International Journal of Zoology Studies
www.zoologyjournals.com
ISSN: 2455-7269
Received: 03-03-2026, Accepted: 03-04-2026, Published: 18-04-2026
Volume 11, Issue 2, 2026, Page No. 25-28

Mites associated with insects (coleoptera), nest and house dust from Indapur and Daund tehsil, Pune, Maharashtra, India

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Abstract
Mites are involved in the transmission of many diseases in humans and animals serving as vector. Our research highlights the diversity of mites from 2 tehsils of Pune district. Three species of phoretic mites, belonging to the order Mesostigmata, were found on beetles (Coleoptera). Abandoned Baya weaver nests collected near the cultivated farms and water bodies showed the presence of three species from order -Mesostigmata, Astigmata and Prostigmata. House dust samples screened from various rural regions were reportedly found to contain a greater number of astigmatid mites, including two different species, and one prostigmatid species. Preference of attachment of Phoretic mites on the host body and morphometric measurements of mite's body were also recorded.

Keywords: Species, symbiotic, phoretic, morphometry

Introduction

Acaroid mites are minute, wingless organisms belonging to the class Arachnida. Due to their small size, mites are well adapted to connect their lives with lives of other animals. The nest of birds, rodents, insectivores, and social insects all have a large population of mites, some living on the minute particles of population food or general detritus accumulated by any animal households (A. M. Hughes, 1973).

The insect-associated mites are of great biological importance as they include phoretic (temporary/passive transport), commensalisms (passive/temporary association), or parasites (living at the expense of the host insect) or for predation (feeding on the haemolymph of the host insect) (Bhaumik *et al*., 2016) [4]. Some species found in dust and nests are associated with allergies, transmit diseases, cause skin infections and irritation, but most of the other are harmless. Reactions to domestic mites can cause asthma, allergic rhinitis, atopic dermatitis, and urticaria (Sun *et al*., 2013) [11]. Therefore, with the increasing number of patients allergic to domestic mites, more monitoring of allergen levels is needed to improve the hygiene conditions of homes (Arlian and Platts-Mills 2001) [3]. Phoretic mites travel on the body of the host. Phoresy is a complex symbiotic association that has evolved in many organisms as a result of the spatial and temporal isolation of their habitats (OConnor, 1982). Phoresy is defined as a form of commensalism facilitating the physical transport of one organism on the body of another, during which time no feeding or reproduction occurs in the phoretic organism (Binns 1982, OConnor 1982) [5]. The function of the phoresy is dispersal (Al-deeb *et al*., 2010) [1].

Material and Methods

Insects were collected during night time using nets, night traps, forceps, and directly by hand in the presence of source of light (Jadhav & Matkar 2025) [7]. Also, abandoned Baya weever nests found near cultivated farms, water bodies, and house dust samples were collected in transparent plastic bags for transportation.

Mites were counted on the head, thorax, legs, sub elytral space, membranous wings, abdominal tergites, and abdominal sternites of each beetle under a dissecting microscope (Al- deeb et.al, 2012) [2]. The mites were collected with a fine brush from the body of beetles and preserved in 70% ethyl-alcohol before clearing in lactic acid (Ozman et.al, 2014). Similarly, the nests were gently tapped and pressed onto the paper, and the residue obtained was carefully examined under light microscope. The live and dead mites were identified by their movement and stability during the examination of sample and were isolated in lactic acid.

After two days, the permanent slides of these mites were prepared using a drop of melted glycerin jelly. The permanent slides were labelled with date, time, location, and host/ sample. Photography of these mites was done using an android camera under the microscope. Mites were captured under 10x and 40x, and the identification was done on the basis of morphological characters using A.M. Hughes (1976) [6] and Vishnupriya & Mohanasundaram (1988) [12].

Result and discussion

The present study documented a total of 6 species of mites associated with the Insects of the order Coleoptera, Baya weaver nest and house dust from Daund, and Indapur tehsil, District- Pune, Maharashtra (Table 1). Two dominant mite species were found associated with *Oryctes rhinoceros* both of the study regions: *Diplogynium oryctae* (Acari: Mesostigmata: Diplogyniidae) and *Hypoaspis lubrica* (Acari: Mesostigmata: Laelapidae) (Fig. 1, 2 & 8). These two specie's count data and preference of attachment on the host body are presented in Table 2 and Figure 8. According to the study, the highest number of phoretic load was found on abdominal tergites, abdominal sternites, and sub-elytra regions, whereas the minimal attachment was noted number

on the head and leg. Species *Celaenopsis sp.* (Acari: Mesostigmata: Celaenopsidae) was found on the dung beetle of Daund region (fig.3).

Analysis of house dust samples revealed 3 different species, among which *Dermatophagoides pteronyssinus* (Acari: Astigmata: Pyroglyphidae) was found to be the most dominant species in both the study areas (fig. 4). In Indapur tehsil, *Suidasia nesbitti* (Acari: Astigmata: Suidasia), and *Cheyletus eruditus* (Acari: Prostigmata: Cheyletidae) were recorded (fig. 6 & 7). Additionally, *Hypoaspis lubrica*, *Suidasia nesbitti*, and *Cheyletus eruditus* were also present in the *Baya weever* nest. The measurements of the mite's body length, width, and leg dimensions are recorded using ImageJ software and are presented in Table 3.

Table 1: Occurrence of mite's species in different study areas and Sample/ Host.

Species	Region		Host/ Habitat		
	Daund	Indapur	Insect	Nest	Dust
Diplogynium oryctae Vishnupriya & Mohanasundaram, 1988[12]	+	+	+	-	-
Hypoaspis lubrica Voigts and Oudemans, 1904	+	+	+	+	-
Celaenopsis sp.	+	-	+	-	-
Dermatophagoides pteronyssinus Trouessart, 1897	+	+	-	-	+
Suidasia nesbitti Hughes, 1948	-	+	-	+	+
Cheyletus eruditus Leach, 1815	-	+	-	+	+

Fig. 1 Ventral view, *Diplogynium oryctae* (Female)

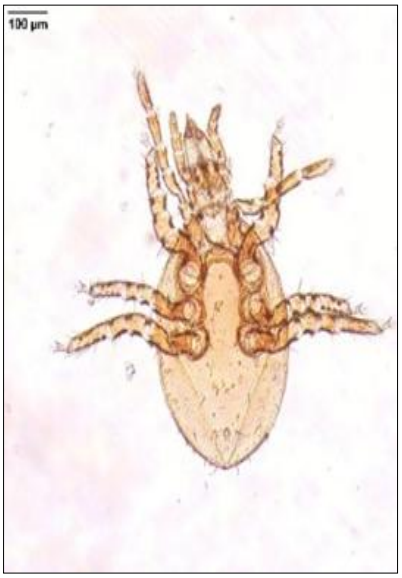

Fig. 2 Ventral view, *Diplogynium oryctae* (Male)

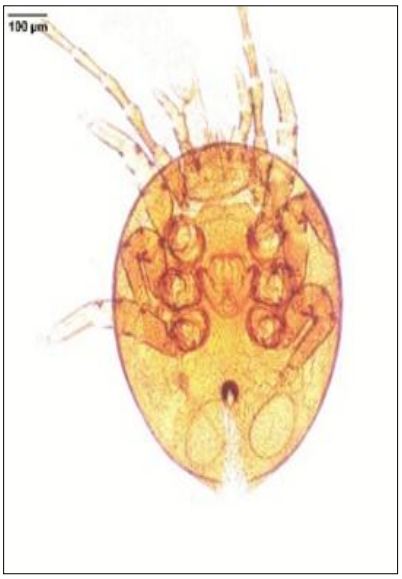

Fig. 3 Ventral view, *Caelenopsis sp.* (Female)

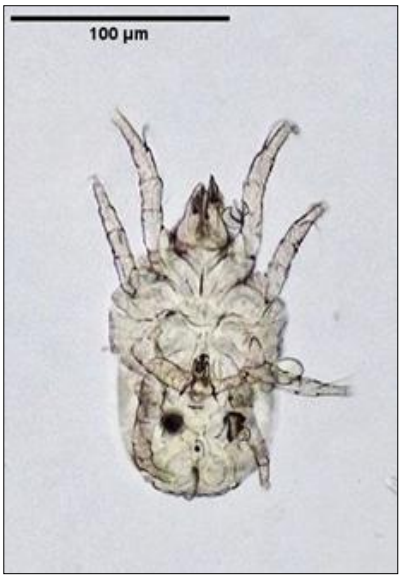

Fig. 4 Ventral view, *Dermatophagoides pteronyssinus*

Fig. 5 Ventral view, *Cheyletus eruditus*

Fig. 6 Ventral view, *Suidasia nesbitti*

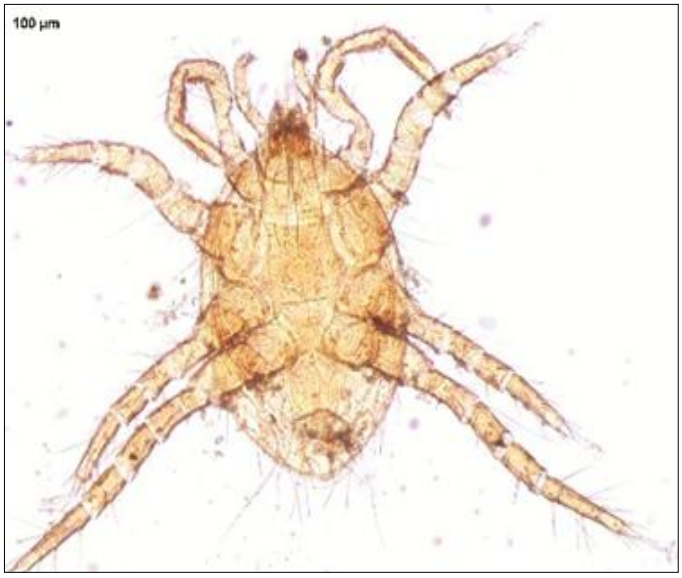

Fig 7: Ventral view, *Hypoaspis lubrica*

Table 2: Loads of *Diplogynium oryctae* and *Hypoaspis lubrica* on *O.rhinoceros*.

Body Parts	Species I	Species II	Total
Head	01	0	01
Abdominal Sternites	03	02	05
Abdominal Tergites	12	04	16
Thorax	02	01	03
Legs	01	01	02
Sub- elytra	02	02	04
Total	21	10	31

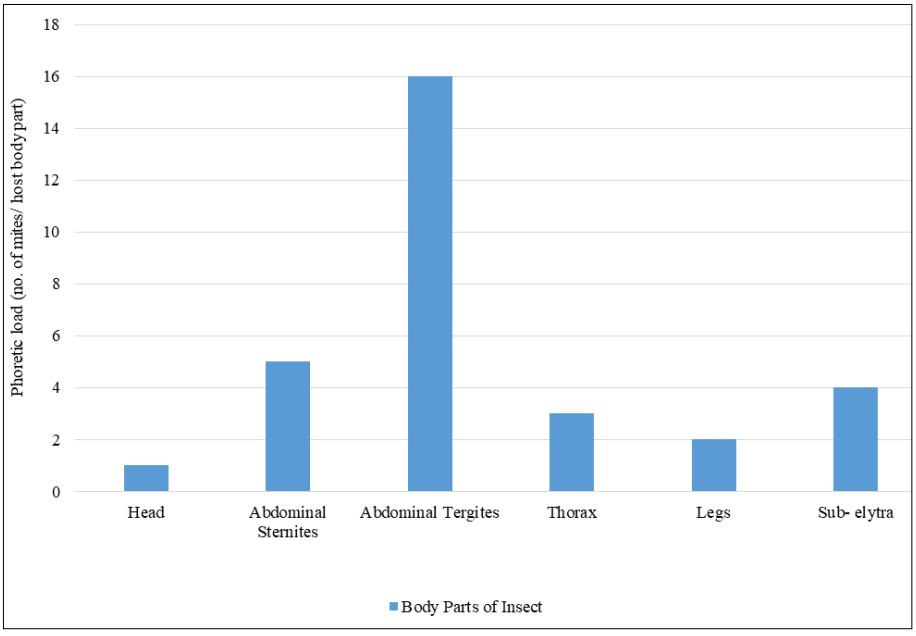

Fig 8: Phoretic load on *Oryctes rhinoceros* adult body parts.

Table 3: Measurements (µm) of body size and leg length of mites.

Species	Length	Width	Leg I	Leg II	Leg III	Leg IV
Diplogynium oryctae (Female)	525 µm	331 µm	396 µm	275 µm	238 µm	380 µm
Diplogynium oryctae (Male)	518 µm	325 µm	401 µm	282 µm	293 µm	353 µm
Hypoaspis lubrica	1102 µm	670 µm	946 µm	832 µm	871 µm	1210 µm
Celaenopsis sp.	683 µm	584 µm	526 µm	399 µm	383 µm	404 µm
Dermatophagoides pteronyssinus	144 µm	76 µm	86 µm	63 µm	66 µm	55 µm
Suidasia nesbitti	225 µm	117 µm	93 µm	71 µm	59 µm	78 µm
Cheyletus eruditus	244 µm	120 µm	125 µm	94 µm	115 µm	122 µm

Conclusion

The present study concludes that mites associated with the Insects primarily belong to the order Mesostigmata and exhibit distinct attachment preference on the host body, occupying the niches with highest occurrence on abdominal tergites, followed by abdominal sternites, sub-elytra, thorax, legs and head. House dust samples had the dominance of mites from order Astigmata, with Prostigmata representing secondary group. Among the predominant dust mites, *Dermatophagoides pteronyssinus* emerged most prevalent species across both the study regions. Abandoned bird nests were found with diverse group of mites belonging to the order Mesostigmata, Astigmata, and Prostigmata.

Acknowledgement

The authors are thankful to the Principal of Tuljaram Chaturchand College of Arts, Science & Commerce, Baramati, (Autonomous), Dr. A. S. Jagtap, HOD, Department of Zoology, Dr. S. P. Chordiya, PG Coordinator, Department of zoology, Dr. D. M. Sangale for providing facilities in completing this work.

The completion of this study could not have been possible without expertise of Dr. S. S. Jadhav, beloved thesis adviser. We sincerely thank the Department of Zoology, Tuljaram Chaturchand College of Arts, Science & Commerce, Baramati, all the staff members for their assistance, family and friends for their invaluable support.

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