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Relative Abundance of Mesostigmatid Mites Associated with Insects in Forest Localities of Tamil Nadu

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This study compares richness, diversity and evenness of mesostigmatid mites associated with insects between three forest locations. Seventeen genera/species of mesostigmatid mites were collected from thirteen insect species *viz*., *Catharsius capucinus*, *Oxya* sp., *Trigona irridipennis*, *Rhynchophorus ferrugineus*, *Onthophagus ramosus*, *Onitis philemon*, *Phyllognathus dionysius*, *Anomala dorsalis*, *Batocera rufomaculata*, *Apis florea*, *Trilophidia turpis*, *Apis cerana indica* and an unidentified Dipteran fly. Species richness was high in Madurai forest region (1.6872) and low in Mettupalayam forest region (1.0831). A similar trend was observed in the diversity index and evenness with an index value of 1.8538 and 0.6543, respectively. Similarity values ranged from 0.47 to 0.76. The diversity index showed 76 per cent similarity between Coimbatore and Mettupalayam regions, whereas 59 per cent between Madurai and Mettupalayam.

Keywords: Mites, species richness, species diversity, evenness and similarity.

Biodiversity is the species richness in an ecosystem (Ehrlich and Ehrlich, 1981). It provides both opportunity and challenges how ecological communities are affected by human activity and environmental perturbations (Reaka-Kudla *et al*., 1997). Forest canopies intercept nutrients and detritus from host-tree and epiphyte foliage, forming discrete accumulations of suspended litter that serve as habitat and resources for microarthopods such as mites (Schowalter and Ganio, 1998).

Insects are primary components of forest biodiversity and some taxonomic groups are known to indicate the age or other conditions of forest (Maetˆo and Sato, 2003). Many mites have complex associations with arthropods, particularly insects. Their association with other animal includes phoresy (temporary passive transport), parasitism and predatory in nature. Phoretic attachment of mites which generally takes place on insect hosts and more than 800 mite species are carried by over 1,300 hosts (Farish, 1965). Among the insect orders, Coleoptera, Hymenoptera, Diptera and Orthoptera attract more mites. The Mesostigmata (Acari) mites are in general predacious on other small arthropods or scavengers and fungus-feeders the soil fauna. Few groups of mites also have phoretic association with insects. The objective of this study was to know the diversity of mesostigmatid mites associated with insects from three forest regions of Tamil Nadu.

Materials and Methods

Collection and Preservation of host insects

Host insects were collected through direct survey from forest area of three locations *viz*. Coimbatore, Madurai and Mettupalayam. Insects were carefully picked by hand without injury through light trap and transferred to polythene bags. The collected insects were transferred into a killing jar. The live insects collected from various sources were anaesthetized with ethyl acetate and stored in glass vials (6.5 cm x 3.0 cm) and insect collection boxes (45 cm x 30 cm x 10 cm) with proper labeling indicating the host, location and date of collection.

Initially, all the insect specimens were examined for the presence of mites under a Carl Zeiss Stemi 2000 stereozoom binocular microscope. The point of attachment of mites to various body parts of insect specimen's *viz*., wing bases, legs, leg joints, acari narium, elytra, abdominal cavities and head regions were observed. The mites were carefully removed from the point of attachment and permanent slides were prepared. The slides were placed under a phase contrast microscope and the taxonomic identification of mites was done based on the available literature.

Estimation of relative abundance

The following indices were worked out to assess and compare the diversity of Acari-Insect association.

Where, S = Number of species; N = Total number of individuals and D = Richness index.

Richness index

Margalef index (Margalef, 1958)

$$D = \frac{S-1}{\ln N}$$

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Diversity index

Species Richness and Diversity II (Pisces Conservation Ltd., www.irchouse.demon.co.uk) (Henderson, 2003) programmes were used to assess and compare the diversity of mesostigmatid mites associated with insects.

Shannon-Weiner index (Whittaker, 1972)

$$\text{Var } H = \frac{\Sigma Pi\,(InPi)^2 - (\Sigma PiInPi)^2}{N} - \frac{S-1}{2N^2}$$

Where, Pi = Proportional abundance of i^{th} species; S = Number of species and N = Total number of individuals.

Species evenness or Equitability J (*Henderson, 2003)*

$$J = H / \log (S)$$

Where, H = Observer Shannon Weiner Index and S = Total number of species in the habitat.

Similarity index

The similarity values were used for cluster analysis. Sequential Agglomerative Hierarchical Non-overlapping (SAHN) clustering was done using Unweighted Pair Group Method with Arithmetic Averages (UPGMA). Data analysis was done using NTSYSpc version 2.02 (Rolff, 1998).

Results and Discussion

A total of 1327, 1227 and 641 mites were collected from Coimbatore, Madurai and Mettupalayam, respectively (Table 1). Ten mite genera/species were associated with coleoptera, three mites from hymenoptera, two from Orthoptera and one from Diptera. Most of the mites are collected from coleoptera family, because of hard elytra and easy portection from enemies. *Anolina prolineata* Ram. and Mohana., *Blattisocius* sp. and *Sejus rufomaculata* Ramaraju were unique to Coimbatore forest location; *Alliphis serrochaetae* Ram. and Mohana., *Eviphis ramosae* Ram. and Mohana., *Eviphis spatulaesetae* Ram. and Mohana., *Poecilochirus coleophorae* Ram. and Mohana. and *Poecilochirus rutellae* Ram. and Mohana. were confined to Madurai forest location. *Digamasellus* sp., *Dinogamasus* sp., *Macrocheles* sp., *Rhyzolaelaps* sp., *Tropilaelaps clareae* Delfinado and Baker, *Uroobovella* sp. and *Varroa jacobsoni* (Oud.) were collected from all the three localities. *Fuscuropoda* sp. was identified from Coimbatore and Mettupalayam, whereas *Gamasellous* sp. was collected from Coimbatore and Madurai. The mite genera/species were collected from *Catharsius capucinus* Fab., *Oxya* sp., *Trigona irridipennis* (Smith), *Rhynchophorus ferrugineus* (Olivier), *Onthophagus ramosus* (Wiedman), *Onitis philemon* Fab., *Phyllognathus dionysius* Fab., *Anomala dorsalis* Fab., *Batocera rufomaculata* (DeGeer), *Apis florea*_Fab. and *Apis cerana indica* Fab.

Table 1. Relative abundance of mesostigmatid mite associated with insects (Nos.)

Mite genera/species	Insect genera/species	Coimbatore	Madurai	Mettupalayam
Alliphis serrochaetae Ram. and Mohana.	*Catharsius capucinus*	0	23±0.7	0
Anolina prolineata Ram. and Mohana.	*Oxya* sp.	16.4±0.6	0	0
Blattisocius sp.	*Trigona irridipennis*	548.8±15.6	0	0
Digamasellus sp.	*Rhynchophorus ferrugineus*	23±0.7	16.2±0.6	42.2±1.7
Dinogamasus sp.	Dipteran fly	14.6±1.2	33.2±1.7	8.8±1.2
Eviphis ramosae Ram. and Mohana.	*Onthophagus ramosus*	0	43.6±1.4	0
Eviphis spatulaesetae Ram. and Mohana.	*C. capucinus*	0	30.8±0.9	0
Fuscuropoda sp.	*T. irridipennis*	128.6±1.7	0	19.6±1.5
Gamasellous sp.	*Onitis philemon*	9.6±1.6	12.6±1.2	0
Macrocheles sp.	*O. philemon*	295±3.2	215.2±3.9	381±6.7
Poecilochirus coleophorae Ram. and Mohana.	*Phyllognathus dionysius*	0	542±2.6	0
Poecilochirus rutellae Ram. and Mohana.	*Anomala dorsalis* Fab.	0	54.8±1.4	0
Rhyzolaelaps sp.	*Batocera rufomaculata*	21.6±1.3	5.6±0.7	12.6±0.9
Sejus rufomaculata Ramaraju	*B. rufomaculata*	33.4±1.6	0	0
Tropilaelaps clareae Delfinado and Baker	*Apis florea*	86.4±1.6	91.2±3.5	64±1.7
Uroobovella sp.	*Trilophidia turpis*	80.8±1.2	108.4±1.7	86.2±3.6
Varroa jacobsoni (Oud.)	*Apis cerana indica*	74.8±1.4	55.2±2.8	29.6±1.5

Analysis of species richness (Margalef index) was maximum in Madurai (13) with a index of 1.6872 and minimum in Mettupalayam (1.0831). Shannon-Wiener index revealed higher mite diversity in Madurai (1.8538). Maximum mite evenness was observed in Madurai (0.6543) and minimum evenness in Mettupalayam (0.4803) (Table 2).

Table 2. Measures of diversity of Mesostigmatid mite species in three forest areas of Tamil Nadu

Locality	No. of species recorded	Richness index	Diversity index	Evenness
		Margalef	Shannon-Wiener	Equitability J
Coimbatore	12	1.5298	1.7956	0.6338
Madurai	13	1.6872	1.8538	0.6543
Mettupalayam	8	1.0831	1.3609	0.4803

Diversity analysis for mites associated with insects collected from three different forest localities of Tamil Nadu was calculated based on Jaccard's similarity coefficient matrices. The similarity coefficient values ranged from 0.47 to 0.76. The diversity index showed 76 per cent similarity between Coimbatore and Mettupalayam, whereas 59 per cent between Madurai and Mettupalayam (Table 3).

Table 3. Values of similarities recorded between mites associated with insects collected from different forest localities using Jaccard's similarity coefficient

Localities	Coimbatore	Madurai	Mettupalayam
Coimbatore	1.0000		
Madurai	0.4706	1.0000	
Mettupalayam	0.7647	0.5882	1.0000

Biodiversity indices of acari-insect association have been worked out for the first time in Tamil Nadu. Heavy mite loads have been observed on most of the honeybees (549) and coleopteran beetles (542) (Table 1). This is in agreement with the findings of Hunter and Rosario (1988) with a mite load of 800, 600, 550 and 292 has been taken from single host individuals. On an overall mite species (13) were recorded in Madurai forest regions. It seeks to characterize the diversity in a locality with reference to other locations. Mac Arthor (1965) who stated that the adjustment in species abundance is more in diversified ecosystem. The forest ecosystems of Madurai forest region were rich in mite species, diversity and evenness, because of undisturbed reserve forest. Similar results were published by Caruso *et al*. (2006), that is undisturbed ecosystem harbour maximum number of species when compared to disturbed ecosystem.

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References

Caruso, T., Pigino, G., Bernini, F., Bargagli, R. and Migliorini, M. 2006. The Berger-Parker index as an effective tool for monitoring the biodiversity of disturbed soils: a case study on Mediterranean oribatid (Acari: Oribatida) assemblages. *Biodiversity and Conservation,* **10**: 25-34.

Farish, D.J. 1965. Some aspects of the sensory and phoretic behaviour of *Macrocheles muscaedomesticae* Scopoli with a consideration of phoresy as a phenomenon. M.Sc. Thesis, North Carolina State University, 151p.

Ehrlich, P.R. and Ehrlich. A.H. 1981. Extinction: the causes and consequences of the disappearance of species. Random House, New York.

Henderson, P.A. 2003. Practical Methods in Ecology. Blackwell Publishers, United Kingdom.151p.

Hunter, P.E. and Rosario, R.M. 1988. Associations of Mesostigmata with other arthropods. *Ann. Rev. Entomol*. **33**: 393-417.

Mac Arthor, R.H. 1965. Patterns of species diversity. *Biological Review*. **40**: 510-533.

Maetˆo, K. and Sato, S. 2003. Impacts of forestry on ant species richness and composition in warm temperate forests of Japan. *Forest Ecology and Management*. **187**: 213-223.

Margalef, D.R. 1958. Information theory in ecology. *Genetics and Systematics*. **3**: 36-71.

Reaka-Kudla, M.L., D.E. Wilson and Wilson, E.O. (Eds.). 1997. In: *Biodiversity II*: *Understanding and protecting our biological resources.* Joseph Henry, Washington, DC.

Rolff, J. 1998. NTSYS-pc. 2.02i. Numerical Taxonomy and Multivariate Analysis System. Applied Biosystem Inc., New York.

Schowalter, T.D. and Ganio, L.M. 1998. Vertical and seasonal variation in canopy arthropod communities in an old-growth conifer forest in southwestern Washington, USA. *Bull. Entomol. Res.*, **88**:633-640.

Whittaker, R.H. 1972. Evaluation and measurement of species diversity. *Taxon*. **21**: 213-251.

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