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SEASONAL INCIDENCE OF MITES ON KINNOW IN PUNJAB

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ABSTRACT

Field surveys were conducted at ten days intervals from February 2016 to September 2017 in six Kinnow orchards at three locations (Ludhiana, Abohar, Hoshiarpur) in different agroclimatic zones of Punjab to evaluate the population dynamics of mites on kinnow. The study revealed the occurrence of *Brevipalpus phoenicis* (Geijskes), *B. californicus* (Banks), *Tetranychus urticae* Koch, *Eutetranychus orientalis* (Klein) and *Polyphagotarsonemus latus* (Banks) as the most common phytophagous mites. The predatory mites viz., *Euseius alstoniae* Gupta, *E. finlandicus* (Oudemans) and *Cunaxa setirostris* (Hermann) were also found. The study showed that weather factors affected mites similarly in different fruit zones of Punjab. There was a negative correlation between mite abundance and rainfall at all locations. The families viz. Tenuipalpidae, Tarsonemidae and Cunaxidae exhibited a negative correlation with temperature and a positive with maximum relative humidity (RH). Tetranychidae had positive relationship with temperature and a negative one with maximum RH. Mite species peaked differently during various months but were more abundant in the arid (Abohar) followed by central (Ludhiana) and submontane zone (Hoshiarpur) of Punjab.

Key words: *Brevipalpus californicus, B. phoenicis*, correlation, *Cunaxa setirostris*, *Euseius alstoniae, Euseius finlandicus*, *Eutetranychus orientalis, Tetranychus urticae*, kinnow, population dynamics, weather factors

Citrus is an important fruit crop, and it occupies an area of 1028 thousand ha with total production of 13404 thousand mt (NHB, 2020), and Punjab contributes about 12.26% (Kumar et al., 2010). Its production is hampered by many factors with insect and mite pests playing a major role. Phytophagous mites (Acarina: Arachnida) are the important pests of citrus worldwide (Childers et al., 2003). The predatory mites are efficient predators in controlling phytophagous mites (McMurtry et al., 2013). The biotic and abiotic factors that influence the ecology of mites on citrus have received considerable attention (Beattie et al., 1991). The weather factors play a role in their population dynamics, but only limited information is available on the acarines on kinnow from Punjab. Hence, this study on mites inhabiting kinnow orchards in three different kinnow growing zones of Punjab.

MATERIALS AND METHODS

Field surveys were conducted at locations namely the Fruit Research Farm, Punjab Agricultural University, Ludhiana (30°54' 3.4740'' N,75°51'26.1972''E); Regional Fruit Research Station, Abohar (N 30°8'15.72", E74°12'9.1548"E) and Department of Horticulture (Punjab), Hoshiarpur (Bhunga) (31°31'38.4780''N,75°54' 49.2228''E). From February 2016 to September 2017, observations were made in these three fruit zones (Ludhiana in central zone; Abohar in arid zone; Hoshiarpur in submontane zone). For the population studies, ten trees were selected at random in each orchard and samples of 25 leaves/ tree were cut directly into transparent polythene bags (20x 25 cm). In the laboratory these leaves were examined under stereozoom microscope for counting number of mites/ leaf at ten days intervals. The mite counts were made from both upper and lower side of leaves. Collected samples were kept in small glass vials containing 70% ethyl alcohol with glycerin. The specimens were mounted in Hoyer's medium after clearing in 40% lactic acid. The mounted specimens were identified as per keys- Panou (1998); Bolland et al. (1998); Lindquist (1986); Chant and McMurtry (2007); and Mesa et al. (2009) by the second author who is working as Principal Acarologist in AINP on Agricultural Acarology. Metrological data was obtained from the Department of Climate Change and Agricultural Meteorology, Punjab Agricultural University, Ludhiana; Regional Research Station, Abohar and Hoshiarpur. The weather parameters at all the locations were correlated with mite incidence and regression equations worked out using SPPS software.

RESULTS AND DISCUSSION

During the period of investigation (February 2016- September 2017) five species of phytophagous mites namely *Brevipalpus phoenicis* (Geijskes) and *Brevipalpus californicus* (Banks) belonging to the family Tenuipalpidae; *Tetranychus urticae* Koch and *Eutetranychus orientalis* (Klein) belonging to Tetranychidae and *Polyphagotarsonemus latus* (Banks) belonging to Tarsonemidae were observed. Among the predatory mites, three species namely *Euseius alstoniae* Gupta and *Euseius finlandicus* (Oudemans) of family Phytoseiidae and *Cunaxa setirostris* (Hermann) of Cunaxidae were also recorded along with phytophagous mites.

Phytophagous mites

Tenuipalpidae (*B. phoenicis* and *B.californicus*): These mites were found to infest leaves throughout the sampling period (February 2016-September 2017), with the incidence of the latter being very low at all the surveyed three locations. As shown in Fig. 1, peak incidence of Tenuipalpidae was observed on December 7, 2016 when maximum and minimum temperature was 26.2 and 9.5ºC, maximum and minimum relative humidity (RH) was 90.4 and 37% and with no rainfall at Ludhiana. At Abohar, incidence reached its peak on November 29, 2016 when maximum and minimum temperature was 29.3 and 9.9ºC, maximum and minimum RH was 95.9 % and 20.7 % and with no rainfall. The population was very low at Hoshiarpur as compared to Ludhiana and Abohar with peak being on November 2, 2016 when maximum and minimum temperature was 26.5 and 15.4ºC. The incidence was low during rainy season (July and August of 2016 and 2017); it was maximum in arid zone (Abohar) which is having hot and dry climatic conditions followed by central zone (Ludhiana) with mild climatic conditions and submontane zone (Hoshiarpur) which is having cooler climatic conditions. The incidence of Tenuipalpidae exhibited a negative correlation with rainfall, minimum RH and temperature but maximum RH had a positive relationship. Similar results were found by Singla and Sadana (2006), Kaur et al. (2015) and Bhullar et al. (2015). In contrast, Singla and Sadana (2000) observed a positive correlation with temperature and negative correlation with RH and rainfall; also, peak incidence of *B. phoenicis* was during May and smaller peak during November on kaghzi lime. The coeffiecient of determination showed that the weather factors had 40.21, 43.03 and 13.33% contribution in regulating the incidence of *B. phoenicis* at Ludhiana, Abohar and Hoshiarpur, respectively. The influence of weather on *B. californicus* population was low at Ludhiana (25.29 %) and Hoshiarpur (27.46 %) as compared to Abohar (48.16%).

Tetranychidae (*T. urticae* and *E. orientalis*): During 2016, Tetranychidae mites started appearing in April, then increased in June with the increase in temperature and decrease in RH; both the species attained peak activity on June 20th (Ludhiana) and June 6th (Hoshiarpur) (Fig. 2). At Abohar *T. urticae* attained peak early (June 2nd) as compared to *E. orientalis* (June 12th). Thereafter incidence declined which might be due to rains and increased RH, and attained another

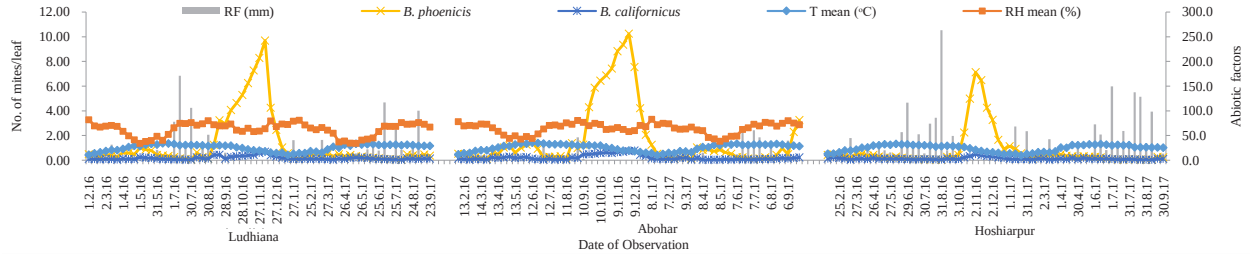

Fig. 1. Effect of weather factors on the incidence of Tenuipalpidae on kinnow leaves (2016 & 2017)

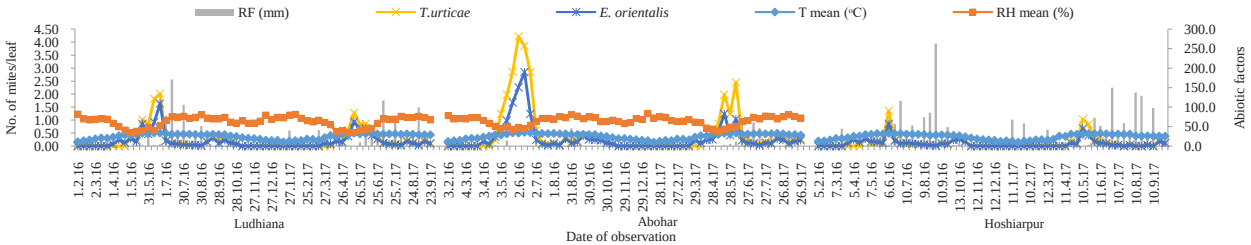

Fig. 2. Effect of weather factors on the incidence of Tetranychidae on kinnow leaves (2016 & 2017)

short peak during September (Ludhiana and Abohar) and October (Hoshiarpur). Thereafter, the incidence declined from October onwards and it was nil during winter months. In 2017, similar trend was observed. The temperature had positive and significant correlation but RH and rainfall had negative impact. Bhullar et al. (2015) also reported the presence of Tetranychidae throughout the year with maximum incidence during April- June and minimum or negligible during winter and rainy seasons. The present findings also corroborate with those of Dhooria et al. (2005), Rachana et al. (2009), Bakar et al. (2015), Kaur et al. (2015) and Mariam et al. (2016). Vela et al. (2017) reported only one peak of *E. orientalis* during autumn.

Tarsonemidae (*P. latus*): This mite was present throughout the period of observation except during hot and dry months which could be due to high temperature and low relative humidity. With increase in relative humidity and decrease in temperature there was an increase in incidecnce, with a small peak observed during December 2016 at Ludhiana and Abohar (Fig. 3); although present throughout, its incidence was very low during July- August, 2017 with a small peak in November 2016 at Hoshiarpur. Temperature and rainfall revealed a negative correlation at all three sampled locations. Kaur et al. (2015) also found *P. latus* on kinnow leaves with a peak during November and similar correlation trend was shown with weather.

Predatory mites

Phytoseiidae (*Euseius* spp.): Phytoseiids started appearing in April and with two peaks in incidence at all the surveyed locations; during 2016, first peak was during June 2016 and the second in October 2016 (Ludhiana, Hoshiarpur) and November 2016 (Abohar) (Fig. 4). During 2017, started appearing during April and followed similar trend as in 2016. No phytoseiid mites were observed during winter while a decreasing trend was observed during rainy months. The incidence revealed a negative correlation with all the weather factors except maximum temperature. Kaur et al. (2015) reported a negative correlation with RH and rainfall and phytoseiid mite population but a positive one with temperature. Singla and Sadana (2000) observed positive correlation with all the weather factors on kinnow.

Cunaxidae (*C. setirostris*): The incidence of cunaxids showed an increasing trend during September to December, with peak occurrence being on October 18th at Ludhiana, December 12th at Abohar and November 2nd at Hoshiarpur (Fig. 4). The incidence declined to nil during rainy (July and August) and winter months (January, February and March). The incidence revealed a negative correlation with maximum and minimum temperature, minimum RH and rainfall. Kaur et al. (2015) observed *C. setirostris* from September to November with peak occurrence during November.

In conclusion, the data shows that the relative changes in the abundance of mite is complex and can be affected by seasonal factors, and the prevailing climatic conditions. Results of this study could help in determining proper time for controlling phytophagous mites. Besides, the result also provides important

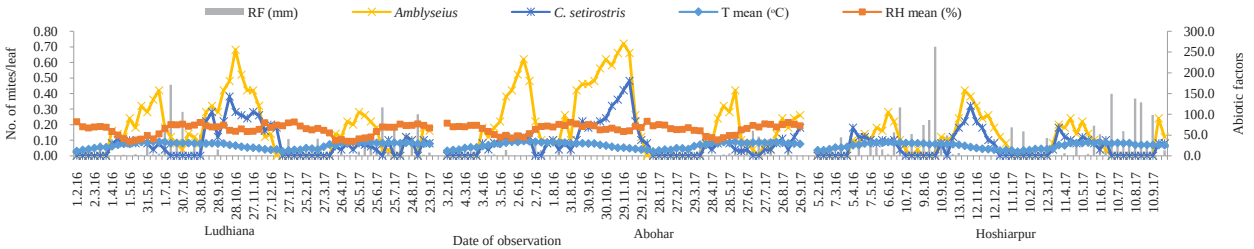

Fig. 3. Effect of weather factors on the incidence Tarsonemidae mite on kinnow leaves (2016 & 2017)

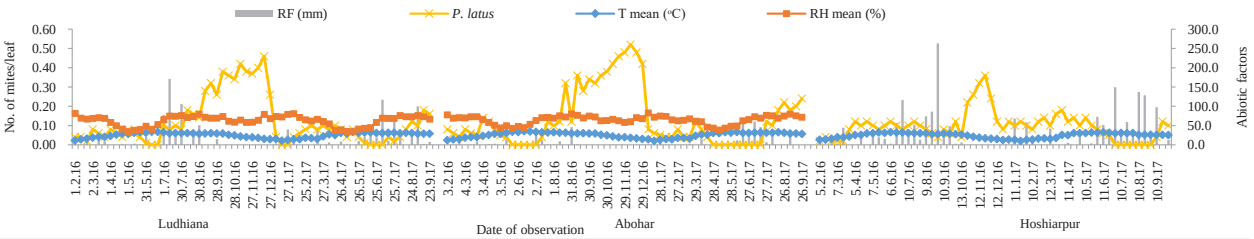

Fig. 4. Effect of weather factors on the occurrence of predatory mites on kinnow leaves (2016 & 2017)
*T= Temperature, RH= Relative Humidity, RF= Rainfall

information on potential predatory mites that can be used as biological control agents.

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REFERENCES

Bakar M A, Aqueel M A, Sohaili M, Raza A B M, Shurjeel H K, Tayyab M, Yahya M . 2015. Fluctuation in population of citrus mites, *Eutetranychus orientalis* (Klein) is mediated by temperature. American Research Thoughts 2: 3101-15.

Beattie G A C, Roberts E A, Vanhoff C L, Flack L K .1991. Effects of climate, natural enemies and biocides on three citrus mites in coastal New South Wales. Experimental and Applied Acarology 11: 271-95.

Bhullar M B, Sharma R K, Kaur P. 2015. Bulletin on mites infesting agri-horticultural crops in Punjab and their management. AINP on Agricultural Acarology, Department of Entomology, Punjab Agricultural University, Ludhiana. 29 pp.

Bolland H R, Gutierrez J, Flechtmann C H W. 1998. World catalogue of the spider mite family (Acari: Tetranychidae). Brill-Leiden-Boston-Koln, Netherland. 392 pp.

Chant D A, McMurtry J A. 2007. Illustrated keys and diagnoses for the genera and subgenera of the Phytoseiidae of the world (Acari: Mesostigmata). pp 220. Indira Publishing House, West Bloomfield, MI, USA.

Childers C C, French J V, Rodrigues J C V. 2003. *Brevipalpus californicus*, *B. obovatus*, *B. phoenicis*, and *B. lewisi* (Acari: Tenuipalpidae): a review of their biology, feeding injury and economic importance. Experimental and Applied Acarology 30: 5-28.

Dhooria M S, Bhullar M B, Mallik B. 2005. Mite pests of citrus and their management in India. AINP (Agricultural Acarology). 28 pp.

Kaur N, Bhullar M B, Sharma D R. 2015. Diversity and seasonal incidence of mites on citrus. Journal of Insect Science 28: 284-289

Kumar B, Mistry N C, Singh B, Gandhi C P. 2010. Indian horticulture database- 2009. National Horticulture Board, Gurgaon, India. 275 pp.

Lindquist E E. 1986. The world genera of Tarsonemidae (Acari: Heterostigmata): A morphological, phylogenetic and a reclassification of the family group taxa in the Heterostigma. Memoirs of the Entomological Society of Canada 136: 1-517.

Mariam M A, Sakkran Th F, Fawzy M M H, El-Shahawy G Z. 2016. Survey and population dynamic of some mites associated with citrus trees in Fayoum Governorate. Egyptian Journal of Agricultural Research 94: 1-16.

McMurtry J A, De Moraes G J, Sourasso N F. 2013. Revision of the lifestyles of phytoseiid mites (Acari: Phytoseiidae) and implications for biological control strategies. Systematics and Applied Acarology 18: 297-320.

Mesa N C, Ochoa R, Welbourn W C, Evans G A, De Moraes G J. 2009. A catalog of the Tenupalpidae (Acari) of the world with a key to genera. Zootaxa 2098. Magnolia Press, New Zealand. 185 pp.

NHB. 2020. 2nd advance estimate, Indian horticulture database, National Horticulture Board, Ministry of Agriculture, Government of India.

Panou H N. 1998. Contribution to the taxonomy and study of the feeding habits of Tydeidae (Acari: Prostigmata) of Greece. Agricultural University of Athens, Athens, Greece.

Rachana R R, Manjunath M, Devi G, Naik M I. 2009. Seasonal incidence of red spider mite *Tetranychus neocaledonicus* Andre and its natural enemies. Karnataka Journal of Agriculture Science 21: 213-14.

Singla N, Sadana G L. 2000. Population of *Brevipalpus phoenicis* (Geijskes) on *Citrus aurantifolia* var. Sourlime in relation to seasonal fluctuations and predators. Annals of Agricultural and Biological Sciences 5: 183-87.

Singla N, Sadana G L. 2006. Factors influencing population dynamics of tenuipalpid mite species on two varieties of citrus. Pestology 30: 20-23.

Vela J M, Wong E, Jaques J A, Ledesma C, Boyero J R. 2017. Mite diversity (Acari: Tetranychidae, Tydeidae, Iolinidae, Phytoseiidae) and within-tree distribution in citrus orchards in southern Spain, with special reference to *Eutetranychus orientalis.* Experimental and Applied Acarology 73: 191-207.

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