RESEARCH ARTICLE

Biodiversity of Mite Fauna in the Intramural Environment of Rat House at Pune

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ABSTRACT

A fortnightly investigation had been carried out in the intramural environment of Rat House of Educational Complex, Erandwane, Pune from January 2015 to August 2015 to analyze the environmental impact on the incidence, population density, monthly variation, seasonal variation and dynamics of mite fauna to explore biodiversity with constant environmental parameters using simple 'Pickup Technique' from husk samples under stereo binocular dissecting microscope. In all 356 mite specimens have been screened, identified and classified into male and females under four genera named as *Haemolaelaps glasgowi* abbreviated as Hg, *Echinolaelaps echidninus* abbreviated as Ee belonging to family Laelaptidae and Unidentified (UI_1) and (UI_2). Interesting findings and catchy specimens have been reported exhibiting fortnightly, monthly and seasonal variation during the study period. Quantitative analysis revealed that *Echinolaelaps echidninus* (78.36%) has been recorded as dominant species followed by *Haemolaelaps glasgowi* (20.78%) and UI_1, UI_2 have been reported very rare. Percentage of *Echinolaelaps echidninus* female had been found to be 44.93% which was more than males (33.39%). The percentage of *Haemolaelaps glasgowi* male was found to be 11% and 9% of *Haemolaelaps glasgowi* female has been observed. Also the overall population of *Echinolaelaps echidninus* has been reported more as compared to *Haemolaelaps glasgowi.* These mites have been reported during all the months but exhibited impacts of environmental parameters like temperature, relative humidity and rainfall on their population load. Maximum load has been recorded during August 2015 (83/gm) with breeding, egg laying, hatching into larvae, moulting into nymphs and adults while minimum load has been recorded during February 2015 (19/gm).

Keywords: Rat Mites, Diversity, Allergenic, *Haemolaelaps glasgowi, Echinolaelaps echidninus,* Unidentified.

INTRODUCTION

Ticks and mites belong to *Arachnida* and have been focused for the studies very recently as a new branch of zoology or veterinary science under Acarology. To a little more extent House Dust Mites have been explored

during last few decades as significant offending intramural allergens causing prominent allergy among sensitive victims. About 20% Indian and world population has been recorded today to suffer from allergic ailments like respiratory or skin allergy.

Hence scientists focused their attention on role of environment on the incidence, population dynamics, fluctuation or rhythmic seasonal dynamics of the house dust mite for their management and treatment of allergy patients to give them good health.

Kern (1921) was the first American Scientist to discover *Dermatophagoides pteronyssinus,* a house dust mite as prominent cause of house dust mite allergy and not the proper dust in the homes as presumed earlier. Subsequently different groups of HDM like Pigeon mites, poultry mites, bed mites, floor mites, animal mites like rat, cat, pig, cattle mites and other bird mites like fowl mites etc. had been studied on top focus to analyze the allergic ailments among the patients by several workers from abroad and also in India.

Accordingly, through further studies in all 36 species have been recorded world over as offending allergens (Spieksma, 1997), 29 species from West Bengal i.e. India, 23 from Karnataka (Rao and Ranganath, 1981), 20 from Maharashtra (Jogdand, 2012) and 17 from Kerala (Haq and Ramani, 2010). Now the Indian record has been raised to 36 and record of Maharashtra to 27, updating the world record to 43 instead of 36 (Jogdand, 2013).

Fain A (1957), Spieksma (1997), Maunsell (1968), Kern (1921) etc.. were prominent researchers from abroad and Shivpuri (1977), Modak *et al.* (1991), Rao and Ranganath (1981), Channabassavana (1981), Lal *et al.* (1973), Maurya *et al.* (1982), Tilak and Jogdand (1989a; 1989b; 1989c;1989d), Jogdand (1986), Jogdand (1994,1995,1996,2000,2007,2010), Rao Krishna SN *et al* (1980), Tilak and Jogdand *et al* (1994), Tilak and Jogdand (2009) etc from India who gave valuable contributions in Acarology. Reviewing this work the present study has been undertaken to explore 'Biodiversity of mite fauna in the intramural environment of rat house at Pune.

MATERIALS AND METHODS

House dust has been considered as intramural detritus ecosystem comprising biotic components like microbes of bacterial and fungal or some times of viral origin from plant kingdom and mites, eggs of mosquitoes, cockroaches, lice, bed bugs, protozoan cysts etc from animal kingdom. Dust in the houses constitute abiotic components including dandruff, cosmetics, debris, paints, colors etc. These biotic and abiotic components of detritus ecosystem constitute the material for the subject. Here we have selected study of mites from the husks of 'Rat House' from Pune.

Simple pickup method (Jogdand 1988) from husk samples under the stereobinocular dissecting microscope has been used for the separation of mite specimens from rat house husk. The fresh samples of rat house husk have been collected fortnightly, regularly on the fixed dates for i.e. 1st and 16th of every month at a fixed time i.e.at 8 a.m. sharply, in sufficient quantity using paper envelope and immediately brought to the research laboratory in the Department of Zoology, BVDU, Yashwantrao Mohite College, in the premises of More Vidyalaya, Pune, Maharashtra.

Examination of Rat husk samples :

Two grams of these fresh samples have been spread on a clean, dry and sterile petridish with a uniform thin layer and observed under a stereobinocular dissecting microscope with illumination device below, so that mites get exposed and illuminated when they get agitated and start their movements and thus easily detected in the husk due to their prominent shape, size and color.

Isolation of mites:

These mites have been manually picked up and collected using a moist needle dipped in 4% lactic acid and stored in lactic acid in a cavity block. Because on touching the mite in the husk by tip of moist needle, it sticks to needle and thus collected.

Clearing and mounting:

Depending upon the extent of sclerotization of body cover, they have been kept safe inside the lactic acid for one to three days and mounted when they become transparent in the melted glycerin jelly, keeping ventral posture up. The cover slip is then gently pressed with blotting paper to remove excess jelly and for proper spreading of body parts and leg pairs. They get solidified on cooling to normal temperature and the slides are ready for microscopy and photography.

Identification:

The mites were identified according to the keys given by Baker and Wharton (1958), Hiware *et al*.

(2003), Hughes (1976), Spieksma (1997) and other available literatures. These specimen slides have been screened under Leica binocular research microscope with camera, monitor and measurement facility in a special Leica room.

RESULT AND DISCUSSION

During the study period in all, 356 specimens have been screened under 4x or 10x X 10x combination magnification and date wise measurements of specimens have been recorded. And these specimens have been identified and classified into male and females under four genera named as *Haemolaelaps glasgowi* (Ewing, 1925), *Echinolaelaps echidninus* (belonging to family *Laelaptidae* and Unidentified (UI_1) & (UI_2) as very rare specimens (Plate I).

Interesting findings have been recorded as briefly described and discussed here. The colour of adult female *Echinolaelaps echidninus* is reddish brown and attains a size of about (1137.54 X 580.51µm) Male and Female (1122.80X594.12µm). The genitoventral plate is widely expanded posterior to coxa IV and extends nearly to the anal plate from which it is separated by a very thin strip of integument. The colour of *Haemolaelaps glasgowi* is dark brown and attains a size of about (508.78X314.41µm) Hg male and female (1114.5X554.08 µm). The genitoventral plate is separated from the anal plate by a distance distinctly greater than the length of the anus. The shape of (UI1) has been found to be oval with stunted leg pairs with terminal disc. It is brownish in colour having 636X393µm. The another species (UI2) is brown in colour having size 502X 381µm.bearing slender and very long leg. (Plate I)

The fortnightly and monthly percentage contribution of all species has been described here. Highest total fortnightly load of rat mites has been recorded during first fortnight of August (83) followed by second fortnight of July (44) and second fortnight of June (41). And lowest total load (4) has been recorded during second fortnight of January 2015.During both March and April first fortnight the load has been found to be same i.e.20. (Table 1 and 2)

The ratio of female: male in both the genera shows interesting findings. The ratio of fortnightly Ee females: Ee males has been found to be 44.93% : 33.39% where as on contrary the ratio of fortnightly Hg female : Hg males has been found to be 8.69% : 12.05%. (Fig.1 and 2)

The quantitative analysis revealed that Ee (78.36%) is dominant species as compared to Hg (20.78%) and UI_1 (0.56%),UI_2 (0.28%). Highest load has been recorded during August i.e. 63 of Ee and 17 of Hg followed by UI_1 (2) and UI_2 (1). Hg contributed 1.12% during January and 1.96% during February while Ee has been found absent during January and contributed 1.69% during February. The highest load of Ee has been found in the month of July (20.78%) comprising 13.48% females and 7.3% males. Whereas highest load of Hg has been observed in the month of August (4.77%) comprising 3.37% males and 1.4% females (Table 3 and 4)

Table1: Fortnightly contribution of *Echinolaelaps echidninus* in the Intramural Environment of Rat House at Pune.

Particulars	% Ee Total Load	%Ee Male	%Ee Female
2nd fortnight Jan.	0	0	0
1st fortnight Feb.	0	0	0
2nd fortnight Feb.	1.69	1.40	0.28
1st fortnight March	5.06	3.93	1.12
2nd fortnight March	1.40	1.40	0
1st fortnight April	3.93	3.93	0
2nd fortnight April	3.65	1.40	2.25
1st fortnight May	5.34	0.84	4.49
2nd fortnight May	4.78	2.81	1.97
1st fortnight June	3.37	1.40	1.97
2nd fortnight June	10.67	3.09	7.58
1st fortnight July	10.11	3.09	7.02
2nd fortnight July	10.67	4.21	6.46
1st fortnight August	17.69	5.89	11.79
Total	**78.36**	**33.39**	**44.93**

Table 2: Fortnightly contribution of *Haemolaelaps glasgowi* in the Intramural Environment of Rat Houseat Pune.

Particulars	% Hg Total Load	%Hg Male	%Hg Female
2nd fortnight Jan.	1.12	1.12	0
1st fortnight Feb.	1.97	0.56	1.40
2nd fortnight Feb.	1.69	1.12	0.56
1st fortnight March	0.56	0.56	0
2nd fortnight March	0.28	0.28	0
1st fortnight April	1.69	1.40	0.28
2nd fortnight April	2.81	0.84	1.97
1st fortnight May	1.69	0.28	1.40
2nd fortnight May	0.56	0.56	0
1st fortnight June	0.28	0.28	0
2nd fortnight June	0.84	0.56	0.28
1st fortnight July	0.84	0.28	0.56
2nd fortnight July	1.68	0.84	0.84
1st fortnight August	4.77	3.37	1.40
Total	**20.78**	**12.05**	**8.69**

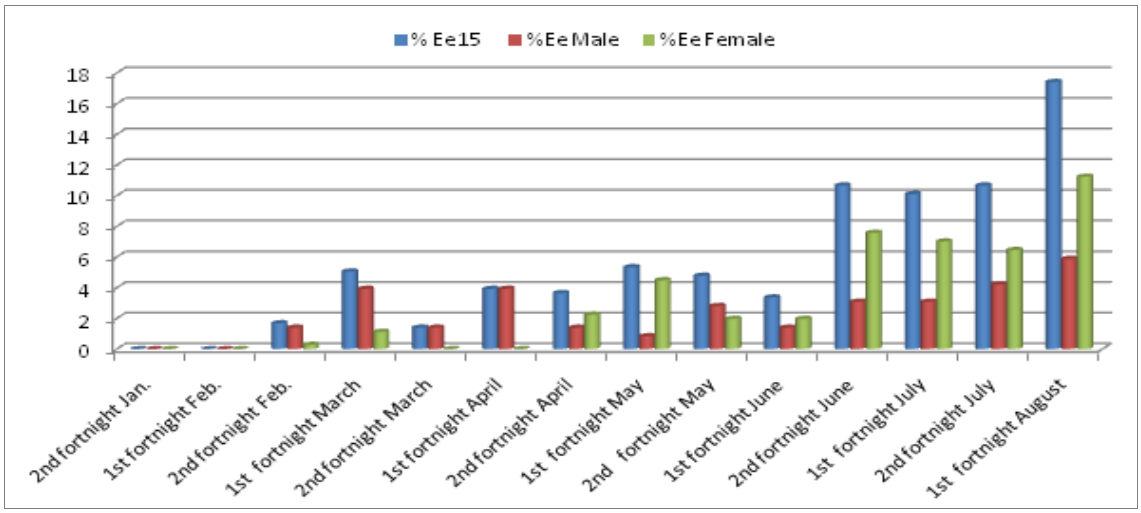


Fig. 1: Fortnightly contribution of *Echinolaelaps echidninus* in the Intramural Environment of Rat House at Pune.

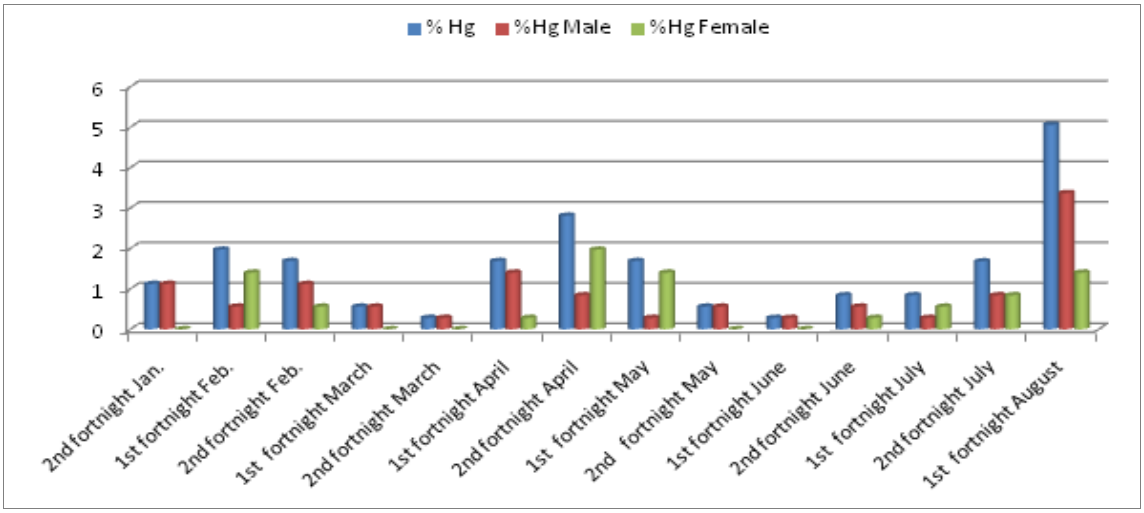


Fig. 2: Fortnightly contribution of *Haemolaelaps glasgowi* in the Intramural Environment of Rat House at Pune.

Table. 3: Monthly contribution of *Echinolaelaps echidninus* in the Intramural Environment of Rat House at Pune.

Echinolaelaps echidninus			
Month	**% Ee Total Load**	**% Ee male**	**% Ee Female**
Jan	0	0	0
Feb	1.69	1.4	0.28
March	6.46	5.33	1.12
April	7.58	5.33	2.25
May	10.12	3.65	6.46
June	14.04	4.49	9.55
July	20.78	7.3	13.48
Aug	17.69	5.89	11.79
Total	**78.36**	**33.39**	**44.93**

Fig.3: Monthly contribution of *Echinolaelaps echidninus* in the Intramural Environment of Rat House at Pune

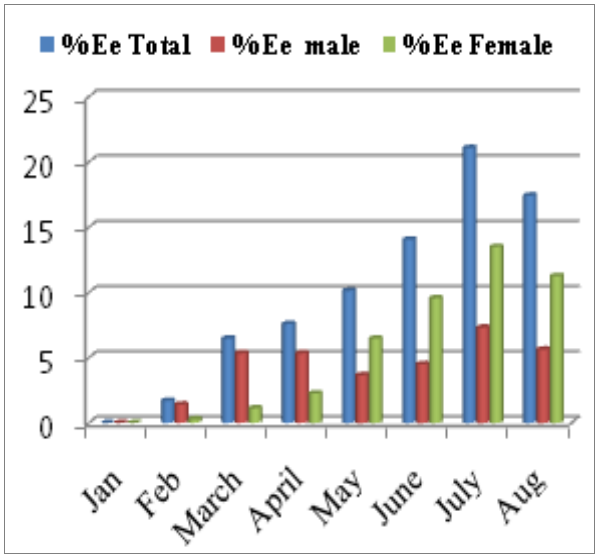
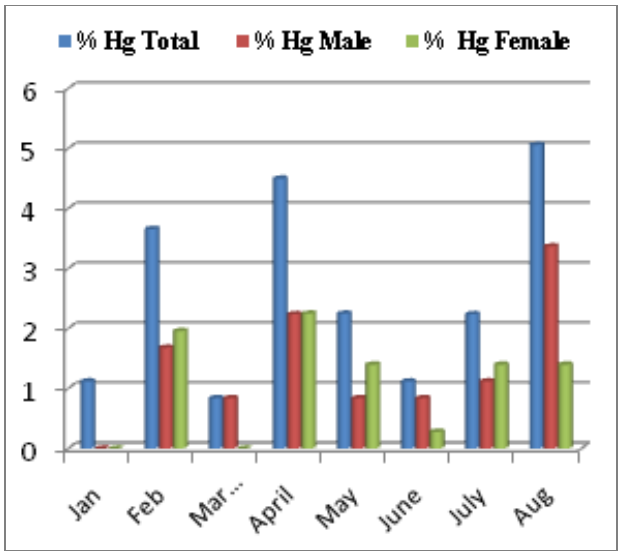


Table 4: Monthly contribution of *Haemolaelaps glasgowi* in the Intramural Environment of Rat House at Pune.

Haemolaelaps glasgowi			
Month	**% Hg Total Load**	**% Hg Male**	**% Hg Female**
Jan	1.12	0	0
Feb	3.66	1.68	1.96
March	0.84	0.84	0
April	4.5	2.24	2.25
May	2.25	0.84	1.4
June	1.12	0.84	0.28
July	2.52	1.12	1.4
Aug	4.77	3.37	1.4
Total	**20.78**	**10.93**	**8.69**

Fig.4: Monthly contribution of *Haemolaelaps glasgowi* in the Intramural Environment of Rat House at Pune.



The monthly ratio during August of Ee females : Hg females has been found to be 11.79%:1.4% and Ee males : Hg males has been found to be 5.89%:1.4%. During both March and April the percentage contribution of Ee males has been found to be same i.e. 5.33%. (Fig. 3 and 4).

The quantitative analysis of egg bearing and non egg bearing females has been carried out. The total number of egg bearing females of Ee and Hg, observed was (163-45.78%),while the highest number of egg bearing females has been observed in the month of July i. e. 47 and in March only 3 females have been found carrying eggs and no egg bearing female has been recorded during January. The Ee females carrying egg showed more contribution (141-39.60%) as compared to Hg (22-6.17%)).Hence The total ratio of Ee egg bearing female: Hg egg bearing female has been found to be 39.60%: 6.17%. and (28-7.86%) females without egg have been observed during study period. Two unidentified species have been recorded during August 2015 as UI_1 and UI_2 consisting a larva and an adult. (Plate I).

***Echinolaelaps echidninus* (Male)**

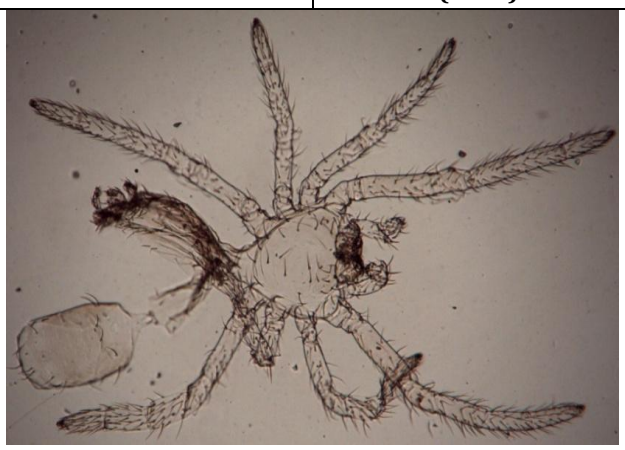
***Echinolaelaps echidninus* (Female)**

Unidentified 1

***Haemolaelaps glasgowi* (Male)**

***Haemolaelaps glasgowi* Female**

Larva of Unidentified 2



Unidentified 2
Identification of UI1, UI2 and larva is in process

Plate1:Identified and unidentified species of Rat mite.

The study on house dust mites has been mostly restricted to human houses/ patients houses further extended to poultry house dusts or different types of dwellings with human association. But this type study is totally new as so far the common word "Rat mites" has been recorded in the published literature. But In this study a continuous study of rat house husks has been carried out for eight months fortnightly. No such study has been carried earlier on Rat House husk mites. But a similar type of study in House Dust Mites in the human dwellings have been carried out (Jogdand, 1988) which revealed variation in mite load as per the types of dwellings (Huts, slums, well built and well ventilated buildings etc.), seasons, months, localities etc. and recorded highest mites load during rainy season particularly in dark damp and illventilated poorly constructed houses as compared to well ventilated posh buildings. Moderate mite load during winter and minimum load during summer seasons (Jogdand 1997a; 1997b) has been reported. 20 species of HDM in Maharashtra (Jogdand, 2012) have been recorded and established role of environment on dynamics of house dust mites at Pune (Jogdand *et al*., 2013). But in this study of rat house husk mites, the usually recorded house dust mites like *D. pteronyssinus, D.farinae, Caloglyphus, Blomia* etc. have been surprisingly found absent totally. Instead of these Ee and Hg have been recorded mostly during rainy and summer season in good numbers, showing seasonal fluctuations and less monthly variation in contrast to HDM which showed prominent variation (Jogdand, 2009).

Biodiversity is specific limited to Ee, Hg and UI1 and UI2 showing more abundance of Ee and Hg while incidence of UI1(2specimens) and UI2(only one specimen) is very rare. The identification of UI1and UI2 is in process and study is continued to determine lower stratum mite fauna below the husk in the rat house dust and elaborate study will be presented in future. However this study has opened a new thrust

area in acarology with good scope to study rat house dust mites from allergy point of view.

CONCLUSION

From the present study it can be concluded that, 356 mites have been recorded from the rat house. These have been classified and identified into 4 genera out of which Ee has been recorded dominant followed by Hg, UI1and UI2 are unidentified and rare and may be new records thus showing biodiversity.

Mites in the house dust are proved allergens causing severe allergy, comparatively in more patients sensitive to them. They show seasonal variations and great species biodiversity. Control of mite populations by various methods including chemical control helps to solve the problem in the management of house dust mite allergy. Thus these studies have been found useful to give relief to ailing allergy patients to afford them good health in twenty first century.

REFERENCES

Baker EW and Wharton GW (1958) An introduction to Acarology: The Macmillan Company,New York:pp:92.

Berlese (1887) In Ghilyarov MS Bregetova NG(Eds) key to the soil Inhibiting Mites Mesostigmata Nauka Leningrad pp:483-5

ChannabasavannaGP,Krishna Rao,SN and Rangnath HR (1981) A new caloglyphus (Astigmata:Acaridae) from poultry litter in Karnataka,India,with taxonomic comments on the genus. *Ind.J.Acar*.6:57-63.

Ewing HE (1925) New parasitic mites og the genus Laelaps.*Proc.Ent.Soc.Wash*.27:7-10.

Fain A (1957) Le genra dermatophagoides Bigdonov 1884 Son imp. Dan allergies respiratories et Cutanueous Chez 1 homme (Psoroptides-Sarcoptiformes). *Acarologia,* 9: 179-229.

Hughes AM (1976) The mites of stored food and ho Tech. *Bull. Minst.Agr.London*.9: 400.

Haq MA and Ramani N (2010) 'Preliminary survey of House Dust Mites at Calicut (Kerla)''. *Acarology* 23.223-226.

Hiware CJ, Jadhav BV, Mohekar AD (2003) Applied Parasitology-A Practical Manual; Mangal Deep Publications; Jaipur (India):.

Jogdand SB (1986) House Dust mites as Allergen, Workshop manual on Environment Biopollution, P.15-21.

Jogdand SB (1986) House Dust mite Allergy in India, Workshop manual on Environment Biopollution, P. 21-26.

Jogdand SB (2012) Arachnida:Acarina,Astigmata-House Dust Mites;State Fauna Series:20:2012.Fauna Of Maharashtra Part 2. *Invertebrates*, pp.667-668.

Jogdand SB (2000) House dust mites as Allergns & Biopollutants, Environ Issues & Susta Dev. (proceedings) Ed. S.B. Wagh, P. 51-52.

Jogdand SB (1988) Ph.D.Thesis submitted to Dr.BAMU.Aurangabad.

Jogdand SB (1994) Role of House dust mites in Allergy, Advances in mycol. & Aerobiology, 323-333.

Jogdand SB (1995) A study on dust mite allergens in patients; Environment, *Ind. J.Aerobiol*, 8: 43-46.

Jogdand SB (1997a) A vertical study of house dust mite fauna at Calicut, Environment & Aerobiol. Houstan USA, P. 41-49.

Jogdand SB (1997b) Recent Trends in House dust mite allergy & Immunology, *Aerobiol.* P. 267-290.

Jogdand SB (2007) Mites as a Bioresource of India in Conservation and Sustainable development of Environment Endemic Bioresource of India – Conservation & Sustainable Development with Spetial Reference to North-East India, Ed. Prof. N. Irabanta Singh, Published by: Bishen Singh Mahendra Pal Singh, Dehera dun, India P.(293-329).

Jogdand SB and Tilak ST (2009) Status and prospects of house dust mite allergy and immunology,souvenir and compendium xv National Conference on Aerobiology Imphal (Manipur),Proceeding pp 9-20.

Jogdand SB (2010) Role of bird mites and house dust mites in causation of human allergy 16th N.C.A. 19-21 November. 2010 Souvenir, p.43-441.

Jogdand SB. House dust mites & Allergy, Clinical Digest series, In press.

Jogdand SB and Ingole AC (2013) Role Of Environment On Dynamics Of House Dust Mites (Hdm) At Pune ; *Int. J. of Life Sciences A1:*29-30.

Kern R (1921) Dust sensitization in bronchial asthma. M. *Clin. N. America,* 5: 751-758.

Rao Krishna NS,Rangnath HR andChannabasavanna OP (1981) House Dust Mites from India *I.J.Acar*.5:85-96.

Lal MA *et al.* (1973) Clinical significance of skin reactions to mite extracts in individuals with bronchial asthama. *Indian J Med. Res*., 61: 5: 672-675.

Maunsell Wraith (1968) Mites and house dust allergy in bronchial asthma. *Lancet*, 1:1267-1270.

Modak SK, Saha N Tandon and Gupta SK (1991) Dust mite fauna in houses of bronchial asthma patients: Comparitive study of three zones of India. *Entamol*. 16(2) : 115-120.

Rao Krishna NS, Ranganath HR and Channabasavanna GP (1980) House dust mites from India." 5 : 85-94.

Shivpuri DN(1977) House dust mites allergy in India." Aspects of allergy and Appl. *Immunol*. 5: 19-35.

Spieksma FTh M (1997)Domestic mites from an Acarologic Perspective: *Allergy*, 52:360-368.

Tilak ST andJogdand SB and Singh NI (1994) Allergy due to house dust mites, Forontr. *Bot. Special*, P. 16-52.

Tilak ST and Jogdand SB (1989a) House dust mites & Allergy at Aurangabad (M.S.), *Frontr. Botany*, Vol. III (1.2), P. 113-115.

Tilak ST and Jogdand SB (1989b) Impact of Environment on incidence of mites, *Ind. J.Aerobiol*.,2(1.2): 35-38.

Tilak ST and Jogdand SB (1989c) Impact of Environment on the incidence of HDM, *Res.J.Envi*., 5(2) P. 51-54.

Tilak ST and Jogdand SB(1989d) House dust mites, *Annals of Allergy* USA, Inc., Vol. 63, P. 392-397.