IMPACT OF WEATHER FACTORS ON SEASONAL ABUNDANCE ANDPOPULATION DYNAMICS OF YELLOW MITE, *POLYPHAGOTARSONEMUSLATUS* (BANKS) ON DIFFERENT VARIETIES OF JUTE, *CORCHORUSOLITORIUS* L. UNDER NET HOUSE CONDITION

A. S. M. Kamruzzaman*, M. Z. Alam and M. R. U. Miah****

* Entomology Department, Bangladesh Jute Research Institute, Manik Mia Avenue, Dhaka-1207, BANGLADESH. E-mail: kzaman_s@yahoo.com
** Entomology Department, Bangabandhu Sheikh Mujibur Rahaman Agricultural University, Gazipur, BANGLADESH.

[Kamruzzaman, A. S. M., Alam, M. Z. & Miah, M. R. U. 2014. Impact of weather factors on seasonal abundance and population dynamics of Yellow Mite, *Polyphagotarsonemuslatus* (Banks) on different varieties of Jute, *Corchorusolitorius* L. under net house condition. Munis Entomology & Zoology, 9 (1): 457-467**]**

ABSTRACT: The outbreak of yellow mite, *Polyphagotarsonemus latus* population almost regularly as one of the most serious pests of jute crop (*Corchorus olitorius* L.) in Bangladesh. The experiment was conducted to ascertain the effect of weather factors on incidence and population development of yellow mite, (*Polyphagotarsonemus latus*; Acari: Tarsonemidae).The objective of this study was to determine effects of rainfall and mean temperature on the abundance and the seasonal dynamics of yellow mite stages of four jute varieties (O-9897, O-72, OM-1 and O-795). Population fluctuation at all stages of yellow mite at 7 days interval after infestation observed highest fluctuation peak for egg (117.67±24.64) at June 10, larva (87.33±4.67) at June 17, pupa (87.33±4.67) at May 6, female (35.00±5.13) at June 17 and male (11.67±1.67) at May 6 in the variety of OM-1 among others varieties under net house condition. Yellow mite stages varied significantly among varieties of jute plants at all sampling dates. All stages of the mite preferred the undersides of the leaves than its upper-sides. Among the different environmental factors mean temperature and weekly total rainfall was positively correlated with the different stages of *P. latus* population. The determination of the effects of different weather factors on population and incidence of *P.latus* in jute is essential for effective pest management. This study not only helpful in forecasting outbreaks of *P.latus* but also effective pest management strategies in formulation.

KEY WORDS: *Polyphagotarsonemus latus*, weather factors, correlation, seasonal abundance, varieties.

Among the non-insect pests of agricultural crops, mites are probably the most notorious ones and gaining tremendous importance in the recent years due to their devastating nature. In Bangladesh, the genus Corchorus is the most important family Tiliaceae, highlighting the jute as the culture of higher expression economy. Yellow mite, *Polyphagotarsonemus latus* (Banks) (Acari: Tarsonemidae) is one of the major and destructive pests of jute (*Corchorus olitorius* L.). Infest the young leaves and shoots, causing significant losses, especially the stoppage of growth or atrophy of the branches (Haji et al., 2001). Its population builds up continual increase, reaches a peak in mid-June and again during the third week of July. The years of most serious mite infestation of jute are those of dry periods prevailing in these months (Kabir, 1975). The damage is often termed as 'Telenga' or 'Telchita' disease in Bangladesh. It appears at the end of April but more active in mid May (Kabir, 1975). Generally, they suck the sap from the apical leaves of the plants, as a result, the young leaves wrinkle and curl down, color changes to copper or purplish, finally dry up and fall down (Siddique & Kabir, 1979). Due to the attack of this pest, the vertical growth of the internodes is suppressed thereby side branches are enhanced (Kabir, 1975). Moreover, they attack flower buds, thus, flowers cannot bloom properly, and infested pods fail to form seeds (Kabir, 1975). The combined yield and quality of fibre are reduced due to the attack of this pest.

Higher atmospheric humidity resulted in increased incidence of the mite (Schoonhoven et al., 1978). In contrast, semi humid condition (Kabir, 1979) and dry weather (Sanap et al., 1985) were found to be more favourable for this mite. Conflicting reports are available with the effect of temperature on the development of *P. latus*. Anderson (1975) reported that lower temperature affected the development favourably in California. Schoohoven et al. (1978) opined that outbreak of the mite occurred exceptionally in warm weather whereas; high temperature adversely affected the population of *P. latus* mite. In contrast, Kabir (1979) and Sanap et al. (1985) reported the role of high temperature in the development and population buildup of the mite. Temperature ranging from 26.8 to 26.90C and relative humidity of 60 to 75 per cent were congenial for multiplication. Borah (1987) and Lingeri et al. (1998) observed that the mite population is favoured by higher temperature coupled with lower humidity having lesser intensity of rainfall. Heavy rains washed out *P. latus* there by completely reducing its population (Kabir, 1979). The correlation between the mite population and weather parameters is negative with maximum and mean temperature (-0.744 and -0.409) whereas, sunshine (0.460) is positively correlated (Ram et al., 1998). Similar observations are done by Mohammed et al. (1999). Patil (2003) recorded significant positive correlation of mite with biotic factors. Yellow mite, *P. latus* is not only destructive pest in Bangladesh but also worldwide reported by some researchers (Das & Roychaudhuri, 1979; Das and Singh, 1985a,b; Nair, 1986; Pradhan & Saha, 1997). It sucks the sap from younger leaves and therefore the leaves curl ventrally, and the colour turns from green to brown. The vertical vegetative growth of the crop is arrested and significantly yield loss occurred regularly. In view of the above facts and scarcity of related information on mites infesting jute crop with special reference, the present investigations were undertaken with the following objectives: to quantify the abundance and the seasonal dynamics of mite, *P. latus* in relation to various weather factors on fibre crop *viz.,* jute (*Corchorus olitorius* L.).

MATERIALS AND METHODS

The experimental works were conducted in the net house of the Department of Entomology, Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU) of Gazipur during the period from March to July 2009.

Collection and rearing yellow mite

Polyphagotarsonemus latus were collected from the infested jute plant of the research field of Bangladesh Jute Research Institute, Dhaka in March, 2009. The collected mites from infested leaves were transferred into the potted jute plants kept outside the laboratory. Fifteen plants were infested to have constant supply of mite for these study purpose.

Mite dynamics related to day after infestation

Jute plants of tossa, *Corchorus olitorius* L varieties (O-9897, O-72, OM-1 and O-795) were grown organically without pesticide application in earthen pots (5 plant/pot). Plants were fertilized with a spoonful of 15-2-3-4 NPKS and sprinkle irrigation twice daily. When the jute plants age as about 28 days, yellow mite (12 pairs female and male) infestation were allowed to build up by artificial inoculation. The experiment was laid out in a completely randomized design (CRD) with three replication under net house condition (100% shaded by 0.05 mash white colored net). Young 3rd leaf by each plant from the tip (from 5 plants/pot) described by Alagarmalai et al. (2009) were collected 7 days after exposure to each variety and thereafter every 7th day of exposure until harvest during 15 April to 8 July (during jute growing season) in 2009, and the number of mite stages per cm^2 leaf (mean±SE) was counted under a stereomicroscope. The data on abiotic factors i.e., temperatures and rainfall were recorded from the net house during March to July 2009.

Data analysis

Descriptive analysis was used to calculate mean and standard error of yellow mite population densities. The mean differences within varieties of plants, the effect of sampling dates were analyzed of variances by Tukey's test. Pearson's correlations ($P \leq 0.05$) were used to test relationships between mean temperature and weekly total rainfall numbers of mite stages on jute plants using the SAEG (Euclides, 1983).

RESULTS AND DISCUSSION

The results of different stages (egg, larva, pupa, female and male) of yellow mite incidence on different jute (*C.olitorius*) varieties (O-9897, O-72, OM-1 and O-795) were counted every 7 days interval after infestation from April 15 to July 8 since 2009. Studies on the seasonal abundance of *P.latus* in relation to weather factors indicated that the activity of *P.latus* was showed by average temperature (maximum and minimum) and rainfall in Figure 1. The incidence of *P.latus* population fluctuation was recorded during 13 meteorological weeks with corresponding mean temperature ranged from 26.25±1.36^{o}C to 32±1.26 ^{o}C and weekly total rainfall ranged from 6.24 mm to 84.12 mm. Accordingly, we may conclude that *P. latus* favors warm and humid conditions of autumn or late summer rather than low temperature and heavy rains of winter months. During summer months, higher incidence of mite population infesting lime (Pena, 1989), potato (Fernandez & Ramos, 1995) and jute (Zaman & Karimullah, 1987; Sarma & Borah, 2009) was also observed. It was also reported that the jute yellow mite becomes active in mid-May, though the damage of the terminal shoot is seldom visible before June. Initial mite attacks are usually seen near dwellings and shady places (Kabir, 1975).

Effect of *P.latus* on *C.olitorius* varieties

The effect of varieties on the incidence of *P. latus* stages was studied. Significant seasonal pattern was found in the overall abundance (i.e. all varieties) yellow mite stages ($P>0.05$). Population fluctuation of *P.latus* eggs on *C. olitorius* varieties (O-9897, O-72, OM-1 and O-795) was found more or less increased the mean number of eggs at certain level (63rd DAI) and then decreased as shown in Figure 2. The significant peak of egg abundance

(117.67±24.64) was recorded at June 10 in the variety OM-1 followed by O-795 (95.67±3.53), O-72 (91.66±14.50) and O-9897 (71.67±11.70).

The incidence of *P.latus* larvae found more or less increased at 70th DAI, after that decreased (Figure 3). The highest significant peak of larval abundance (87.33±4.67) was recorded at June 17 in the variety OM-1 followed by O-795 (41.33±2.91), O-72 (29.33±2.03) and O-9897 (23.33±2.19).

The *P.latus* pupal population fluctuation was found more or less increased at 28th DAI, later starting decreased (Figure 4). The significant peak of pupal abundance (12.00±3.21) was recorded at May 6 in the variety OM-1 followed by O-795 (9.67±2.19), O-72 (5.33±0.33) and O-9897 (3.33±0.33).

Population fluctuation of *P.latus* females found more or less increased at 70th DAI and then decreased (Figure 5). The female population became more abundant and reached its peak at June 17 significantly in the variety OM-1 (35.00±5.13) followed by O-795 (26.67±4.33), O-72 (17.33±1.86) and O-9897 (12.00±1.15).

The *P.latus* male population fluctuation on *C.capsularis* varieties were found more or less increased at 28th DAI after that decreased (Figure 6). Peak of male abundance was highest in the variety OM-1 (11.67±1.67) followed by O-72 (5.67±0.67), O-795 (4.00±1.00) and O-9897 (3.00±0.58) at May 6, which was statistically significant among the varieties.

Weekly mean weather and population growth of *P.latus*

Maximum and minimum temperature of the study site was almost steady in the sampling period. Correlation (r) coefficient between mean number of yellow mite stages and different environmental factors for jute varieties have been evaluated and presented in Table 1. Among the environmental factors the mean temperature that affected the abundance of *P. latus* stages was positively correlated for all varieties, where effect was significance except larva and pupal stage OM-1 & O-795 and OM-1 for female & O-72 & OM-1 for male stage. The correlation between population of *P. latus* stages and weekly total rainfall was positively correlated among all varieties, where effects was non-significant except variety of O-9897 and O-72 for female and O-9897 for male stage showed significantly effect on the population build up of yellow mite in shown Table 1. It was showed that weather factors had more or less significant influence of incidence of *P. latus* population.

This is the first time reported that concentrates on Tarsonemidae mites on jute in Bangladesh. Population fluctuation patterns may have different between the years and places. Higher densities of *P. latus* were observed in Gazipur, where the occurrence of higher total rainfall. It seems to be an indirect relationship with temperature due to the rainy season (convective rain) occurs during periods of high temperature in this area. This fluctuation is probably physical factors such as the amount of rainfall and/or biological factors including the changing of plant stage as well as the presence of other arthropods or interactions between the different factors. As shown in this study, increasing broad mite density was related to the time and amount of rainfall during April till July since 2009. In contrast, Leite et al. (2003) found that densities of mite pests on eggplant positively correlated with mean temperature and total rainfall. Nevertheless, the rain may dislodge thrips from plants but not broad mite. Our results also supported with Peña (1990) who reported the density of broad mites to be high during the rainy period in spring and summer. Phompanjai et al. (2005) planted sesame at different times of the year and mentioned that if the plants emerged later in the rainy season, a higher infestation broad mites was observed at the peak population density. Additional rainfall, the population peak is reached in the season could not prevent a reduction in mites reported by Pena's (1990) and also supported our studies. These results suggested that the rain might never cause the negative impact on broad mites' density and also not the major factor of direct promote their population growth. However, the rain might indirectly manipulate broad mites *via* the impact on the other biological factors related to them such as host plant suitability.

In our results indicated that broad mite infestation period occurred during vegetative to fruiting stage under net house conditions. This result is in agreement with De Coss-Romero and Peña (1998) for the population fluctuation of chili pests under greenhouse conditions.

Broad mite population also increased from the vegetative to the flowering stages and reached the highest peak in young pod stage in sesame (Phompanjai et al., 2005). Jovicich et al. (2004) stated that the population growth of broad mites is more rapid on bell pepper seedlings since there are more leaves available to feed upon than in the cotyledon stage. However, mite populations declined after partly due to plant age, as in the case of young cucumber leaves that are preferred by broad mites over older cucumber leaves (Alagarmalai et al., 2009). However, the plants are injured by the mites as in the case of *Tetranychus urticae* Koch feeding on beans (Nachman & Zemek, 2002). In addition, the seasonal change in leaf quality may be responsible for population reduction as in *Tetranychus kanzawai* Kishida populations on hydrangea (Gotoh & Gomi, 2000).Various environmental factors are important for regulating the population density of plant feeding mite. Li & Li (1986) mentioned that the increase of population density was influenced by temperature, rainfall, initial population and the growth condition of food plants. Results of the present study are almost similar to those obtained in potato (Sontakke et al., 1989), aubergines (Misra et al., 1990) and jute (Somchoudhury et al., 2008). However, the present results are not in the same direction to those obtained by Ahuja (2000), who found that maximum temperature showed negative and significant correlation and minimum temperature showed negative and none significant correlation with mite population infesting sesame. This may be due to different leaf morphological features between these plants.

Accordingly, we may conclude that the temperature-rainfall combination is an important regulatory factor affecting arthropod development and that the warm and humid conditions prevailing during april to july months is more suitable for the increase of population densities of *P. latus*. The progressive increase in mite population in the months suggests the need for initiating control of *P. latus* after planting and the peak of *P. latus* population period. This study will help to identify which predatory mite is available in that period for biological control at future.

ACKNOWLEDGEMENTS

The authors are grateful to Dr. Md. Zinnatul Alam for reviewing the manuscript. Dr. Ramiz UddinMiah and Dr. Md. Mofazzal Hosssain provided useful comments on an earlier draft.We also acknowledge Md. Fazler Rahman, Abdul Mazid Mia, Razzob Ali, Abdul Quader for laboratory assistance and to Dr. khandokar saif Uddin for statistical advice. This study was partially funded by a development project of "Jute production, diversified

use of jute products & its extension" by Bangladesh Jute Research Institute (BJRI).

LITERATURE CITED

Ahuja, D. B. 2000. Influence of abiotic factors on the population of mite, *Polyphagotarsonemus latus* (Banks) infesting sesame (*Sesamum indicum* L.) in the arid region of Rajasthan (India). Journal of Entomological Research, 24 (1): 87-89.

Alagarmalai, J., Grinberg, M., Perl-Treves, R. & Soroker, V. 2009. Host selection by the herbivorous mite *Polyphagotarsonemus latus* (Acari: Tarsonemidae). J. Insect Behav., 22: 375-387.

Anderson, B. R. 1975, Weather in the West. American West Publication Company, California., 223.

Borah, D. C. 1987. Bio-ecology of *Polyphagotarsonemus latus* Banks (Acari: Tarsonemidae) and *Scirtothrips dorsalis* Hood (Thysanoptera: Thripidae) infesting chilli and their natural enemies. Ph.D. Thesis, University of Agricultural Sciences, Dharwad.

Das, L. K. & Roychaudhuri, D. N. 1979. *Physalis minima* (Solanaceae) – a new host plant of yellow mite, *Polyphagotarsonemus latus* (Banks). Science and Culture, 45: 169-170.

Das, L. K. & Singh, B. 1985a. Effective control measures against yellow mite, *Polyphagotarsonemus latus* (Banks) of jute. Jute Development Journal., 28-29.

Das, L. K. & Singh, B. 1985b. Number of sprays suitable against yellow mite, *Polyphagotarsonemus latus* (Banks) of jute. Science and Culture, 51: 376-377.

DE Coss-Romeo, M. & Peña, J. E. 1998. Relationship of broad mite (Acari: Tarsonemidae) to host phenology and injury levels in *Capsium annuum*. Florida Entomol., 81: 515-526.

Euclides, R. F. 1983. Sistema de ana´lises estatı´sticas e gene´ticas – Manual Proviso´rio. CPD=UFV, Vic¸osa., 74.

Fernandez, M. & Ramos, M. 1995. Incidence of pests and bioregulators on cultivars of potatoes adapted to heat. Revista de Proteccion Vegetal., 10 (2): 133-142.

Gotoh, T. & Gomi, K. 2000. Population dynamics of *Tetranychus kanzawai* (Acari: Tetranychidae) on hydrangea. Exp. appl. Acarol., 24: 337-350.

Haji, F. N. P., Moreira, A. N., Lopes, P. R. C., Ferreira, R. C. F., De Alencar, J. A. & Barbosa, F. R. 2001. Monitoring and determination the level of action of broad mite culture of the grape. Petrolina EMBRAPA Semi-Arid, 7p. (Embrapa Semi-Arid Circular Técnica, 68).

Jovicich, E., Cantliffe, D. J., Osborne, L. S. & Stoffella, P. J. 2004. Mite population and damage caused by broad mites (*Polyphagotarsonemus latus* [Banks]) infesting bell pepper (*Capsicum annuum* L.) at different seedling developmental stages. VII Int. Symp. on Prot Cult Mild Winter Climates (eds. D.J. Cantliffe, P.J. Stoffella snd N. Shaw), ISHS 339-344, Acta Hort., 659.

Kabir, A. K. M. F. 1975. Jute pest of Bangladesh. Bangladesh Jute Research Institute. Dacca. 15. pp. 28-36.

Kabir, A. K. M. F. 1979, Bio-ecology and behaviour of yellow jute mite. In: *Recent Advances in Acarology*, Ed. Rodriguez, J. G., Academic Press, New York, 519 – 523.

Leite, G. L. D., Picanco, M., Zanuncio, J. C. & Marquini, F. 2003. Factors affecting mite herbivory on eggplants in Brazil. Exp. appl. Acarol., 31: 243-252.

Li, Y. R. & Li, L. S. 1986. Studies on the population fluctuation of the broad mite. Acta Entomologica Sinica, 29 (1): 41-48.

Lingeri, M. S., Awaknavar, J. S., Lingappa, S. & Kuldkarni, K. A. 1998. Seasonal incidence of chilli, mites, *Polyphagotarsonemus latus* (Banks) and thrips, *Scirtothrips dorsalis* (Hood). Karnataka Journal of Agricultural Sciences, 11 : 380-385.

Misra,K. K., Sarkar, P. K., Das, T. K. & Somchoudhury, A. K. 1990. Incidence of *Tetranychus cinnabarinus* (Boisd.) (Acari: Tetranychidae) on some selected accessions of brinjal with special reference to the physical basis of resistance. Indian Agriculturist, 34 (3): 177-185.

Mohammed, G. H., Ahmed, K. & Rao, N. H. P. 1999. Influence of abiotic factors on population dynamics of yellow mite, *Polyphagotarsonemus latus* (Banks) on chilli. Pestology, 23: 5-9.

Nachman, G. & Zemek, R. 2002. Interactions in a tritrophic acarine predator-prey metapopultaion system IV: effects of host plant condition on *Tetranychus urticae* (Acari: Tetranychidae). Exp. appl. Acarol., 26: 43-70.

Nair, M. R. G. K. 1986. Insects and mites of crops in India. Indian Council of Agricultural Research, New Delhi., 122-126.

Patil, S. R. 2003. Evaluation of indigenous products for the management of chilli mite, *Polyphagotarsonemus latus* (Banks) (Acari : Tarsonemidae). M.Sc. Thesis, University of Agricultural Sciences, Dharwad, India., 106.

Pena, J. E. 1989. Relationships of broad mite (Acari: Tarsonemidae) density to lime damage. Journal of Economic Entomology, 83 (5): 2008-2015.

Peña, J. E. 1990. Relationships of broad mite (Acari: Tetranychidae) density to lime damage. J. econ. Ent., 83: 2008-2015.

Phompanjai, P., Sinsawat, V. & Nawnoi, V. 2005. Damage and loss due to broad mite on different growth stage of sesame. Thai agric. Res. J., 23: 44-52.

Pradhan, S. K. & Saha, M. N. 1997. Effect of yellow mite (*Polyphagotarsonemus latus* Bank) infestation on the major nutrient contents of tossa jute (*Corchorus olitorius* L.) varieties. Journal of Entomological Research, 21: 123-127.

Ram, S., Patnaik, M. C., Sahoo, S. & Mahapatra, A. K. B. 1998. Population fluctuation of chilli thrips, *Scirtothrips dorsalis* Hood and the yellow mite, *Polyphagotarsonemus latus* Banks on chillies at Semiliguda, Orissa. The Andhra Agricultural Journal, 45: 79-82.

Sanap, M. M., Nawale, R. N. & Ajri, D. S. 1985. Seasonal incidence of chilli thrips and mites. Journal of Maharashtra Agricultural Universities, 10: 345-346.

Sarma, K. K. & Borah, 2009. Preliminary screening of jute gerplasm against yellow mite, *Polyphagotarsonemus latus* Banks. Insect Enviroment, 14 (4): 152-152.

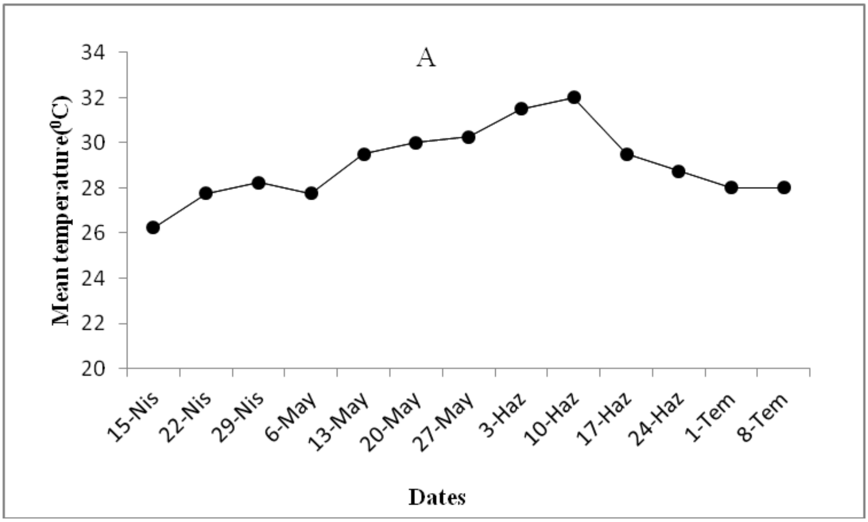
Schoonhoven, A., Pieldrahita, J., Valderroma, R. & Galvez, G. 1978. Biology, damage and control of tropical mite, *Polyphagotarsonemus latus* (Banks) (Acarina: Tarsonemidae) on beans. Turrialba, 28: 77-80.

Siddique, M.A. B. & Fazlul Kabir, A. K. M. 1979. Mating behabiour, infestation and alternate hosts of jute mite. Bangladesh J. Agril.. 4 (2): 121-126.

Somchoudhury, A. K., Jana, S. K., Nair, N., Samanta, A. & Sarkar, P. K. 2008. Studies on the effect of different abiotic factors and bio-efficacy of different chemicals on yellow mite, *Polyphagotarsonemus latus* (Banks) infesting jute. Journal of Entomological Research, 32 (2): 105-107.

Sontakke, B. K., Singh, D. N. & Misra, B. 1989. Seasonal abundance of potato pests in relation to environmental factors. Environment and Ecology, 7 (2): 391-394.

Zaman, M. & Karimullah, 1987. Relative abundance of yellow mite, *Polyphagotarsonemus latus* (Banks), on six cultivars of jute in Peshawar. Pakistan Journal of Zoology, 19 (2): 133-139.



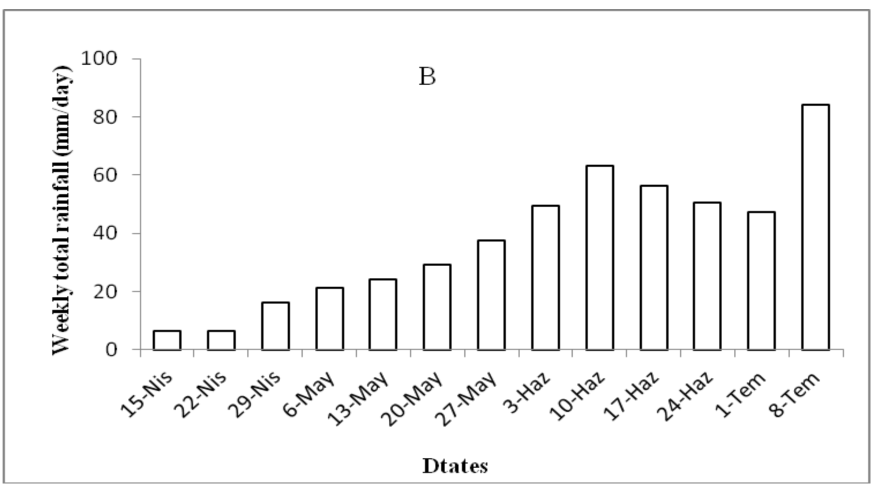


Figure 1. Mean temperature ((minimum+maximum)/2) (A) and Weekly total rainfall (B) distribution during 15April to 8 July in 2009.

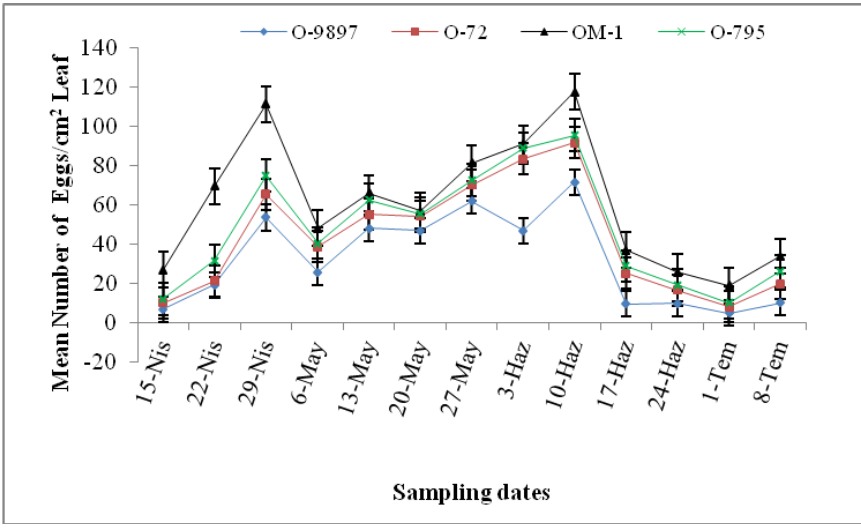


Figure 2. Population fluctuation of *P. latus* eggs on different varieties of *C. olitorius* leaves/cm² ((adaxial+abaxial)/2) during April 15 to July 8, 2009.

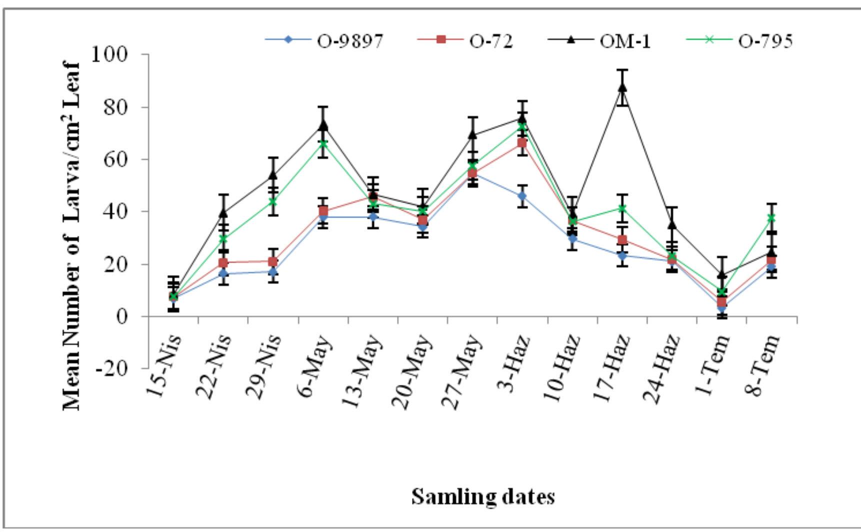


Figure 3. Population fluctuation of *P.latus* larvae on different varieties of *C. olitorius* leaves/cm² ((adaxial+abaxial)/2) during April 15 to July 8, 2009.

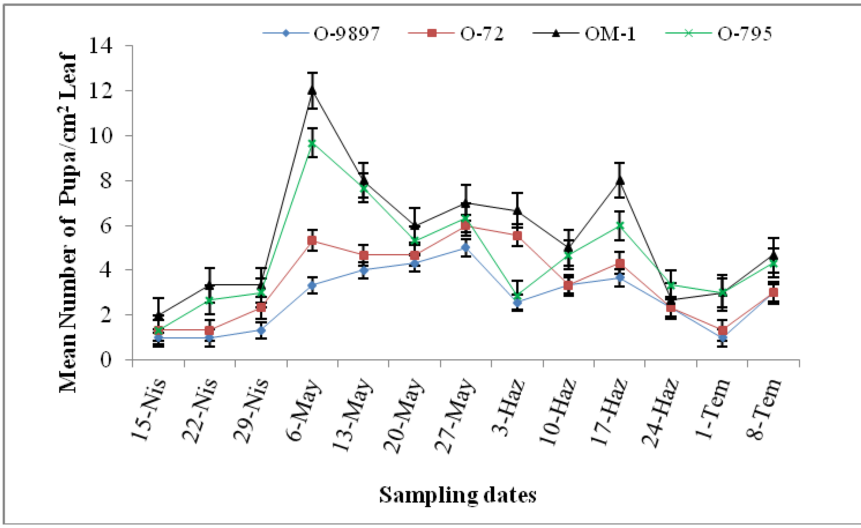


Figure 4.Population fluctuation of *P.latus* pupae on different varieties of *C. olitorius* leaves/cm² ((adaxial+abaxial)/2) during April 15 to July 8, 2009.

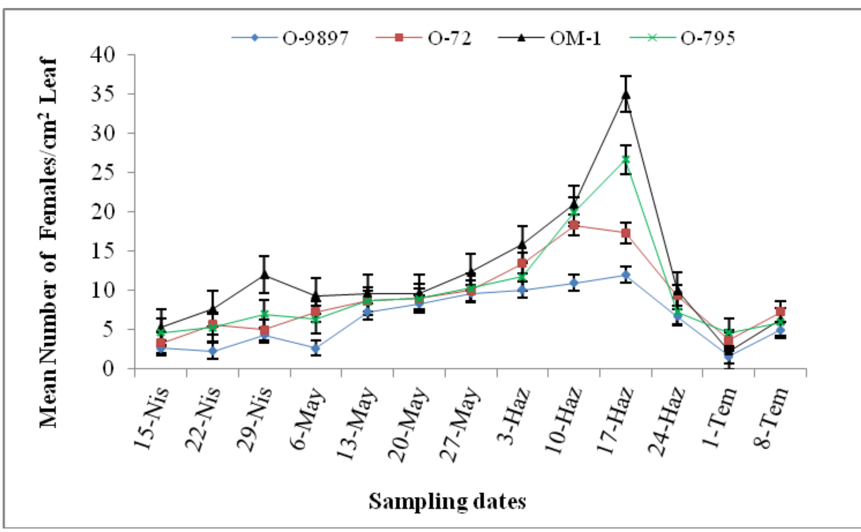


Figure 5. Population fluctuation of *P.latus* females on different varieties of *C. olitorius* leaves/cm² ((adaxial+abaxial)/2) during April 15 to July 8, 2009.

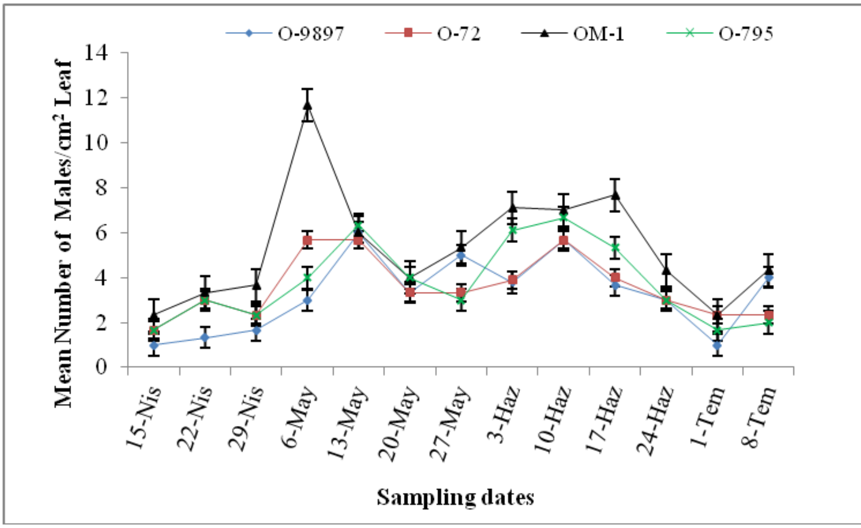


Figure 6. Population fluctuation of *P.latus* males on different varieties of *C. olitorius* leaves/cm^2 ((adaxial+abaxial)/2) during April 15 to July 8, 2009

Table 1. Correlation coefficient (r) between the incidence of yellow mite in varieties and various weather factors.

Variety	Egg population		Larval population		Pupal population		Female population		Male population	
	Mean temp. (^{0}C)	Rainfall (mm)	Mean temp. (^{0}C)	Rainfall (mm)	Mean temp. (^{0}C)	Rainfall (mm)	Mean temp. (^{0}C)	Rainfall (mm)	Mean temp. (^{0}C)	Rainfall (mm)
O-9897	.732**	.112	.671*	.188	.593*	.449	.858**	.573*	.735**	.573*
O-72	.824**	.193	.747**	.179	.611*	.238	.823**	.588*	.551	.104
OM-1	.623*	.022	.478	.079	.294	.035	.542	.366	.356	.129
O-795	.802*	.170	.530	.114	.210	.100	.633*	.474	.785**	.201

* Significant at 0.05 level, ** Significant at 0.01 level, Mean temp. – (Maximum temperature + Minimum temperature)/2