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Impact of certain agrochemicals on spider population in bhendi (*Abelmoschus esculentus* (L.) Moench) ecosystem

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ABSTRACT

Two supervised field experiments were conducted in the bhendi hybrid MH 10 during *kharif*, 2012 and *rabi*, 2012-13 to study the impact of agrochemicals on spider population in Karaikal district, U.T. of Puducherry, India. The agrochemicals used were fertilizer, insecticide and herbicide individually as well as in combinations. It was found that the population of spiders was higher in the untreated check (0.30 to 1.03/plant) while a low population was recorded in the treatment with herbicide + insecticide which ranged from 0.10 to 0.36/plant during *kharif*, 2012. In *rabi*, 2012-13, a higher population was recorded in the untreated check (0.36 to 1.00/plant) while a low population was observed in the treatment with herbicide + insecticide (0.16 to 0.40/plant). It was also found that, the population was higher in the treatment with fertilizer alone (0.50 and 0.56/plant in *kharif* and *rabi* respectively) compared to the other treatments. From the two experiments, it was concluded that, an impact of agrochemicals namely herbicide and insecticide was observed on the spider population while a lesser impact was noticed in the treatment with fertilizer alone compared to the untreated check.

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INTRODUCTION

Bhendi (*Abelmoschus esculentus* (L.) Moench) is the choicest vegetable grown extensively in the tropical, subtropical and warm area of the temperate zones of the world. It is a native of tropical Africa, and widely cultivated in India. In India, Uttar Pradesh, Assam, Bihar, Orissa, Maharashtra, West Bengal and Karnataka are important bhendi producing states. In India, it is grown in an area of 0.49 million hectares with an annual production of 5.80 million tonnes and productivity of 11.6 tonnes per hectare (Anon, 2011). Bhendi accounts for 60 per cent of export of fresh vegetables excluding potato, onion and garlic (Sharma and Arora, 1993). Ewete (1983) has reported 72 insect pest species that attack and damage okra.

Spiders are among the numerically dominant insectivores in terrestrial ecosystem and exhibit a very diverse range of life style and foraging behaviours. They are important predators of insect pests. Though they are mostly generalist predators but some spider species are specialist predators (Whitecomb, 1962). They form a major component of the generalist predator fauna and are potentially able to restrict pest population growth (Harwood *et al.*, 2001). Favourable results can be achieved by using spiders as biological control agents in combination with selective and non-persistent insecticides and restricting the number of their applications to only specific times so as to protect them (Mushtaq *et al.*, 2003 and 2005). The indiscriminate use of insecticides in agro-ecosystems has been increased many folds resulting in ecological imbalance and appearance of more resistant pest strains in crops. Spiders as an excellent bio-control agent offer an opportunity and provide an alternative means of control for insect pest. Among the various methods of pest management, the use of agrochemicals forms the first line of defence against the insect pests. In many cases, ecofriendly method of insect pests management offer adequate level of pest control with less hazards and safe to non-target organisms. In the present study, the impact of agrochemicals (fertilizer, herbicide, insecticide) on spiders were evaluated and presented.

MATERIALS AND METHODS

Two field experiments were conducted to assess the impact of certain agrochemicals on arthropods

population in bhendi during *kharif*, 2012 and *rabi*, 2012-13 at Eastern farm of Pandit Jawaharlal Nehru College of Agriculture and Research Institute (PAJANCOA and RI), Karaikal, U.T. of Puducherry, India on the bhendi hybrid MH 10. The experiment was laid out in a Randomized Block Design with three replications and eight treatments in a 5.4 x 4.5 square meter plots. The treatments include untreated check, herbicide only (Oxyflourfen 23.5 EC @ 0.15 kg a.i/ha applied as pre emergence application at 3 days after sowing (DAS)), fertilizer only (NPK applied @ 20:50:30 kg/ha as basal and the remaining N 20 kg/ha applied at 30 DAS), insecticide only (Carbaryl 50 WP @ 2g/lit as foliar spray at 50 DAS), herbicide + fertilizer (Oxyflourfen 23.5 EC @ 0.15 kg a.i/ha applied as pre emergence application at 3 DAS and NPK applied @ 20:50:30 kg/ha as basal and the remaining N 20 kg/ha applied at 30 DAS), herbicide + insecticide (Oxyflourfen 23.5 EC @ 0.15 kg a.i/ha applied as pre emergence application at 3 DAS and carbaryl 50 WP @ 2g/lit as foliar spray at 50 DAS), fertilizer + insecticide (NPK applied @ 20:50:30 kg/ha as basal and the remaining N 20 kg/ha applied at 30 DAS and carbaryl 50 WP @ 2g/lit as foliar spray at 50 DAS) and herbicide + insecticide + fertilizer (Oxyflourfen 23.5 EC @ 0.15 kg a.i/ha applied as pre emergence application at 3 DAS and NPK applied @ 20:50:30 kg/ha as basal and the remaining N 20 kg/ha applied at 30 DAS and carbaryl 50 WP @ 2g/lit as foliar spray at 50 DAS). *Insitu* counts were taken at weekly intervals on ten randomly selected plants of middle three rows, leaving the border row plants. The total number of spiders were counted and expressed as number/plant. The data obtained from the field experiments were analysed in a Randomized Block Design by 'F' test for significance as described by Panse and Sukhatme (1958). Critical difference values were calculated at 5% probability level and the treatment mean values of the experiment were compared using Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

During *kharif*, 2012 and *rabi*, 2012-13, the impact of certain agrochemicals on the population of spiders in bhendi was studied in both the seasons.

Field experiment I (*Kharif*, 2012)

The impacts of agrochemicals on the population of spiders in bhendi ecosystem are presented in Table 1. At 1st and 2nd week after sowing there was no population of spiders and hence the population of spiders was observed from 3rd week and continued upto 12th week after sowing. The mean population of spiders during *kharif* ranged from 0.24 to 0.63/plant. A low population of spiders was observed in the treatment with herbicide + insecticide (0.24/plant) with a per cent reduction of 61.90 per cent followed by the treatment with herbicide + fertilizer (0.30/plant) compared to the untreated check (0.63/plant) while a lower per cent reduction of spiders population was observed in the treatment with fertilizer alone (20.63%).

Field experiment II (*Rabi*, 2012-13)

The impact of agrochemicals on the population of spiders in bhendi ecosystem are presented in Table 2. At 1st and 2nd week after sowing there was no population of spiders and hence the population of spiders was observed from 3rd week and continued upto 12th week after sowing. During *rabi*, the mean population of spiders ranged from 0.30 to 0.70/plant. A lower population of spiders was observed in the treatment with herbicide + insecticide (0.30/plant) with a per cent reduction of 57.14 per cent followed by the treatment with insecticide (0.38/plant) compared to the untreated check which recorded a higher population of spiders (0.70/plant) while a lower per cent reduction of spiders population was observed in the treatment with fertilizer alone (20.00%).

The present findings revealed that, there was a higher reduction of spiders in the treatment with the herbicide + insecticide followed by insecticide alone and other treatments. The results also showed a lower per cent reduction was observed in the treatment with fertilizer alone. Hence, it was concluded that the agrochemicals namely herbicide + insecticide found to have an impact on the population of spiders while fertilizer alone found to have a lesser impact on the population of spiders.

Table 1. Impact of agrochemicals on the population of spiders in bhendi ecosystem during *kharif*, 2012 (Field experiment I)

Treatments	Population of spiders #										Overall mean	Percent reduction over control
	3rd week	4th week	5th week	6th week	7th week	8th week	9th week	10th week	11th week	12th week		
Untreated check	0.30^{b}	0.36^{c}	0.50^{b}	0.56^{b}	0.63^{c}	0.60^{c}	0.66^{c}	0.76^{c}	0.90^{d}	1.03^{c}	0.63^{f}	--
Herbicide	0.16^{a}	0.13^{a}	0.30^{ab}	0.26^{a}	0.36^{ab}	0.33^{ab}	0.43^{ab}	0.43^{ab}	0.50^{abc}	0.46^{ab}	0.33^{bc}	47.61
Fertilizer	0.23^{ab}	0.30^{bc}	0.40^{ab}	0.43^{ab}	0.53^{bc}	0.46^{bc}	0.56^{bc}	0.63^{bc}	0.76^{cd}	0.70^{bc}	0.50^{e}	20.63
Insecticide	0.13^{a}	0.23^{abc}	0.26^{a}	0.30^{a}	0.36^{ab}	0.33^{b}	0.40^{ab}	0.43^{ab}	0.36^{ab}	0.36^{a}	0.31^{b}	50.79
Herbicide+fertilizer	0.16^{ab}	0.26^{abc}	0.26^{ab}	0.33^{a}	0.33^{ab}	0.36^{b}	0.36^{a}	0.40^{ab}	0.33^{a}	0.30^{a}	0.30^{b}	52.38
Herbicide+insecticide	0.10^{a}	0.16^{ab}	0.23^{a}	0.26^{a}	0.23^{a}	0.20^{a}	0.30^{a}	0.36^{a}	0.30^{a}	0.26^{a}	0.24^{a}	61.90
Fertilizer+insecticide	0.23^{ab}	0.30^{bc}	0.30^{ab}	0.43^{ab}	0.40^{ab}	0.43^{bc}	0.46^{abc}	0.46^{ab}	0.60^{bcd}	0.70^{bc}	0.43^{d}	31.74
Herbicide+fertilizer+insecticide	0.13^{a}	0.33^{bc}	0.33^{ab}	0.36^{ab}	0.36^{ab}	0.40^{b}	0.43^{ab}	0.46^{ab}	0.53^{abc}	0.50^{ab}	0.38^{c}	39.68
CD(P=0.05)	0.136**	0.149**	0.166*	0.146*	0.141**	0.122**	0.122**	0.144*	0.178**	0.191**	0.074**	--

**- Significant at P=0.01, *- Significant at P= 0.05, In a coloum mean followed by a common letter are not significantly different by DMRT (P=0.05), # - Mean of 10 plants, Mean of 3 Replications

Table 2. Impact of agrochemicals on the population of spiders in bhendi ecosystem during *rabi*, 2012-13 (Field experiment II)

Treatments	Population of spiders #										Overall mean	Percent reduction over control
	3rd week	4th week	5th week	6th week	7th week	8th week	9th week	10th week	11th week	12th week		
Untreated check	0.36^{b}	0.46^{b}	0.60^{b}	0.66^{b}	0.63^{b}	0.70^{e}	0.80^{d}	0.86^{c}	0.90^{d}	1.00^{c}	0.70^{e}	--
Herbicide	0.23^{ab}	0.26^{a}	0.40^{a}	0.36^{a}	0.36^{a}	0.40^{bc}	0.46^{abc}	0.53^{ab}	0.53^{abc}	0.56^{ab}	0.41^{bc}	41.43
Fertilizer	0.30^{ab}	0.40^{ab}	0.46^{ab}	0.50^{ab}	0.53^{ab}	0.60^{de}	0.63^{cd}	0.66^{bc}	0.73^{cd}	0.80^{bc}	0.56^{d}	20.00
Insecticide	0.23^{ab}	0.33^{ab}	0.36^{a}	0.40^{a}	0.36^{a}	0.23^{ab}	0.46^{bc}	0.46^{ab}	0.46^{ab}	0.46^{a}	0.38^{b}	45.71
Herbicide+fertilizer	0.26^{ab}	0.36^{ab}	0.40^{a}	0.43^{a}	0.43^{a}	0.46^{cd}	0.40^{ab}	0.46^{ab}	0.50^{ab}	0.40^{a}	0.41^{bc}	41.43
Herbicide+insecticide	0.16^{a}	0.26^{a}	0.30^{a}	0.33^{a}	0.36^{a}	0.16^{a}	0.30^{a}	0.40^{a}	0.36^{a}	0.36^{a}	0.30^{a}	57.14
Fertilizer+insecticide	0.30^{ab}	0.40^{ab}	0.36^{a}	0.46^{ab}	0.46^{ab}	0.26^{ab}	0.50^{bc}	0.56^{ab}	0.63^{bc}	0.80^{bc}	0.48^{c}	31.43
Herbicide+fertilizer+insecticide	0.20^{a}	0.43^{b}	0.36^{a}	0.43^{a}	0.43^{a}	0.30^{abc}	0.46^{abc}	0.53^{ab}	0.56^{bc}	0.60^{ab}	0.43^{bc}	38.57
CD(P=0.05)	0.115**	0.118**	0.119**	0.133*	0.118**	0.125**	0.124**	0.129**	0.125**	0.154**	0.076**	--

**- Significant at P=0.01, *- Significant at P= 0.05, In a coloum mean followed by a common letter are not significantly different by DMRT (P=0.05), # - Mean of 10 plants, Mean of 3 Replications

This finding is in accordance with the reports of several authors. Mahal *et al.* (1994) reported spiders, ants and beetles played significant role in balancing the population of harmful insects in bhendi. Sakthivel (2007) recorded least population of spiders in the treatment with carbaryl 50 WP @ 0.1 per cent. Many researchers claimed that herbicide not only affect the survival of spiders but also influence their behaviour (Tietjen, 2006; Deng *et al.,* 2007 and Wilder and Rypstra, 2007). Mochiah (2011) reported that, huntsman spider, *Heteropoda venotoria* Linn. numbers were larger on NPK treated plots and least on the control plots of cabbage.

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