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Research Article

Seasonal population dynamics of spider mite, *Tetranychus ludeni* Zacher (Tetranychidae) and associated predatory mite, *Neoseiulus* sp. nr. *neoghanii* (Phytoseiidae) on tomato (*Solanum lycopersicum* L. *var*. Solan gola: Solanaceae) from Himachal Pradesh, India

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ABSTRACT: The study was carried out during 2013 and 2014 on tomato (*var*. Solan gola) in open field. Infestation of *Tetranychus ludeni* Zacher was recorded. Predatory mite *viz*. *Neoseiulus* sp. nr. *neoghanii* was observed in association with *T. ludeni*. Maximum population of *T. ludeni* was recorded during June month both years with population 2.6±0.58 (2013) & 2.3±0.42 (2014) mites/leaf. *N.* sp. nr. *neoghanii* was observed in June and July month. Population was 0.2±0.2 mites/leaf both years. Populations of *T. ludeni* and *N.* sp. nr. *neoghanii* showed a positive correlation with average temperature and negatively correlated with relative humidity. Occurrence of these species on this crop was the first report from this region. The study will be useful in bio control programme in near future.

KEY WORDS: Biological control, mite, phytophagous, predator

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INTRODUCTION

Tomato (*Solanum lycopersicum* L.) is an important vegetable of Himachal Pradesh and plays an important role in uplifting the economy of farmers in the state. This crop is grown on a commercial scale in the mid hill regions under protected as well as in open field. This vegetable is attacked by a number of pest species. Worldwide, more than one hundred pests have been reported on this crop (Taleker *et al*., 1983). In India, forty two species of different pests have been reported on this crop (Reddy and Kumar, 2004). Eight pest species were also reported on tomato and other vegetables from Himachal Pradesh (Vashisth *et al*., 2013). Pests not only causes major losses to the quality and quantity but act as vector of various diseases. (Dharumarajan *et al*., 2009). Yield loss in vegetables was approximately 9.15-100% or some time failure of the crop due to pests attack (Gupta, 1991; Prasad and Singh, 2007; Prasad *et al.,* 2007; Patil and Nandihalki, 2009; Vinothkumar *et al*., 2009).

Mites belonged to the family Tetranychidae and Eriophyidae are among the destructive pests on various crops in many parts of the world (Pokle and Shukla, 2015a). The two spotted spider mite is cosmopolitan in its distribution and reported as one of the serious pest on various crops (Manjulata *et al.*, 2002). Introduction of high yielding varieties, improvements in cultural practices and indiscriminate use of pesticides since last three decades have made these pests become more serious (Prasad *et al.*, 2007). Due to their short life cycle, they are reported to develop resistance against different chemicals (Kumar *et al.,* 2002; Sridhar and Jhansi Rani, 2003; 2007).

So, the need of need of the hour is to apply IPM practices to overcome the problem of resistance and to check the economic loss of farmers. Biological control offers an efficient alternative to check their population below economic injury level (Mahr *et al*., 2008). Predatory mites are reported as potential predators of spider mites throughout the world (Rachana *et al*., 2009; Bjorson, 2008; Zhang, 2002). But, before using these natural enemies as biological control agents, it is essential to know about their habitat and seasonal population. So, keeping this in view, the present investigation was carried out to know the seasonal incidence of spider mite and predatory mites association on tomato.

MATERIALS AND METHODS

Study was carried out during 2013 and 2014 on tomato crop (*var*. Solan gola) in open field at experimental farm, Department of Entomology. Seedlings were planted in the month of April for both the years and data was recorded from May to August at fifteen days interval. For data observation five plants were selected randomly. Samples of fifteen leaves from each plant were plucked and placed in polythene bag tied with rubber band. Samples were kept in refrigerator at 5^{0}C overnight to immobilize the mites. Samples were observed under stereo zoom microscope (Olympus SZX 9) and only motile stages were counted carefully. Mean population and standard error of mean was calculated through one way ANNOVA.

Correlation between population dynamics and abiotic factors (*i.e.* average temperature and relative humidity) were carried out and correlation coefficient was calculated.

Identification

For identification, the mite specimens were mounted in a drop of Hoyer's medium on microscopic slides (Singh and Raghuraman, 2011; Jeppson *et al.*, 1975). Slides were dried in hot air oven at 35-40^{o}C for 4-5 days. Specimens were observed under phase contrast microscope (Olympus SZX 41) and identification was done by following standard keys (Gupta and Gupta, 1994; Gupta, 2002, 2003; Chant and McMurtry, 2007).

RESULTS AND DISCUSSION

Infestation of *Tetranychus ludeni* Zacher was observed throughout the crop season. Only phytoseiid *i.e. Neoseiulus* sp. nr. *neoghanii* was recorded in association with the population of *T. ludeni*. Data were recorded for two crop seasons during 2013 and 2014.

Seasonal population of *Tetranychus ludeni* and *Neoseiulus* sp. nr. *neoghanii* during 2013 and 2014

Average population of *T. ludeni* was 1.2±0.42 mites/leaf (2013) and 2±0.42 mites/leaf (2014). Increase in population was recorded in the month of June for both the years *i.e.* 2.6±0.58 mites/leaf in 2013 and 2.3±0.42 mites/leaf during 2014. Population decline was also recorded from July to August during the years. Population of *T. ludeni* during these months were 2.1±0.43 & 1±0.42 mite/leaf (2013) and 2.2±0.43 & 1.2±0.41 mite/leaf during 2014 (Figure. 1).

Neoseiulus sp. nr. *neoghanii* was observed in association with *T. ludeni* during June and July months of 2013 and 2014. Average population was 0.2±0.2 mites/leaf respectively (Figure 1).

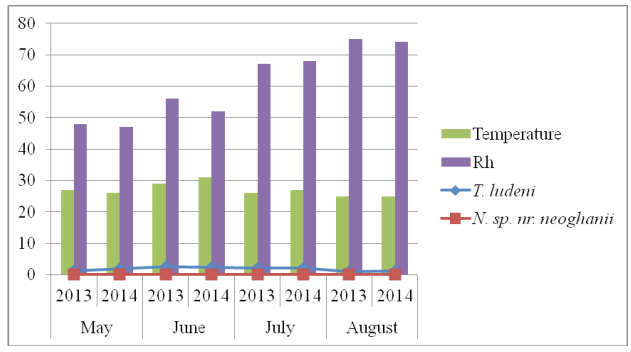

Fig. 1. Seasonal population dynamics of *Tetranychus* and *Neoseiulus* sp. nr. *neoghanii* on tomato (*var*. Solan gola) during 2013 and 2014.

The correlation study of mite population with abiotic factors *viz.* average temperature and relative humidity were also worked out (Table 1). The population of *T. ludeni* showed a high positive correlation with temperature during the period of study however population was negatively correlated with relative humidity (Table 1). Population of *N.* sp. nr. *neoghanii* was positively correlated with temperature for both the years but showed no correlation with relative humidity during 2013 but negatively correlated with relative humidity was observed 2014 (Table 1).

Table 1. Correlation between population of *Tetranychus ludeni* Zacher and *Neoseiulus* sp. nr. *neoghanii* with abiotic factors on tomato (*var*. Solan gola) during 2013 and 2014

Climatic Factors	*T. ludeni*		*Neoseiulus* sp. nr. *neoghanii*	
	2013	2014	2013	2014
Temperature (^{0}C)	0.731	0.730	0.507	0.768
Relative Humidity (%)	-0.202	-0.621	0	0.022

Earlier, infestation of *T. ludeni* was reported by Sood and Kakar (1990) on *Dahlia* sp. from Himachal Pradesh. Rachana *et al*. (2009) reported two species of phytoseiid *viz*. *Amblyseius longispinosus* (Evans) and *Phytoseilus persimilis* A&H on okra in association with *T. neocaledonicus*. Population of *T. neocaledonicus* was high in the month of April whereas population of *A. longispinosus* and *P. persimilis* was reported during July and October. Zhang (2002) and Rachana *et al*. (2009) reported *Phytoseiulus persimilis* as natural enemies of spider mites on different vegetables but the *T. ludeni* population was low Pokle and Shukla (2015a) reported infestation of *T. urticae* on tomato under polyhouse condition from Navsari, Gujarat. During their study they observed that the maximum population of mites in the month of June and population was positively with correlated with the average temperature and relative humidity. These studies supported the present investigation. Infes-

tation of *A. lycopersici* was reported on tomato with population peak during May month (Pokle and Shukla, 2015b). They reported a positive correlation between abiotic factors and mite population. Solangi *et al*. (2017) reported infestation of *Eriophyes sheldoni* latus Banks on tomato in Pakistan and highest population increase was observed from May and June. These studies support the present investigation.

This study will be useful in the bio control of phytophagous mites and other soft bodied pests on tomato. So, there is need to conserve and mass multiply these beneficial organisms for use in IPM programs which will reduce the use of synthetic chemicals on various crops and make the environment safe.

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