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Diversity and Seasonal Variation in population of a Phytophagous and Predatory Mites associated with Apple trees in District Kullu (H.P.)

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ABSTRACT: Studies on population dynamics of some mites found associated with apple plants were conducted in orchards located at Nirmand (1450 m) in Kullu area. *Panonychus ulmi* Koch, a phytophagous mite and *Amblyseius (Euseios) pruni* Gupta, a predatory mite were investigated during March, 2005 to February, 2006 in the leaf samples collected from Nirmand area of Kullu hills. Studies on seasonal variations in population dynamics of *Panonychus ulmi* and *Amblyseius (Euseius) pruni* revealed that both these species appeared in the month of March on apple crop. Thereafter, their population started increasing till it attained a maximum during the month of June (27.83% and 26.93% respectively). Afterwards, there was a considerable decline till the month of August. A minor peak was again observed during the month of September (0.71% and 0.43% respectively) and then there was a constant decline in population of both *Panonychus ulmi* and *Amblyseius (Euseius) pruni* till December (0.71% and 0.43% respectively) and afterwards no infestation was observed. These variations in mite populations may be due to the fluctuations in temperature, relative humidity and sunshine hours.

Keywords: Mite, Phytophagous, Predatory, Seasonal Variation, Population.

INTRODUCTION

Mites constitute a huge group of economically important invertebrate arthropods with rich diversity and a wide range of habitats. At present there are more than 40,000 species under about 1,800 genera[1]. In recent years mites are gaining importance because they play an important role in agriculture, as many species are plant feeders causing various types of plant deformities and reduction in crop yield. Not all mites are harmful, but there are some species which are beneficial to mankind and predate upon phytophagous and other harmful species, thereby playing an important role in biocontrol programmes[2,3 & 4]. Most of the Phytophagous and predatory mites occur in the field throughout the year in tropical climates except, of course, in rainy seasons when the population declines considerably due to washing away of the mite population and also during severe winter months when the egg laying ceases due to dropping down of temperature below the developmental threshold[5]. The temperature, humidity and light are the important factors influencing the dynamism of mites[6-9]. At present, Himachal Pradesh is one of the principal temperate fruit growing states of the country with apple, almond, cherry, peach, plum and apricot being the important temperate fruits. Temperate fruits popularly known as hill fruits are grown in Himachal Pradesh at altitudes of 1200 m or above. One of the major problems regarding temperate and tropical fruits is the damage caused by insects and mite pests. The plant feeding or phytophagous mites usually feed on their leaves, but as their population increases and overcrowding occurs they migrate to other parts of infested plants[5]. Trees, because of their perennial nature, provide a more stable environment for the development and build up of mite population. Therefore there is a need to conduct detailed studies on the biology, behavior, ecology and damage caused by various fruit mites. These studies also form the basis for the management of different phytophagous and parasitic mites infesting different agricultural and horticultural crops of India.

MATERIAL AND METHODS

Mites were collected during the survey conducted in orchards of Nirmand area (1450m) of District Kullu, Himachal Pradesh during 2005-06. Specimens were preserved in the Oudeman's fluid and mounted in Hoyer's medium[2] in the laboratory for identification. Seasonal variations in population of some phytophagous and predatory mites associated with apple crop were studied at Nirmand (1450 m) in Kullu hills. In the apple orchards located at Nirmand (Kullu), phytophagous mite *Panonychus ulmi* (Koch) and predatory mite, *Amblyseius* (*Euseius*) *pruni* Gupta were investigated during March 2005 to February 2006. For these studies, annual cycle of Nirmand area (Kullu) was divided into spring (March-April), summer (May-June), rainy (July-August), autumn (September- October), early winter (November-December) and late winter (January-February) seasons. In the field, five plants were selected randomly and examined closely with the help of a hand lens (10 x 1), so that an idea of the plants being infested could be made. It was essential in order to ensure the presence of mites on the plant material before their collection. From each plant, six leaves were plucked and a sample of 30 leaves was examined at regular fortnightly intervals. Every time leaves of five plants were taken from the field for investigations. Observations regarding the occurrence of mites were recorded both on the ventral as well as dorsal surface of each leaf. The count of motile stages was made on each leaf sample[10]. Statistical analysis of data was done by calculating standard deviation, standard error about mean and coefficient of variation. t-test was applied for testing the significance of the results[11].

RESULTS AND DISCUSSION

Studies revealed the presence of a Phytophagous mite *Panonychus ulmi* (Koch) of family Tetranychidae and a predatory mite *Amblyseius (Euseius) pruni* Gupta of family Phytoseiidae.

1. *Panonychus ulmi* (Koch):

Diagnostic Features: A large brick red mite, female larger with oval, convex upward body measured 379±2.568 µ in length and 224±1.659 µ in breadth; dorsal idiosomal setae borne on strong whitish tubercles; setae long serrated and tapering gradually; white spots present at the bases of dorsal setae; terminal sensillum of palpus much longer; tibia I and tarsus I with one sensory seta each; genital flap with transverse striae; medioventral setae of moderate size; body of male weakly convex dorsally and ventrally, narrowed posteriorly. Aedeagus sharply bent dorsally, becomes slender to form sigmoid distal end (Figure 1, 2).

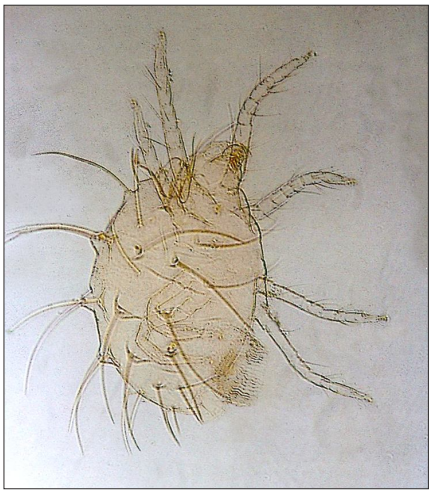

Figure1: ***Panonychus ulmi*** **(Koch) Female**

Figure 2: ***Panonychus ulmi*** **(Koch) Male**

2. *Amblyseius* (*Euseius*) *pruni* Gupta:

Diagnostic Features: Creamish white fast moving mite with rounded body measured 422±1.278 µ in length and 228±1.265 µ in breadth; sternal shield slightly longer than wide with 3 pairs of sternal setae; genital shield almost as wide as the greatest width of ventrianal shield; a pair of genital setae present; ventrianal shield wider than long, widest at its anterior end; 3 pairs of preanal setae present; chelicerae digits armed with teeth; macrosetae present on leg IV; posterior mediodorsal pair of setae longer and serrated; peritreme extended anteriorly upto coxae II (Figure 3).

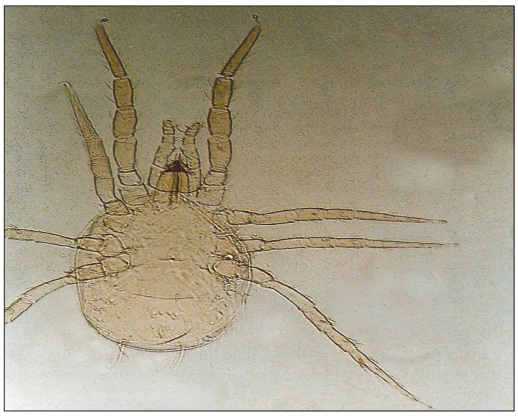

Figure3: ***Amblyseius* (*Euseius*) *pruni* Gupta**

3. Seasonal Variations: Seasonal variations in population dynamics of a phytophagous mite, *Panonychus ulmi* (Koch) and a predatory mite, *Amblyseius (Euseius) pruni* Gupta were recorded in an orchard located at Nirmand in Kullu hills from March 2005 to February 2006. The data on the buildup of population was recorded every 15 days interval commencing with the appearance of the mites during April till occurrence of leaf fall when almost zero population was observed during December (Table 1; Figure 4, 5 & 6).

3.1 Spring Season (MARCH - APRIL): Acarological data revealed that the population of *Panonychus ulmi* in April was 3.60±1.02. However, no infestation of this mite was found in the month of March. The population of predatory mite *Amblyseius (Euseius) pruni* was more in month of April (7.80±0.25) than March (0.50±0.32) and the difference was statistically highly significant ($P<0.01$). The percent population of *Panonychus ulmi* was 2.85 in April. Similarly percent population of *Amblyseius (Euseius) pruni* was significantly greater (11.17) in the month of April than March (0.72).

3.2 Summer Season (MAY - JUNE): The number of *Panonychus ulmi* was more in month of June (35.20±6.56) as comared to May (14.80±1.87) and the difference was statistically higly significant ($P<0.01$). Similarly the number of *Amblyseius (Euseius) pruni* was more in month of June (18.80±1.42) than May (11.80±0.85) and the difference was statistically significant ($P<0.05$). Thus the percent difference in population of *Panonychus ulmi* (27.83%) was not significant as compared to the percent population of *Amblyseius (Euseius) pruni* (26.93%).

3.3 Rainy Season (JULY - AUGUST): Studies further revealed that the number of *Panonychus ulmi* were more in July (17.20±3.2) as compared to August (7.80±1.03) and statistically the difference was highly significant ($P<0.01$) . However, very little difference was observed in the population of *Amblyseius (Euseius) pruni* in July (5.60±0.96) and August (6.20±0.66) and the difference was not significant ($P>0.05$).

Therefore, in the month of July (13.60), the population percent of *Panonychus ulmi* was significantly greater than August (6.17) and the difference in population percent of *Amblyseius (Euseius) pruni* was negligible in the months of July (8.02) and August (8.88).

3.4 Autumn Season (SEPTEMBER - OCTOBER): Number of *Panonychus ulmi* mites was more in the month of September (23.60±2.02) than October (17.20±3.2) and the difference was not significant

(P>0.05). Similarly, population of *Amblyseius (Euseius) pruni* mites was more in the month of September (10.10±1.22) as compared to October (5.60±0.76) and statistically the difference was significant (P<0.05). Thus, the percent population of *Panonychus ulmi* in the month of September was (18.66) which was greater than as in the month of October i.e. (13.60) and in case of *Amblyseius (Euseius) pruni* the percent population was greater in September (14.47) than October (8.02).

3.5 Early Winter (NOVEMBER - DECEMBER): After September a gradual decline in the population of *Panonychus ulmi* and *Amblyseius (Euseius) pruni* was recorded during October to December. Data revealed more population of *Panonychus ulmi* in November (6.20±1.86) than December (0.90±0.48) and statistically the difference was significant (P<0.05). The population of *Panonychus ulmi* reached to a zero level by the end of December.

Similar trend was observed in *Amblyseius (Euseius)* pruni. More population of *Amblyseius (Euseius) pruni* was recorded in November (3.10±0.51) than December (0.30±0.20) and reached to a zero level and the difference was significant statistically (P<0.05).

Thus the percent infestation of *Panonychus ulmi* was significantly more in November (4.90) as compared to December (0.71). Similarly the percent population of *Amblyseius (Euseius) pruni* was more in the month of November (4.44) as comared to December (0.43).

3.6 Late Winter (JANUARY- FEBRUARY): No infestation of *Panonychus ulmi* was found in the month of January and February. Similarly *Amblyseius (Euseius) pruni* was not found during these winter months.

Thus, present acarological data showed that number of *Panonychus ulmi* and *Amblyseius (Euseius) pruni* was maximum in June as compared to other seasons of the year. The results of the studies indicated that the mites started appearing in the last week of March or the first half of April month. Population decline was observed in the late July and August. Then again second population build up was observed in the month of September. In the following months the population declined and reached a zero level by the end of December due to gradual fall in temperature.

Table1

SEASONAL FLUCTUATIONS IN THE POPULATION* OF *Panonychus ulmi* (Koch) AND *Amblyseius* (*Euseius*) *pruni* Gupta ON APPLE CROP AT NIRMAND (KULLU) IN HIMACHAL PRADESH

MITE SPECIES	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB
Panonychus ulmi (Koch) X ±S.E.	Nil	3.60 ±1.02 (2.85) **	14.80 ±1.87 (11.70)	35.20 ±6.56 (27.83)	17.20 ±3.2 (13.60)	7.80 ±1.03 (6.17)	23.60 ±2.02 (18.66)	17.20 ±3.2 (13.60)	6.20 ±1.86 (4.90)	0.90 ±0.48 (0.71)	Nil	Nil
Amblyseius (*Euseius*) *pruni* Gupta X ± S.E.	0.50 ±0.32 (0.72)	7.80 ±0.25 (11.17)	11.80 ±0.85 (16.91)	18.80 ±1.42 (26.93)	5.60 ±0.96 (8.02)	6.20 ±0.66 (8.88)	10.10 ±1.22 (14.47)	5.60 ±0.76 (8.02)	3.10 ±0.51 (4.44)	0.30 ±0.20 (0.43)	Nil	Nil

* = Population expressed in terms of number of mites per sample
** = Figures in parenthesis indicate percent population.
X ± S.E. = Mean ± Standard error about mean
P < 0.05 = Significant
P < 0.01 = Highly significant
P. ulmi = JUN, SEP > OCT, JUL, MAY, AUG, NOV, APR, DEC (P < 0.05; P < 0.01)
A. pruni = MAY, JUN > SEP, APR, AUG, OCT, JUL, MAR, DEC (P < 0.05; P < 0.01)

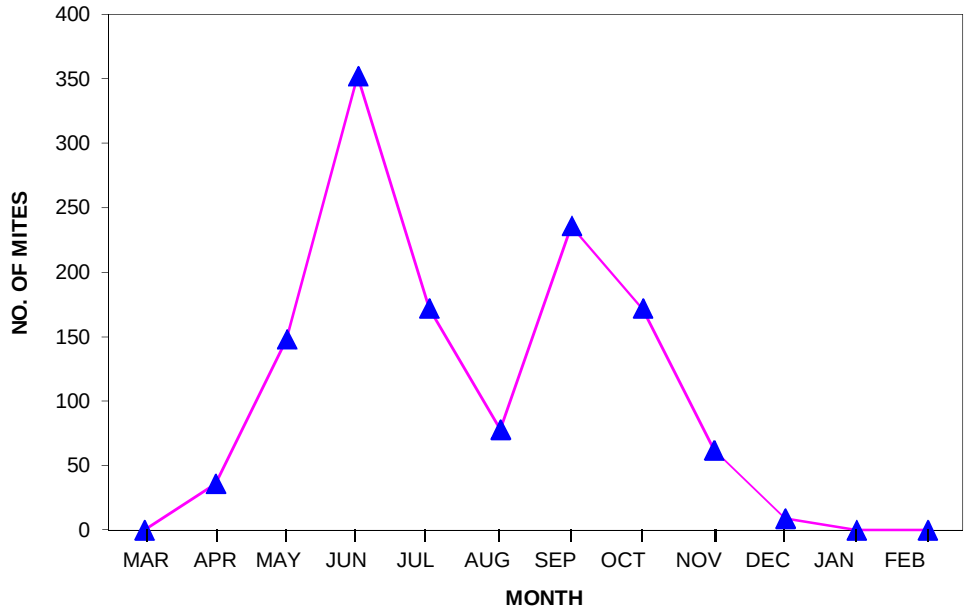

Figure 4: Seasonal variations in population of *Panonychus ulmi* on apple at Nirmand in Kullu Hills (Himachal Pradesh).

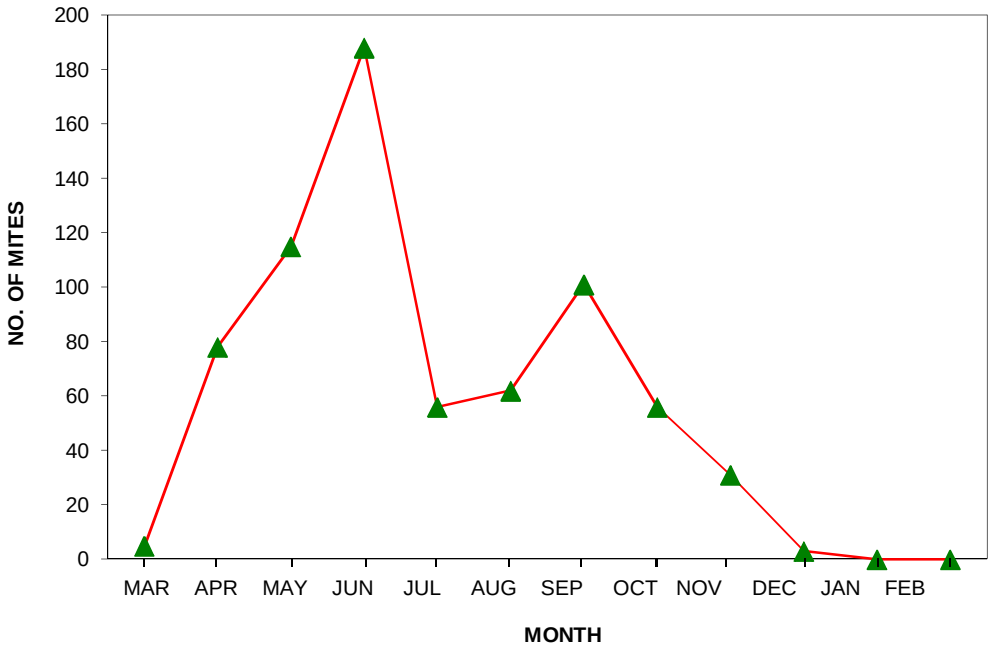

Figure 5: Seasonal variations in the population of *Amblyseius pruni* on apple at Nirmand in Kullu Hills (Himachal Pradesh)

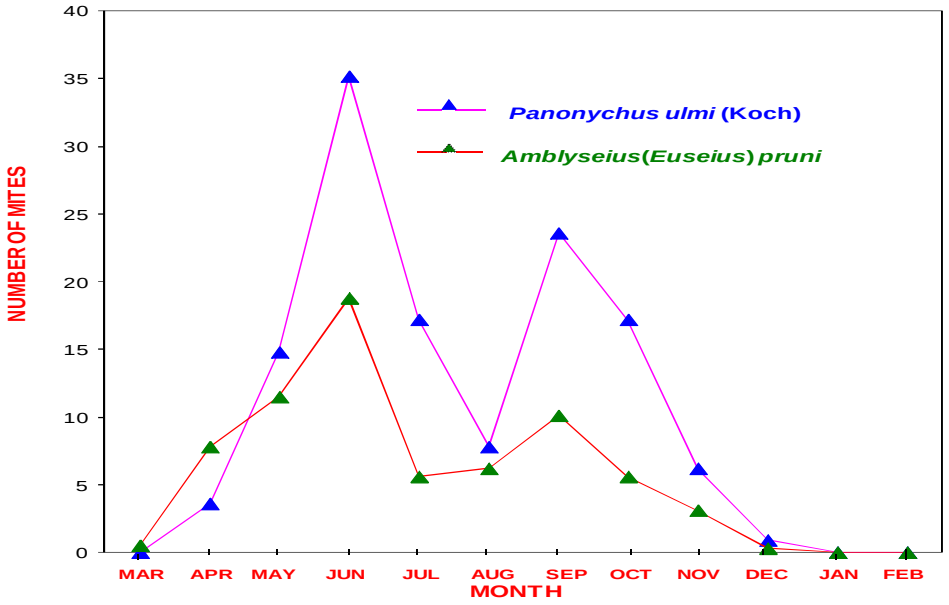

Fig. 6 Seasonal variations in population of *Panonychus ulmi* (Koch) and *Amblyseius (Euseius) pruni* on apple crop at Nirmand (Kullu) in Himachal Pradesh

Panonychus ulmi Koch and Amblyseius *(Euseius) pruni* Gupta were found infesting apple in Kullu hills of Himachal Pradesh. Earlier, an epidemic outbreak of *Panonychus ulmi* was reported in apple orchards of Himachal Pradesh[12]. Similar epidemic outbreak was reported in all apple growing areas of Himachal Pradesh in 1996, 1998 and 2000[13, 14 & 15]. Many investigators have earlier observed *Amblyseius* (*Euseius*) *pruni* Gupta on various crops in different parts of the country, for example, on Croton in Arunachal Pradesh, peach in West Bengal, pear, fig, blackberry in Meghalaya, coconut, nerium in Lakshadweep, pear in Punjab and undetermined plants in Jammu and Kashmir and Himachal Pradesh[16, 17]. This mite has also been found a predator of phytophagous mites in various bio-geographical regions of the country[4].

Studies on seasonal variations in the population dynamics of *Panonychus ulmi* revealed June as the peak month of mite infestation of apple at Nirmand. The infestation rate was 27.83%. Present results thus corroborate the earlier findings in which it has been observed that the seasonal occurrence of *P. ulmi* increased continuously from early May with a peak in early to mid July and then rapidly decreased from August and further concluded that the occurrence of mites was clearly related to the mean temperature and precipitation and was shown to decrease rapidly after rain over 100 mm[18]. The causes for the severe problems with *P. ulmi* in apple orchards in Belgium were explained and it was observed that high temperature of July-August caused an explosion in the number of mites[19]. Many other investigators studied the seasonal fluctuation in the population of *P. ulmi* in different parts of the country and it was observed that temperature, rainfall and humidity exert a great influence on the population build-up of phytophagous mites[6].

Previously, it was observed that the dry spell of June-August in 1991 provided favourable conditions for the proliferation of *P. ulmi*[12]. Further, it was reported that the population of *P. ulmi* significantly increased during summer and Monsoon months[20]. Present acarological data on seasonal variations in population of predatory mite *Amblyseius (Euseius) pruni* revealed that the population of this mite was also maximum during the month of June (26.93%) at Nirmand in Kullu hills. Earlier findings showed that

the population trend of pests and predatory mites is influenced by temperature, relative humidity and sunshine hours. The predatory mite population is influenced positively and significantly with the population of pest mite and with temperature i.e. with the rise in pest population there is a rise in population of predatory mites and also with a warming up of the season, the population of predatory mites also increases[21].

Present studies also showed the same trend in population fluctuations of *P. ulmi* and *Amblyseius* (*Euseius*) *pruni*, as the maximum population of both pests and predatory mites was during the month of June. A similar trend has been observed by different workers[6, 22, 23, 24 & 25].

CONCLUSION

These variations in mite populations during different seasons might be due to the fluctuations in temperature, relative humidity and sun-shine hours.

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