboratory conditions. The predatory potential of each spider species is evaluated by the feding them on these four pests for 10 days. The spider species *Argiope anasuja* and *Thomisus* species are found to the more effective in reducing the pest insects. The results are analyzed with present literature.

Key words: Spider, insect pest, vineyard, Tasgaon Tehsil.

Introduction

Spiders are seventh largest group of animal belonging to phylum Arthropoda, class Arachnida and order Araneae. At present total 47439 species of spiders are recorded in the world (Platinick: World spider catalogue, 2018) and total 1698 species are recorded in India (Keswani *et al.,* 2012). A total of 90 species belonging to 55 genera and 19 families are recorded from Zolambi Region of Chandoli National Park which came under the Sangli District (More, 2015). Spiders are abundant and ubiquitous in most terrestrial and aquatic habitat thus, they are valuable component of ecosystem functioning. Most of the spiders are generalist predators, can kill a large number of various insect pests in agriculture (Sunderland *et al.,* 1986). Some researchers have studied spider family response to changes in habitat diversity at the field and landscape scales of vineyards (Smith, 2014).

The vineyard is one of the major cash crops of farmers of Tasgaon Tehsil. Some local verities of grapes like Tas-A-Ganesh, Manikchaman , Sharad, Thomsson and Sonakka are cultivated in 11032 hectares of Tasgaon Tehsil (Mane, 2015). Various living organisms lived in perfect harmony and balance with each other in different ecosystems before chemical agriculture and chemical pest control come into the picture. More than 30 gm. chemical pesticides per hectare are spread on grapes by the farmers of this Tehsil (Kale, 2016). This produced risk of side effect on non-target species like human and long lived residues in the environment. To survive from these hazardous effects there is need to discover some alternative tools for pest control. The present study to use spider as biological agent to control the grapes pest will hopefully help in enhancing the economic and ecofriendly pest management through ecosystem maintenance for future generation.

Materials and Methods

The spiders *viz., Argiope anasuja, Leucauge decorate, Araneas mitificus, Thomisus spe., Telamonia dimidiate and Ageleana spe.* (Table No. 01) and pests *viz.,* aphid, mealybug, leaf hopper and thrips are collected from vineyard and nearby habitat of Tasgaon Tehsil, Dist. Sangli (M.S.). The collected spiders and pests are maintained in individual cages (30X20X20 cm.) under laboratory conditions. The water is provided in small test tube plugged with cotton. The present study was conducted from month of August 2017 to March 2018. For study of predatory effect of spiders each spider species is fed with ten individuals of each pest for 10 days on daily basis. The replication set were prepare, the dead individuals of pests are removed in every 24 hours and we calculated mean and its standard error (Balarin and Polenec, 1984; Sebastian *et al.,*2002; Jeyaparvathi *et al.,* 2013). The data is analyzed by using R software (Ver.3.4.4.) and Microsoft Office Excel, 2010.

Results

During present study we observed that the spider, *Argiope anasuja* has high predatory potential. It consumed maximum individuals of mealybug (2.6±0.42), aphids (2.0 ±0.33), thrips (1.4±0.16), and leaf hopper (0.4±0.16). The *Agelena* spe. has less predatory rate. It prefers less number mealybug (1.0±0.20), aphids (0.7±0.15), thrips (1.0±0.20) and leaf hopper (0.1±0.09). The *Thomisus* spe. prefers more aphids (2.0±0.25) as compare to mealybug (1.9±0.23), thrips (1.2±0.13) and leaf hopper (0.3±0.15). The *Araneas mitificus* prefers more mealybug (2.3±0.21) as compare to aphids (1.5±0.0.22), thrips (1.3±0.15) and leaf hopper (0.2 ± 0.13). The *Leucauge decorate* prefers more mealybug (2.0 ± 0.25) as compare to aphids (1.5±0.22), thrips (1.0±0.25) and leaf hopper (0.3±0.15). While the *Telamonia dimidiate* prefers more aphids (1.8±0.0.19) as compare to mealybug (1.6±0.16), thrips (1.1±0.16) and leaf hopper (0.1±0.09), (Table No. 02) and (Fig.No.01-06). All the species of spider studied were have high predatory rate towards mealybug than aphid, thrips and leaf hopper (Table No. 02).

Discussion

For implementing environmentally safe strategies, several eco- sustainable control methods and integrated pest management (IPM) programs have been recently evaluated (Zappala *et al.,* 2012). As generalist predators spiders are not an insignificant component of terrestrial ecosystems and the can play a role in the biological control of insect pest in agro-ecosystems (Picchi *et al.,* 2016). Spiders, particularly assemblages of species, have been shown to be effective in reducing pest insects and crop damage in field (Chad *et al.,* 2006). Predators help to maintain a balance among organism, by consuming prey, altering prey behavior and prey habitat selection (Smee, 2012).

The present study is reported that the predatory effect of spider, *Argiope anasuja* has high predatory potential than other spiders. It consumed more mealybug (2.6±0.42), aphids (2.0 ±0.33), thrips (1.4±0.16) and leaf hopper (0.4±0.16). The *Agelena* spe. was less predatory rate, it prefers less mealybug (1.0), aphids (0.7± 0.15), thrips (1.0), leaf hopper (0.1).According to some other scientist spiders can significantly reduce prey densities. Jeyaparvathi *et al.* (2013) is observed that spider *Peucetia viridana* (0.8 ± 0.79) has high predatory potential than *P. latikae* (0.39 ± 0.47) and *O. salticus* (0.6 ± 0.52). Lang *et al.* (1999) found that spiders in maize crop depressed population of leaf hopper (Cicadellidae) thrips (Thysanoptera) and aphid

(Aphididae). Jesikha (2012) studied potential of spider *Pilixeppus petersi* as a biocontrol agent on *Musca domestica*. She reported jumping spiders significantly increased housefly mortality. In 03 treatments, she observed 100% mortality in 32 hours duration and 69.33% in 48 hours duration. Giuseppe (2017) reported the predatory effect of 14 species of spiders on *Metcalfa pruinosa*. He reported the predatory rate of spiders belonging to Agelenidae (27.4%), Linyphiidae (26.7%) and Araneidae (15.6%). Balarin and Polenec (1984) reported predatory effect of *C. mildei* on cotton bugs. The average feeding of *C. mildei* is 8.2. Our results are in good agreement with the findings of Jeyaparvathi (2013), Lang *et al.* (1999) and Giuseppe (2017).

Table No. o1. List of Spider Studied

Sr.No.	Family	Common Names	Genus or species name
	Hunting Spider		
1.	Salticidae	Jumping spiders	*Telomonia dimidiate*
2.	Thomisidae	Crab spiders	*Thomisus species*(Female)
	Web weaving spiders		
3.	Agelenidae	Funnel web spiders	*Agelena species* (Female)
4.	Araneidae	Orb web spider	*Argiope anasuja* (Female)
			Araneas mitificus(Female)
5.	Tetragnathidae		*Leucauge decorate* (Female)

Table No 02 : Predatory rate (No./day/spider) of six spiders on four different pests

Sr. No.	Name of the Spider	Mean of Pest Consumed			
		Aphids	Leafhopper	Mealybug	Thrips
1.	*Argiope anasuja* (Female)	2.0 ±0.33	0.4±0.16	2.6±0.42	1.4±0.16
2.	*Leucauge decorate* (Female)	1.5 ±0.22	0.3 ±0.15	2.0± 0.25	1.0±0.25
3.	*Araneas mitificus* (Female)	1.5 ±0.22	0.2 ±0.13	2.3±0.21	1.3±0.15
5.	*Thomisus species* (Female)	2.0± 0.25	0.3± 0.15	1.9±0.23	1.2±0.13
7.	*Telamonia dimidiate* (Female)	1.8 ±0.19	0.1 ±0.09	1.6± 0.16	1.1±0.17
10.	*Agelena species.* (Female)	0.7± 0.15	0.1 ±0.09	1.0 ±0.20	1.0 ±0.20

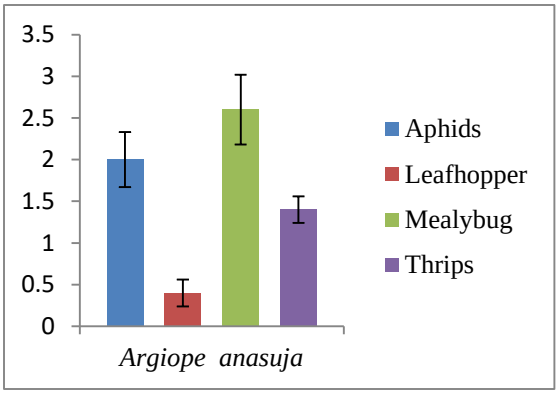

Fig. 01- Mean and Error bars of different pests consumed by *Argiope anasuja*

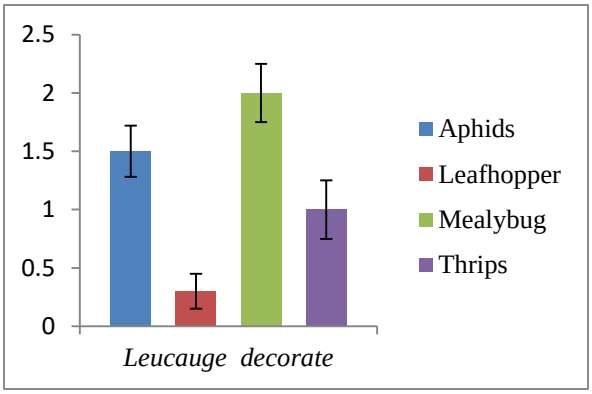

Fig. 02-Mean and Error bars of different pests consumed by *Leucauge decorate*

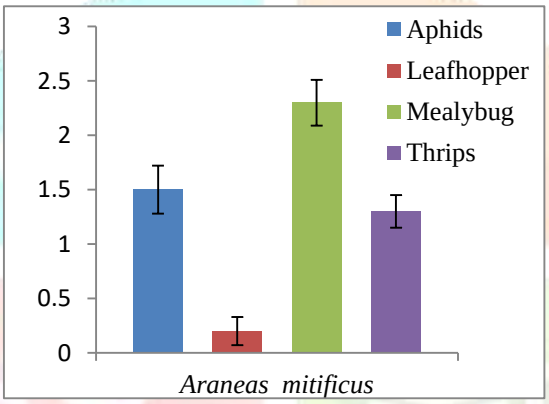

Fig.03- Mean and Error bars of different pests consumed by *Araneas mitificus*

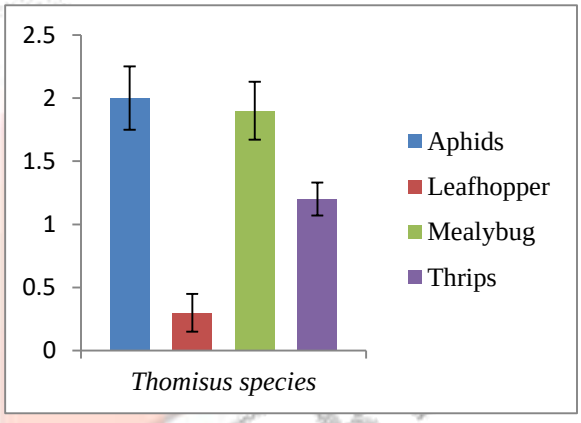

Fig.04- Mean and Error bars of different pests consumed by *Thomisus Spe.*

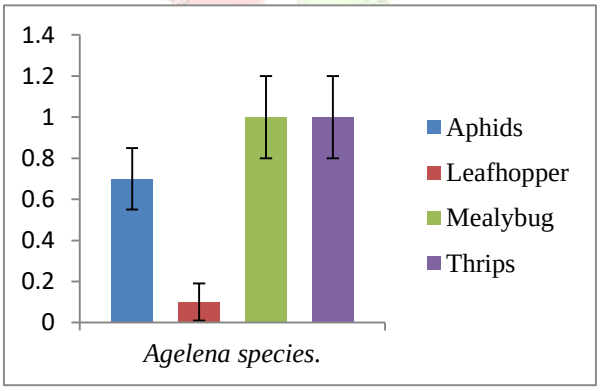

Fig.06-Mean and Error bars of different pests consumed by *Agelena species*

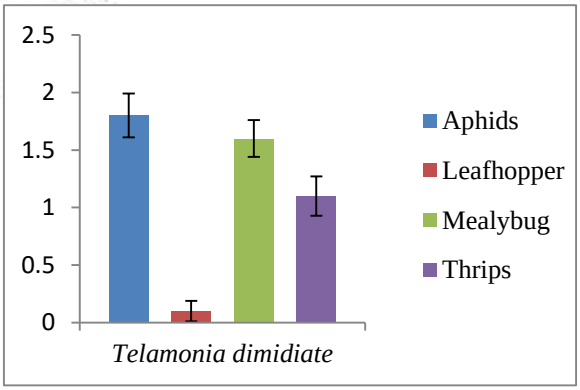

Fig.05- Mean and Error bars of different pests consumed by *Telamonia dimidiate*

Photo Plate 01- A. *Argiope anasuja;* **B.** *Thomisus species;* **C.** *Leucauge decorate;* **D.** *Telamonia dimidiate*

Conclusion

The present study was clearly reveals that, spiders are effective biocontrol agents in grapes agro ecosystem pest management. Most of the selected spiders have more predatory rate towards mealybugs and thrips which are major pest in vineyard. Further research is needed to assess the impact of the spiders on population dynamics of the grape pests. The study also reveals that the complex of indigenous spider can potentially give a contribution to limit the grape pests.

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