International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438

Population Density and Distribution Pattern of Mites Infesting The Invasive Plant, *Bidens Sulphurea* Cav.

C.Saritha[1], N. Ramani[2]

[1]Research scholar, Division of Acarology, Department of Zoology, University of Calicut, Kerala, 673635, India

[2] Professor, Division of Acarology, Department of Zoology, University of Calicut, Kerala, 673635, India

Abstract: ***Population density and distribution pattern of the major groups of mites infesting an invasive plant, Bidens sulphurea Cav. were studied during the period of January, 2013 to September, 2013 covering three districts of Kerala viz. Malappuram, Palakkad and Thrissur. Random samples of leaves were collected from mite infested plants of B. sulphurea growing in various localities, based on visual symptoms. Individual leaf was thoroughly screened under a stereomicroscope to record the species diversity, nature of infestation, distribution pattern etc. of the associated mites. Results of the study revealed the association of both phytophagous and predatory mites on the plant. The phytophagous mites recovered during the study included members of 3 families viz. Tenuipalpidae, Bryobiidae and Tetranychidae while the predatory mites belonged to the family Phytoseiidae. A general abundance of tenuipalpid mites was recorded on the plant, irrespective of geographical variation. The family Tetranychidae was found represented by two genera viz. Tetranychus and Eutetranychus while the remaining families were found to comprise of a single genus each. Most of mite species preferred the lower surface of the leaves and in cases of severe infestation, the upper surface of the leaves was also found invaded by a few species. The paper also discusses on the population density and distribution pattern of individual mite species on B. sulphurea.***

Keywords: Invasive plant, phytophagous , Population density, Distribution pattern, *B. sulphurea*

1. Introduction

B. sulphurea is an annual herb introduced widely as an ornamental plant for its beautiful flowers. It escaped from gardens and started growing wild along road sides, disturbed areas and wastelands. *B. sulphurea* was declared invasive by the United States Southeast Exotic Pest Plant Council in 1996 (US Department of Agriculture Plant Profile of *Cosmos sulphureus*). The introduction of invasive species generally causes extinction of local species and irreparable changes to the habitat and biodiversity of invaded ecosystems. These species lead to the killing or crowding of native species through predation, parasitism, diseases and competition (Chornesky and Randall 2003). They also alter ecological processes such as the water, nutrient, and energy cycles and thus completely change the ecosystem functions (Union of Concerned Scientists, 2007). Noxious invasive weeds like *Chromolaena odorata* and *Eichhornia crassipes* are known to harbour varied species of mites like the spider mites, oribatid mites eriophyid mites etc. (Ramani and Haq, 1984,1987; Haq and Ramani, 1987; Sheela and Haq, 1988, Sumangala and Haq, 2003, Ramani, 2007). The present paper presents the results of a study conducted on the population density and distribution pattern of some species of phytophagous mites infesting invasive plant viz. *B. sulphurea* in Kerala.

Figure 1: Invasive plant, *Bidens sulphurea* Cav.

2. Materials and Methods

Middle aged leaves of *B. sulphurea* showing heavy infestation by mites were collected randomly in every two weeks, from various localities distributed over 3 districts Kerala viz. Malappuram, Palakkad and Thrissur of Kerala. Thorough screening of individual leaf was made under a Stemi DV4 stereo zoom microscope in the laboratory for recording the presence of mites. Population density of individual mite species was assessed following Per Leaf Counting method by keeping the leaves immersed in 70% alcohol for 5-7 minutes in a petriplate. The leaves were thoroughly washed in 70% alcohol to extract the entire mite population from the leaf surface. The mite specimens thus extracted from were then examined under the stereo zoom microscope. In order to study the population density of individual species of mite, the numbers of different life stages viz. the eggs, nymphal stages and adults, were counted separately for each species. The numbers of live individuals representing each species present on 25 leaves of the host plant were noted separately district-wise, for each sampling occasion. Data on the population density of each species during each sampling period were recorded and presented in

graphs. Live mite specimens were segregated with the help of a moistened camel hair brush and transferred to 70% alcohol for further processing. The specimens were dehydrated in alcohol series, cleared in clearing medium (mixture of absolute alcohol and lactic acid in 1:1 ratio), slide mounted in Hoyer's medium and identified following keys and relevant literature.

3. Results and Discussion

Results of the study enabled to record the association of both phytophagus and predatory mites, representing 2 suborders viz. Prostigmata and Mesostigmata, on the invasive plant, *B. sulphurea*. The phytophagous mites recovered during the study included members of 3 families viz. Tenuipalpidae, Bryobidae and Tetranychidae while the predatory mites belonged to the family Phytoseiidae. Tetranychidae was found represented by members of two genera viz. *Eutetranychus* and *Tetranychus* while the other families were represented by a single genus each. The tenuipalpid species recovered during the study was *Brevipalpus phoenicis* Geijskes. The family Bryobidae was represented by *Bryobia* sp. *Eutetranychus orientalis* Klein and *Tetranychus* sp. were the species of tetranychid mites recovered during the study.

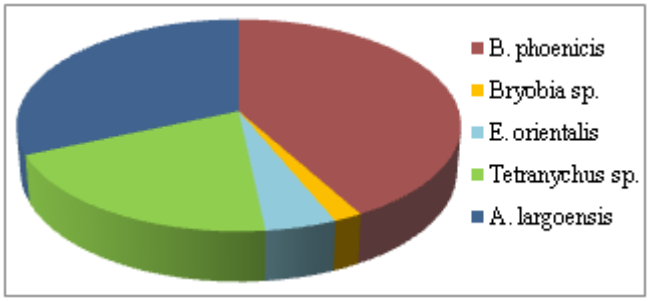

Figure 2: Mean Population Density of Mites On *B. sulphurea* from the 3 Districts of Kerala

All these species are known to be highly polyphagous with wide host range and are listed as major/minor pests of plants with varied economic categories ((Jeppson *et al*. 1975; Chiavegato and Kharfan 1993; Childers *et al.* 2003, Prabheena and Ramani, 2013) Besides the above phytophagous species, a predatory species viz. *Amblyseius largoensis* Muma also could be recorded from *B. sulphurea*. This phytoseiid mite has been recorded as an efficient predator of pest mites like the spider mites, false spider mites and eriophyid mites (Reis *et al*. 2000a).

Figure 3: *Amblyseius largoensis* (Predatory mite) *and Brevipalpus phoenicis* recovered from *B. sulphurea*

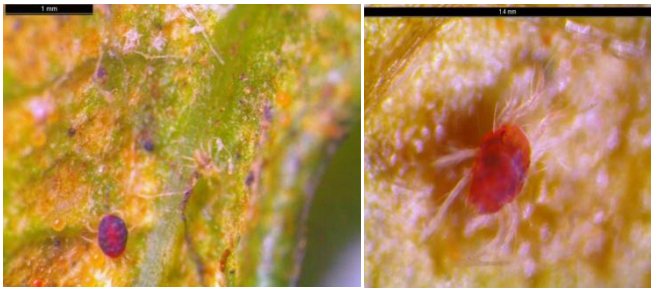

Figure 4: both male and female *Tetranychus* sp. and *Eutetranychus orientalis* recovered from *B. sulphurea*

Results of the field studies disclosed a general tendency of the mites to colonize under surface of middle aged leaves where they preferred to occupy areas adjacent to the mid rib of the host plant leaves. However, in cases of heavy infestation, the mites were found to colonize both surfaces of the leaf lamina. The life stages of the various species were also found mostly confined to the lower surface of leaves, closer to the midrib (Reis *et al.*, 2000 and Childers *et al.*, 2003). All the life stages of the tetranychid and tenuipalpid mites were found to suck the plant sap by their stylet like chelicerae. Desapped regions were easily recognized by the development of damage symptoms like chlorotic spots, yellowing, bronzing of leaves, necrotic areas and leprosis.

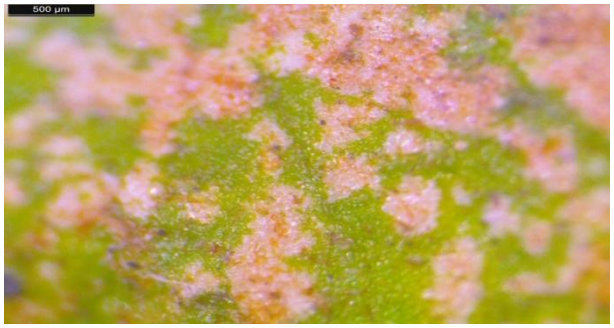

Figure 5: Damage caused by the phytophagous mites on *B.sulphurea*

The population density and distribution pattern of the phytophagous mites showed variation with respect to seasonal and geographic variations. Numerical abundance of these mites could be recorded in April and the minimum population was observed in January. Seasonal changes in diversity and density of arthropods in tropical regions have been correlated with alterations in various local environmental factors like temperature, rainfall and relative humidity (Klein *et al*., 2002; Philpott *et al*., 2006; Teodoro *et al*., 2008). A positive correlation between mite density and physical factors like temperature and relative humidity was reported earlier in the case of gall forming eriophyid mites while rainfall exerted a negative correlation (Nasareen and Ramani, 2014). *B. phoenicis* recorded. The highest mean population density was recorded for *B. phoenicis* (646.9 individuals / 25 leaves), followed by *A. largoensis* (487.4 individuals / 25 leaves) and *Tetranychus* sp. (311 individuals / 25 leaves), *E. orientalis* (70.8 individuals / 25leaves) and *Bryobia* sp. (28.4 individuals / 25 leaves).

The population density of the mites showed variation with respect to geographical variation also. During the present study, all the species except *B. phoenicis*, showed maximum

population in Palakkad Dt. followed by Malappuram and Thrissur. The population of *B. phoenicis* was found high in Palakkad Dt. followed by Thrissur and Malappuram Dts.

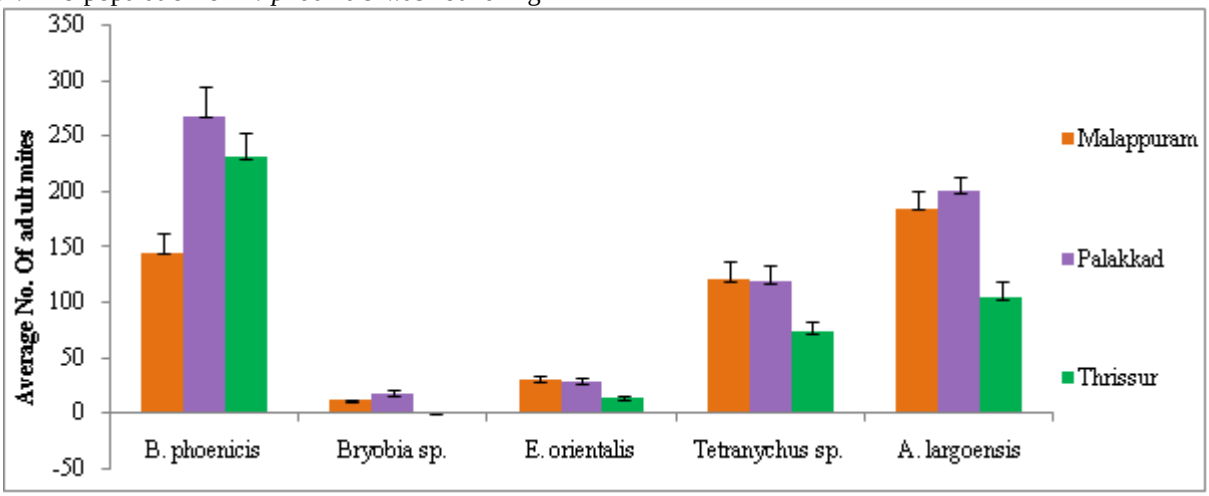

Figure 6: Comparative Analysis of Mite population from different sites

4. Conclusion

Invasive alien plants, usually escape cultivation and become agricultural pests, infest lawns as weeds, displace native plant species, reduce wildlife habitat, and alter ecosystem processes. Mites, being a less explored group in India, especially in Kerala, studies were undertaken to explore and exploit their potential towards the regulation and effective suppression of the invasive plants, to ensure ecosystem functioning. Results of the present study revealed maximum population of mites during the dry season. *B. phoenicis* was species with highest population density followed by the predatory mite *A. largoensis*, *Tetranychus* sp., *E. orientalis* and *Bryobia* sp. The mite population density was found high in Palakkad Dt. followed by Malappuram and Thrissur, except in the case of *B. phoenicis*, which showed high population in Palakkad, followed by Thrissur and Malappuram. Feeding symptoms induced by mites included the presence of chlorotic spots, yellowing, followed by bronzing of leaves and development of necrotic areas and leprosis.

References

[1] Chiavegato, L.G., Kharfan, P.R. (1993). Behaviour of the leprosies mite *Brevipalpus phoenicis (*Acari: Tenuipalpidae) on citrus. Entomol. Braz., **22**:355-359.

[2] Childers, C. C., French, J. V., Rodrigues, J. C. V. and Welbourn,W.C. (2003). *Brevipalpus californicus, B. obovatus, B. phoenicis* and *B. lewisi* (Acari: Tenuipalpidae): a review of their biology, feeding injury and economic importance. *Exp. Appl. Acar.*, **30**: 5-28.

[3] Childers, C. C., French, J. V., Rodrigues, J. C. V. and Welbourn, W. C. (2003b). Host plants of *Brevipalpus californicus, B. obovatus* and *B. phoenicis* (Acarina: Tenuipalpidae) and their potential involvement in the spread of one or more viruses. *Exp. Appl. Acar.*, **30**: 29-105.

[4] Chornesky, E. A., and J. M. Randall. (2003). The Threat of Invasive Species to Biological Diversity. *Annals of the Missouri Botanical Garden*, **90**: 67-76.

[5] Haq, M. A. and Sumangala, K. (2003). Acarine regulators of water hyacinth in Kerala (India) . *Exp. Appl. Acar*, **29**: 27-33.

[6] Haq, M.A. and N. Ramani, 1987. Possible role of oribatid mites in weed control. In : K.J. Joseph and U.C.Abdurahiman (Eds.)Advances in Biological Control Research in India, pp. 214-220, M/S Printex India.

[7] Jeppson, L. R., Keifer, H. and Baker, E.W. (1975). Mites injurious to economic plants. Berkeley (CA): University of California Press.614pp.

[8] Klein, A. M., Stefan-Dewenter, I. and Buchori, D., *et al* (2002). Effects of land-use intensity in tropical agroforestry systems on coffee visiting and trap-nesting bees and wasps. *Consn. Biol.***16**: 1003–1014 .

[9] Nasreen, P. N. M. and Ramani, N. (2014). Seasonal variation in the population density of the gall mite, *Aceria pongamiae* Keifer 1966 (Acari: Eriophyidae) within the leaf galls of *Pongamia pinnata* (L.) *J. of Entomol. and Zool. Stud.*, **2**: 126-130.

[10] Philpott, S., Perfecto, I. and Vandermeer, J. (2006). Effects of management intensity and season on arboreal ant diversity and abundance in coffee agroecosystems. *Biod. and Consn.***15**: 139-155.

[11] Prabheena, P. and Ramani, N. (2013). Assessment of chlorophyll loss induced by *Brevipalpus phoenicis* Geijskes (Acari: Tenuipalpidae) infesting the medicinal shrub, *Ocimum gratissimum* Linn. *Int. J. Acar.* **38**:67-71.

[12] Ramani, N. and M.A.Haq, 1984. Oribatid mites associated with *Eupatorium odoratum*. *Indian Journal of Acarology*, 8 : 95-99.

[13] Ramani, N. and M.A.Haq, 1987. Biology of *Scheloribates decarinatus* Aoki, 1984 (Acari:Oribatei) , an inhabitant of *Chromolaena odorata*. *Journal of Soil Biology and Ecology*, 7(1) : 27-35.

[14] Ramani, N., 2007. Developmental studies of mite *Acalitus adoratus* infesting the weed *Chromolaena odorata*. *Journal of Ecobiology*, 21(2):171-175.

[15] Reis, P.R., Teodoro, A.V. and Souza, J.C. (2000a). Predatory activity of phytoseiid mites on the developmental stages of coffee ring spot mite (Acari: Tenuipalpidae). *Entomol. Braz.*, **29**:547-553.

[16] Reis, P.R., Teodoro, A.V. and Souza, J.C. (2000b). Spatial distribution of *Brevipalpus phoenicis* (Acari: Tenuipalpidae) in coffee plants (Coffea arabica). *Entomol. Braz.*, **29**: 177-183.
[17] Taylor, B., Rahman, P. M., Murphy, S. T. and Sudheendrakumar, V. V. (2012). Within-season dynamics of red palm mite (*Raoiella indica*) and phytoseiid predators on two host palm species in south-west India. *Exp .Appl. Acar.*, **57**: 331-345.
[18] Teodoro, A. V., Klein, A. M. and Tscharntke, T. (2008). Environmentally mediated coffee pest densities in relation toagroforestry management, using hierarchical partitioning analyses. *Agri. Ecosys. Environ.*, **125**:120-126.

Author Profile

Saritha. C studied M.Sc. (Applied Zoology) from University of Calicut, Malappuram and done M.Phil in Zoology from Division of Acarology, Department of Zoology, University of Calicut, Malappuram, Currently doing Ph.D from Division of Acarology, Department of Zoology, University of Calicut, Malappuram, Kerala, India.