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Impact of weather factors on predatory spiders in Bt and non Bt-cotton fields of Warangal, Telangana

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ABSTRACT

The diversity of spiders were recorded in the growth period of Bt and non Bt-cotton fields in Warangal district. Spiders were collected every week from June 2011 to March 2012, and June -2012 to March 2013, using two types of sampling methods hand picking and pitfall traps. A total of 1626 spiders belonging two families, 4 genera and five species were recorded. Araneidae was represented by three species, viz *Areneusspp, Arjiopeanasuja,* and *Arjiope pulchella*and oxyopidae by twospecies*Peucetia viridians,* and *Oxyopesrufisternum*. Abundance of spiders population showed positive correlation with minimum temperature and relative humidity (morning and evening) negative correlation with maximum temperature and rainfall.

KEYWORDS: spider fauna, Bt-cotton and non Bt-cotton, temperature, relative humidity, rainfall.

INTRODUCTION

Cotton is very important cash crop of many warm climatic countries of the world i.e. USA, Brazil, China, India and Pakistan etc. cotton was considered as a major fiber crop and Indian farmers were named it as white gold.

The climate of Telangana is very suitable for Bt and non Bt-cotton cultivation. But unfortunately phytophagous insects cause serious damage to cotton crops. In the recent years, the use of the insecticides in cotton fields of Telangana has increased by several fields**.** The use of insecticides adversely affected the non- target organisms and also deplete biodiversity essential for ecological stability. Spiders are abundant invertebrate fauna in any environment (Coddingfon and Levi 1991); Spiders play a key role in integrated pest management (IPM) in agro ecosystems.

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Spiders are not insects, but most species are highly beneficial as they feed on insects and small arthropods. They have eight legs two body regions. They are abundant, widely distributed on every continent except Antarctica (Foelix 1996). Ecological parameters and taxonomic importance of different species of spiders from cotton fields were investigated by many researchers, (Nentwing 1986, Ghafoor 2002, Platnick 2004, Alvi 2007, Maqsood 2011). They have been reported more than 1000 individuals per m^2 (Ellenberg*et al.,* (1986).More than 35000 species of spiders have been identified in the world (Ghavami*et al.,* 2007a) Spidersare more common predators of the harmful insects, (Nentwing 1986, Riechert 1984) Ecological diversity of spiders plays very important role in natural check (Huffaker 1975). So biological control through spiders is one of the best strategies to redue the use of chemical pesticides as well as the population of the insect pests. Spiders have been observed as potential natural enemies of key pests of cotton and play an important role in the cotton eco system (Dhaka and Pareek, 2007). The seasonal dynamics of spider population were observed in the early stages of the Bt-cotton. Liu*et al.,* (2003**)** and reported that number of spiders in Bt-cotton field was 398 per 100 plant at 49.7 percent of the total predators (Bardwell and Averill 1997) reported that *Oxyopes mandulus* was dominant species in cotton fields. *Philodromu scespitum* was on the most common predator on cotton pests in chiness cotton fields (Liu and Niu (1981).

O. salticus dominant species in Texas cotton fields (Dean *et al.,* 1982) *C*. *pennyi* had high population in German cotton fields (Wolf 1990).Spiders are one of the most abundant predatory groups, in the terrestrial ecosystems and play important role in pest control (Schaffer 1974; Edwards *et al.,* 1976).

The present study aims to investigate diversity of spiders in Bt-cotton and non Bt-cotton fields of Warangal, Telangana.

MATERIAL AND METHODS

The abundance of spiders were collected using two types of sampling methods (pitfall traps and hand picking) every week from June2011 to March 2012 and June 2012 to March 2013throughout the cropping period of the Bt and non Bt-cotton fields..

We carried out a survey by "fixed plot method Govindaiah and Gunashekar V. (1992) in five Bt-cotton fields and five Non Bt- cotton fields, with similar crop pattern in agricultural fields, surrounding of Warangal. The survey was made during June-2011 to March-2013. In each selected cotton field five plots of 5 m × 5 m were marked out (one each in the four corners, 10m away from the border, and one in the center), thus making a total of 25 plots in each crop. Total number of plants and number of spiders on each plant were counted in each plot the percentage was calculated every week after sowing. The data was recorded at morning hours (8-10am), the predators were identified with help of guide on cotton pest and predators (Dilip kumar *et al*., 2008), Regional Agricultural research station ANGRAU, Warangal and with help of literature. Meteorological data of rainfall, temperature and humidity was measured during the whole research period and calculated its impact on predators abundance with correlation coefficient.

RESULTS

A total of fivespider species belonging, two families were recorded. Family oxyopidae represented two species *Peucetia viridians,* and *Oxyopesru fisternum,* and family araneidae, *Areneusspp, Arjiopeanasuja,* and *Arjiopepulchella* (Table-1).

The green spiders were observed in 5th week in both Bt-cotton and Non Bt-cotton fields. Maximum number of green spiders was recorded 16th week (October) in Bt-cotton and Non Bt-cotton fields during June 2011-March 2012. The green spiders were recorded in 5th week in both crops. Maximum number of green spiders were recorded18th week in Bt-cotton and 15th week in Non Bt-cotton (October) during June 2012-March2013.The abundance of green spider was higher (7.40 ± 1.36, 6.00 ± 1.04) in Non Bt-cotton compared to the Bt-cotton during 2011-2012 and (6.6 ± 0.68, 5.25 ± 1.31) during 2012-2013respectively (Table-2 & 3) and (Figure-1).

The Brown lynx spider was observed in 9th week in Bt-cotton and 5th week in Non Bt-cotton. Maximum number of brown lynx predators were recorded11thweek (September) in Bt-cotton and Non Bt-cotton fields during June 2011- March 2012, (Figure-2).The brown lynx spider was recorded in 7th week in Bt-cotton and 4th week in Non Bt-cotton During the June 2012 March 2013. Maximum number of brown lynx spider were recorded 13thweek (September) in Bt and Non Bt-cotton fields. The brown lynx spider abundance was higher (3.00 ± 0.40, 1.75 ± 0.25) in Non Bt-cotton compared to the Bt-cotton fields during 2011-2012and (3.00 ± 0.70, 1.8 ± 0.58) during 2012-2013 respectively (Table-2 & 3).

The garden spider was observed in 5th week in Bt and Non Bt-cotton fields, maximum number of garden spiders was recorded15th week (October) in Bt and Non Bt-cotton during June 2011- March 2012, (Figure-3).

However, garden spider was recorded in 4th week in Bt-cotton and 6th week in Non Bt-cotton crops after sowing. Maximum number of garden spiders was recorded16th week (October). The garden spider abundance was higher in Non Bt-cotton compared to the Bt-cotton (6.8 ± 0.96, 5.20 ± 0.2) and (5.6 ± 1.56, 4.5 ± 1.19) during June 2011- March 2012and June 2012- March 2013 respectively.

The predator *Arjope anasuja* was observed in 13th week in Bt-cotton and 11th week in Non Bt-cotton and maximum number of *Arjope anasuja* predator was recorded in 28thweek (January) in Bt and Non Bt-cotton during 2011-2012 and 2012-2013. The predator *Arjope anasuja* abundance was higher in Non Bt-cotton compared to the Bt-cotton (6.00 ± 0.87, 5.00 ± 0.54) and (5.00 ± 0.40, 8.25 ± 0.62) during 2011-2012 and 2012-2013 (Table-2 & 3) and (Figure-4).

Table-1. Diversity of spider species collected fin the Bt and Non Bt-cotton fields of Warangal District, during 2011-2013

S.NO	ORDER	FAMILY	SCIENTIFIC NAME	COMMON NAME
1	Aranea	oxyopidae	*Peucetiaviridans*	green lynx spider
2		oxyopidae	*Oxyopesrufisternum*	brown lynx spider
3		araneidae	*Areneus spp*	garden spider
4		araneidae	*Arjiope anasuja*	Writing spider
5		araneidae	*Arjiope pulchella*	Signature spider

Figure-1: *Peucetiavirdans* (Green lynx spider) in Bt-cotton and Non Bt-cotton fields

Figure-2: *Oxyopesrufisternum* (Brown lynx spider) in Bt-cotton and Non Bt-cotton fields

Figure-3: *Areneusspp* (Garden Spider) in Bt-cotton and Non Bt-cotton fields

Figure-4: *Arjiope anasuja* (Writing spider) in Bt-cotton and Non Bt-cotton fields

Figure-5: *Arjiope pullchella* (Signature spider) in Bt-cotton and Non Bt-cotton fields

The predator *Arjiope pulchella* was observed in 12th week in Bt-cotton and 11th week in Non Bt-cotton. Maximum *Arjiopepulchella* were recorded 28th week (January) in Bt-cotton and Non Bt-cotton during 2011-2012**.** The *Arjiopepulchella* was observed n 13th week of Bt-cotton and 11th week of Non Bt-cotton. It's gradually reached at maximum in 29thweek of crop (January) in Bt and Non Bt-cotton during 2012-2013. The *Arjiopepulchella* was higher in Non Bt-cotton compared to the Bt-cotton (7.2 ± 0.96, 5.80 ± 0.73) and (6.25 ± 0.25, 4.5 ± 0.64,) during 2011-2012 and 2012-2013 respectively (Table-2 & 3) and (Figure-5).

Statistical Analysis

The correlation between incidence of spiders and weather factors such as monthly maximum temperature, minimum temperature, morning relative humidity, evening relative humidity and rainfall was calculated (Table-4 & 5).

The correlation of green spiders with maximum temperature showed negative correlation and positive correlation with minimum temperature relative humidity morning and evening in both crops. Showed positive correlation and rainfall showed negative correlation both the years.

The brown spider showed a negative correlation with maximum temperature and a significant positive correlation with minimum temperature morning, evening relative humidity and rainfall in Bt and Non Bt-cotton fields in both the years.

Garden spiders showed a negative correlation with maximum temperature and rainfall and positive correlation with minimum temperature, relative humidity morning evening in Bt and Non Bt-cotton during the study period (at the 0.01 levels) (Table-4 & 5).

The correlation of *Arjiopeanasuja* showed a significant negative correlation with maximum temperature minimum temperature and rainfall and a positive correlation with morning, evening relative humidity in Bt and Non Bt-cotton during the study period.

The *Arjiope pulchella* showed a significant negative correlation with maximum temperature minimum temperature and rainfall and positive correlation with morning and evening relative humidity in Bt and Non Bt-cotton during the study period (Table-4 & 5)

DISCUSSION

The survey was carried out to study the pest of Bt and Non Bt-cotton and their natural enemies at different crop growth stages under rain fed condition during 2010-2012. The results of the present investigation were discussed. The seasonal mean abundance of spiders indicated that no much variation in the mean population of spiders between Bt-cotton and Non Bt-cotton fields.

Natural enemies like pirate bug, big eyed bug, Green lacewings and Ants were present throughout the season while spiders were mostly found in middle of the cropping seasons in the present study Ge-Feng*et al.,* (1996) reported same results in the cotton field of China.Xu Wen Hua*et al.,* (2004) reported the significant variation in population dynamics spiders in cotton fields in China during 2002.

In general the seasonal mean abundance of predators indicates that there was little difference with respect to natural enemies viz,.Green lynx spider, brown lynx spider, garden spider, writing spider and signature spider in Bt and Non Bt-cotton.

Present results indicated that Bt-cotton effect the activity of natural enemies like spiders present findings are in close agreement with Kengegowda (2003), who reported that natural enemies spider appeared more or less same in Bt and Non Bt-cotton. Rajanikanth (2004) who reported that there was no difference in predatory population in Bt and Non Bt-cotton. The present investigation not agreement with Hegde*et al.,* (2004a) who reported no difference in the population of coccinellidae between Bt and Non Bt-cotton**.**

The present findings were contrary to the Hagerty*et al.,* (2005) who reported that the activity of natural enemies (Spider, coccinellits, lace wings) were consistently higher in Bollgard and Bollgrard-II, as compared to Non Bt-cotton.

Sun *et al.,* (2003) reported that the population density of natural enemies was significantly lower in transgenic cotton than in normal cotton the present findings similar that of Sun *et al.,* Head *et al.,* (2005) reported that the population of *Geocorisspp,* orius *spp*. *Solenopsis invicta*, lady beetles and spiders, while the number of *Helicoverpa* were significantly lower in the Bt cotton the present findings are close that of Sun *et al.,* (2003).

In the present investigation observed that predator numbers varied significantly between months within two years in Bt and Non Bt-cotton. This is similar to the finding of Silberbaur (2001). These crops could be providing resources for predators at different times of the year. In September there were a large number of predators in Bt-cotton and Non Bt-cotton fields. However, predators were observed from September to December during study period. It is possible that predators migrated from surrounding vegetation in to the cotton fields, this could be because the cotton is provides a suitable microclimate for both insect pests and predators.

CONCLUSION

Overall predator of spiders population was little higher in Non Bt-cotton compared to Bt-cotton. These were quite complex interactions between the habitats and the movement of predators.

Conflict of Interests

Authors declare that there is no conflict of interests regarding the publication of this paper.

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