First record of Astigmatid mites (Acari: Sarcoptiformes) from animal carcasses of Punjab(India)

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Abstract : *This paper analyses the occurrence of mites of the infra order Astigmata in situations involving of forensic aspects. Species belonging to the families acaridae, glycyphagidae, histiostomatidae and lardoglyphidae encountered in cattle carcases. Advance decomposition of animal remains allows mites for rapid dispersal and colonization of such unpredictable resources.*

Keywords : Forensic Acarology, Carcases, Astigmata, animal carcases.

Introduction

Mites of the infra order Astigmata (Order Acariformes, Suborder Sarcoptiformes) are able to exploit variable habitats like dead animal places by a specialized deutonymphal instar that typically disperses via phoresy on arthropod or vertebrate hosts (OConnor 1982; Houck and OConnor 1991). From apparently phoretic associations, astigmatid mites have also emitted generally as permanent parasites of birds and mammals. Because of short generation time, many species of these mites can build up large populations on intense resource spots. Astigmatid mites are the dominant constituent of the acarofauna of house dust and stored food products (Hughes 1976; Wharton 1976; Colloff and Stewart 1997).

Forensic aspects of house dust mites, including their implication as proximal causes of death by anaphylaxis in sensitive persons (Edston and van Hage-Hamsten 2003), are treated in a companion article (Solarz 2009). The small size, high species diversity, difficult and incomplete taxonomy of these mites have caused them to be largely overlooked by the legal system (Hughes 1976; Smiley 1987). Lastly, many astigmatid mites are obligate or facultative parasites of vertebrate carrion and have been encountered both in legal cases involving human corpses and from analytical studies of faunal succession in animal carcasses. Most astigmatid mites encountered in these situations belong to a small number of families, although many different species can be involved.

The Acaridae is one of the largest families of free-living astigmatid mites, including 80 genera and almost 500 described species. This family includes many important pests of stored food products as well as species that can contaminate other sensitive materials such as cell or fungal cultures. These mites may feed directly on fresh or processed plant material (seeds, pollen, flour, etc.) or on fungi associated with such material. Several genera can be encountered in forensic situations also. The genus *Acarus* contains the most important mite pests of stored

food products (Hughes 1976). *Acarus siro* L. is a cosmopolitan pest in both fresh and processed food. However, this species has also been reported on carrion (Me ´gnin 1894). A major difficulty with this genus is that there are a number of species that are morphologically very similar and difficult to separate by the non-specialist. For example, the illustrations of *A. siro* given by Me ´gnin (1894) are not sufficiently detailed to distinguish this species from other closely related species. I have collected a large population of *Acarus siro* from dead animal bodies. The genus *Tyrophagus* includes some of the most universal astigmatid mites. Most species of this genus have abandoned phoretic dispersal and no longer form the specialized deutonymphs. Species also can be found in such non-patchy habitats as field litter. In addition to being common in stored food products and house dust, these mites can occur in animal carcases also. Russell *et al.* (2004) reported large numbers of *T. putrescentiae* from a human corpse and Early and Goff (1986) obtained it in carrion studies in Hawaii (USA). I have found *Tyrophagus putrescentiae* and *Tyrophagus longior* in large numbers from animal carcasses from Punjab.

A third acarid genus reported in forensic cases is *Sancassania* (= *Caloglyphus*). Species in this very large, poorly known genus are commonly found in various types of moist, decaying organic materials such as manure, compost, poultry litter, decayed bulbs and tubers, and fungal fruiting bodies. Much of the diversity of this genus is associated specifically with scarabaeoid beetles that provide phoretic dispersal among preferred habitats of both beetles and mites. The species commonly referred to as *Sancassania berlesei* (Michael) (the taxonomy of this species is confused) is very widespread in synanthropic habitats such as those mentioned above. Leclercq and Verstraeten (1988) recorded this species from two human corpses in Belgium that had been discovered between 3 and 4 months postmortem. Early and Goff (1986) also described this species from carrion ecology studies in Hawaii. These authors also reported an unidentified species of *Sancassania* in their studies, and I have also found the species of this genus in buffaloes and cows carcasses in the later stage of decay (black putrefaction stage).

Glycyphagidae are commonly found in different stored food products, granaries, other farming and occupational environments and are also found in house dust. These are commonly known as storage mites (Warner *et al.*, 1999) feed on decaying plants and similar products.

Lardoglyphidae includes two genera and nine species that are best known as crowding stored food products, particularly those consisting of processed animal materials (Hughes 1976; Olson 1982). Baker (1990) described two new species from the stomach contents of human mummies from Chile and the United States. Iverson *et al.* (1996) reviewed the distribution of *L. zacheri* in North America and reported feeding stages of the mites from animal carcasses (e.g., a raccoon carcass in the dry, skeletal stage of decomposition) and deutonymphs attached to beetles of the genus Dermestes collected in bird (e.g., ex Dermestes caninus 'in feathers under dead and decayed bird', Texas) and mammal carrion (e.g., ex Dermestes fasciatus in bloated deer carcass, Utah, USA). I have also found a genus *lardoglyphus* from animal carrion in later stage of decomposition. Although Catts and Goff (1992) referred lardoglyphid mites to their category of 'incidentals', i.e., 'arthropods that use the corpse as a concentrated resource extension of their normal habitat,' it would appear that animal carcasses are likely the natural habitat of most species of lardoglyphid mites.

The Histiostomatidae (= Anoetidae) is the second largest family of free-living Astigmata, including 57 genera and almost 500 species. Feeding forms of this family are unusual in having chelicerae highly modified for filter feeding. The movable cheliceral digit is reduced and fused with the fixed digit, which typically is elongate, flattened, and bears a row of tiny teeth used to strain microorganisms from water films. Although a few histiostomatid taxa are fully aquatic, most inhabit wet decaying materials. Given the short duration of favorable conditions in most such habitats, histiostomatid mites often have very short generation times, some as little as 6 days from deutonymph to deutonymph. Numerous genera have specialized in habitats such as manure, decaying fungi, wet subcortical spaces, and phytotelmata, and a few occur only in vertebrate carrion. These taxa utilize carrion-associated Coleoptera and Diptera for dispersal, so often colonize a carcass in the relatively early stages of decomposition. Because they can be numerically overwhelmed by dipteran larvae at this stage, they are rarely reported in carrion studies. Nonetheless, if an effort is made, these mites can be discovered. Me ´gnin (1894) reported *Histiostoma* (= Serrator) *feroniarum* (Dufour), a common species inhabiting a variety of decaying materials, and human corpses. Given their preferred habitat and stage of decomposition, it is not surprising that most species of carrion-associated Histiostomatidae have been described only from deutonymphs phoretic on insects. The few post-deutonymphal stages that have been described were obtained by rearing (Scheucher 1957). The particular beetles are typically attracted to larger carcasses. I have collected two species of histiostomatidae from carrion of cattles in the black putrefaction decay stage.

Material and method

Phoretic mite fauna is collected directly from animal carcases with the help of brushes and with their host beetles from different dead animal houses of Punjab, india.

Preserving and clearing and mounting (Krantz, 1978)

Mites were preserved in mixture of 70% alcohol and glycerine in 10:1 ratio in small vials. For microscopic studies the mites were cleared in 60% lactic acid. The cleared mites were mounted in Hoyer's medium.

Photography

Photography of the specimens was done with the help of Leica microscope at magnification of 100X and 200X.

Identification

The identification of the slides was done under microscope by using keys given by Krantz (1978) and Collof (2009).

Results and Discussion

A total 3113 mite specimens were collected from caracasses of cattles from different dead animal places of Punjab. From which 56.93% mites were found belonging to family acaridae, 15.80% mites were found belonging

to family histiostomatidae, 19.43% were found belonging to family glycyphagidae and 7.83% mites were found belonging to family lardoglyphidae. From collected fauna highest no. of mites were of sancassania genus and lowest no. were from *lardoglyphus* genus. Other mites which were found are of genus *acarus, tyrophagus, rhizoglyphus, glycyphagus, histiostoma* and *rhopalanoethus*. Early and Goff (1986) reported an undescribed species of *sancassania* genus from dry cat carcasses in Hawaii, possibly related to colonization of the carcasses by ants. Early and Goff (1986) reported *Lardoglyphus zacheri* Oudemans from carrion studies in Hawaii. Russell *et al.* (2004) reported large numbers of *T. putrescentiae* from a human corpse. Iloba and Fawole (2006) reported *A. siro* is one of the most abundant arthropods on vertebrate carcasses of all types. Leclercq and Verstraeten (1988) collected a few individuals of *Histiostoma sachsi* Scheucher and one specimen of an undetermined *Histiostoma* from human corpses in Belgium. *Histiostoma sachsi* was originally described from cattle manure in Germany and its occurrence on the body was likely incidental.

Till now, astigmatid mites have played little role in the field of forensic entomology, particularly medicocriminal entomology. This is probably the result of their small size, making collection of specimens particularly difficult from crime scene. Other difficulties include the problem of separating closely related mite species, especially by non-specialists, and the so-called 'taxonomic impediment,' the fact that many species of astigmatid mites encountered in carrion remain undescribed, particularly outside Europe. Of the astigmatid mites that are true necrophages (i.e., feeding directly on the corpse or associated microorganisms), most have fairly specific phoretic associations with particular insect groups such as dermestid and histerid beetles and heleomyzid flies. Since the insects themselves are larger and more easily studied in this context, the mites may provide little or no additional information. Still, in particular circumstances, astigmatid mites may provide decisive clues to investigators. Russell *et al.* (2004) reported that the finding of large populations of the two 'domestic' species, *Acarus immobilis* and *Tyrophagus putrescentiae*, on a corpse wrapped in plastic and found buried in the basement of a home, strongly suggested that the corpse had been in place there for a significant length of time and not recently placed there after earlier burial in soil.

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Table 1. showing total fauna of astigmata found from animal carcases.

Order	Number
Sarcoptiformes(astigmata)	3113

Table 2. showing % of mites family wise from astigmata

Orders/families	No. of mites	%
Astigmata		
Acaridae	1772	56.93
Histiostomatidae	492	15.8
Glycyphagidae	605	19.43
Lardoglyphidae	244	7.83

Table 3. showing % of mites species wise from astigmata

Orders/families	No. of mites specie s wise	%
Astigmata		
Acaridae		
Sancassania berlesei	467	15
Acarus siro	466	14.97
Rhizoglyphus robini	323	10.37
Tyrophagus putrescentiae	309	9.92
Tyrophagus longior	207	6.65
Histiostomatidae		
Histiostoma feroniarum	319	10.24
Rhopalanoethus	173	5.55
Glycyphagidae		
Glycyphagus destructor	318	10.21
Glycyphagus domesticus	287	9.22
Lardoglyphidae		
Lardoglyphus zacheri	244	7.83

Table 4 showing % of mites season wise from astigmata.

Season/Mites	**Summer season** **CCL I** **N=811**	**Rainy season** **CCL II** **N=2047**	**Winter season** **CCL III** **N=255**	**Total number of mites** **N=3113**
ASTIGMATA				
Sancassnia berlesei	93(2.98)	315(10.11)	59(1.89)	467(15.00)
Acarus siro	78(2.50)	326(10.27)	62(1.99)	466(14.97)
Rhizoglyphus robini	83(2.66)	218(7.00)	22(0.70)	323(10.37)
Histiostoma feroniarum	97(3.11)	201(6.45)	21(0.67)	319(10.24)
Glycyphagus destuctor	87(2.79)	206(6.61)	25(0.80)	318(10.21)
Tyrophagus putrescentiae	85(2.73)	203(6.52)	21(0.67)	309(9.92)
Glycyphagus domesticus	70(2.24)	202(6.48)	15(0.48)	287(9.21)
Lardoglyphus zacheri	85(2.73)	159(5.10)	NF	244(7.83)
Tyrophagus longior	72(2.31)	105(3.37)	30(0.96)	207(6.64)
Rhopalanoethus	61(1.95)	112(3.59)	NF	173(5.55)
Total fauna	811(26.05)	2047(65.75)	255(8.19)	3113

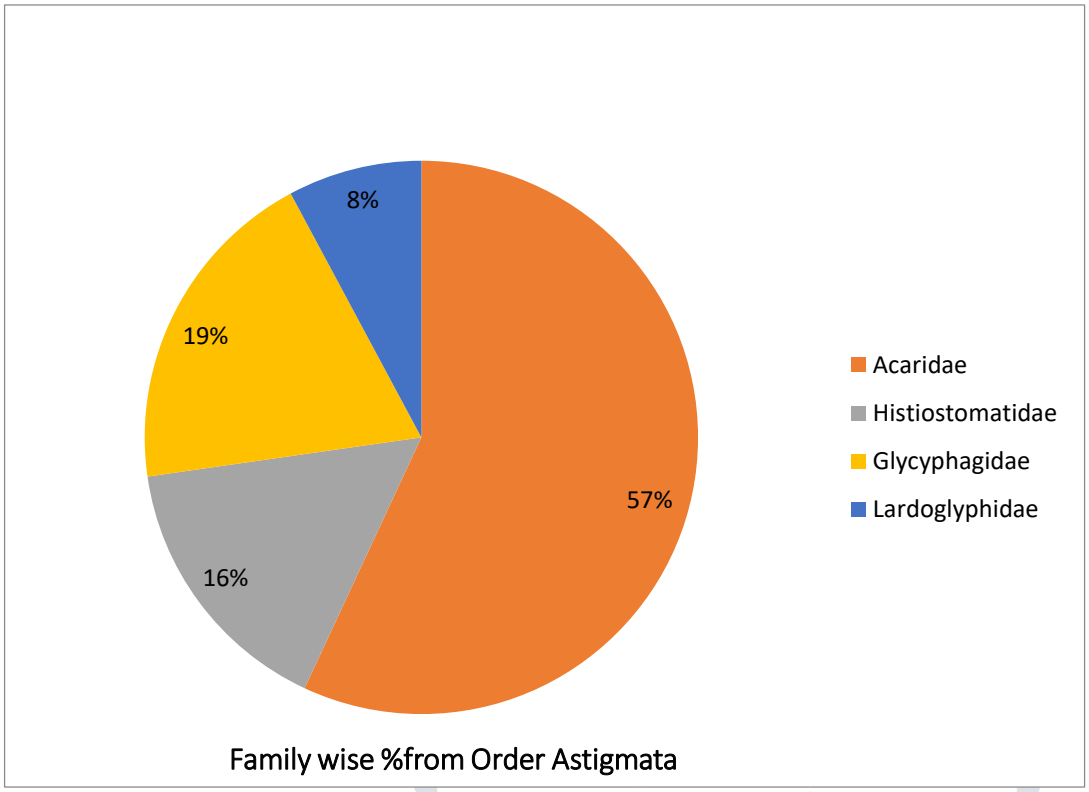

Fig. 1. showing % of mites family wise from astigmata

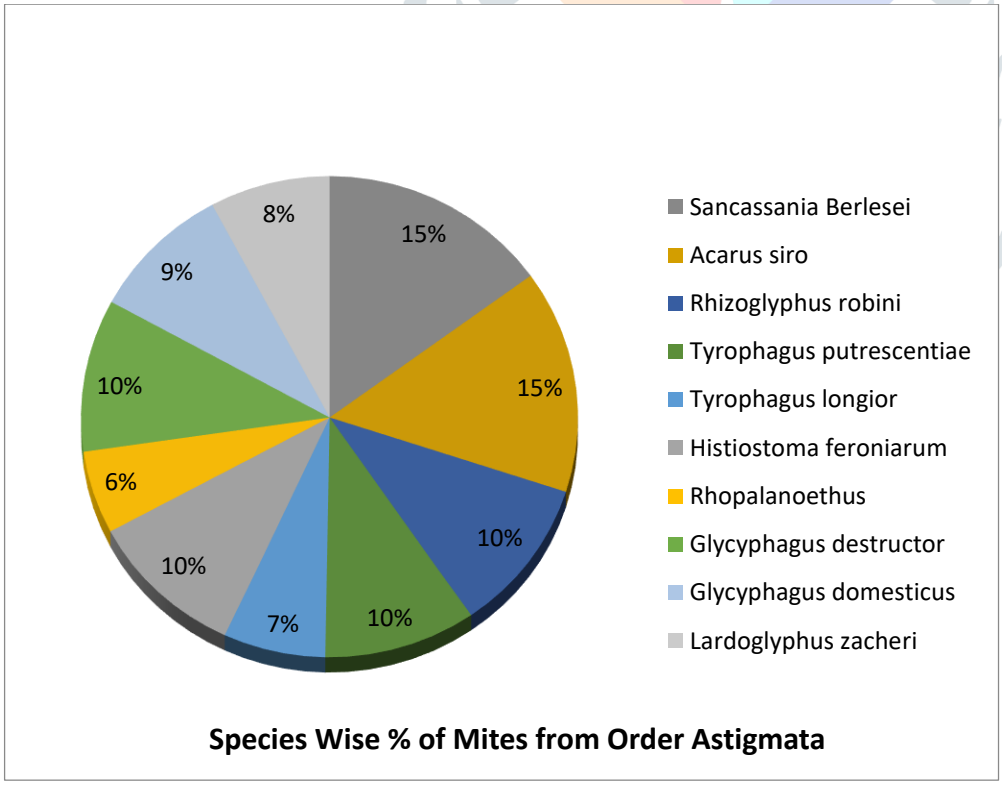

Fig. 2. showing % of mites species wise from astigmata.

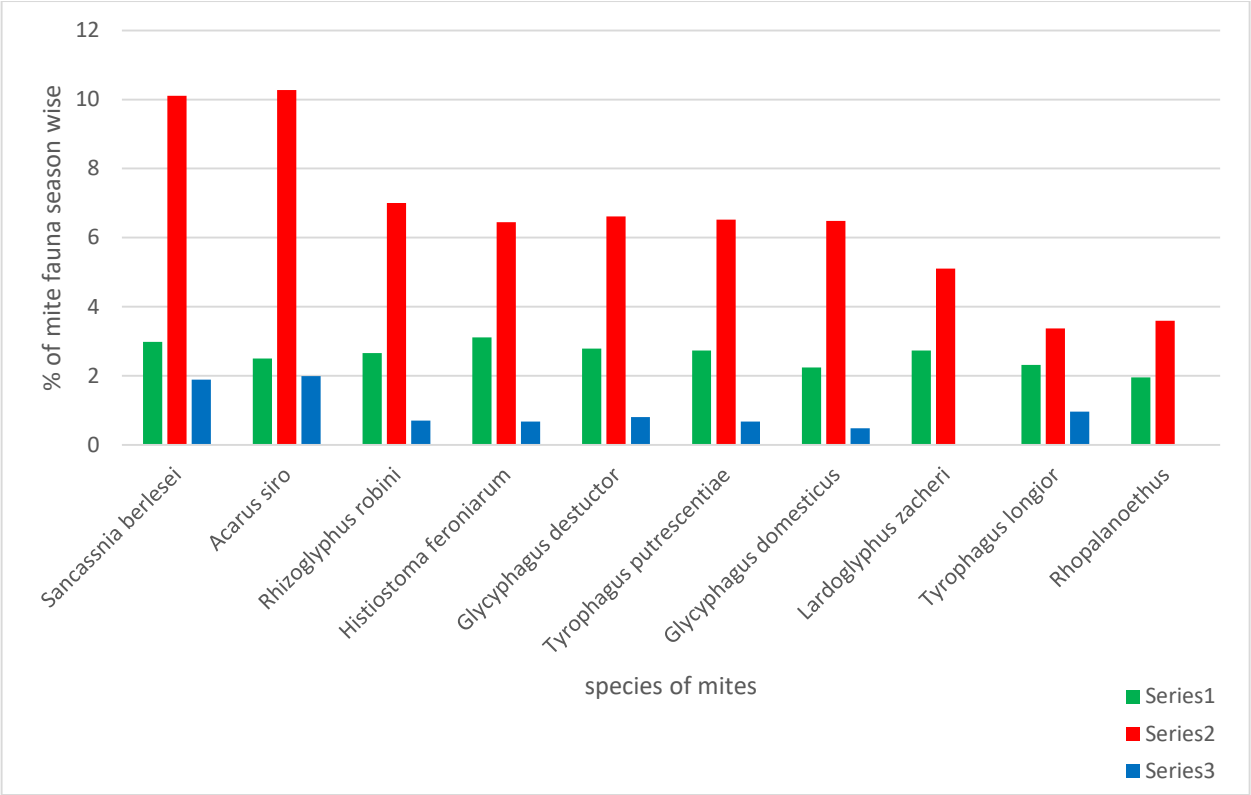

Fig. 3a showing comparison of mites season wise from astigmata.

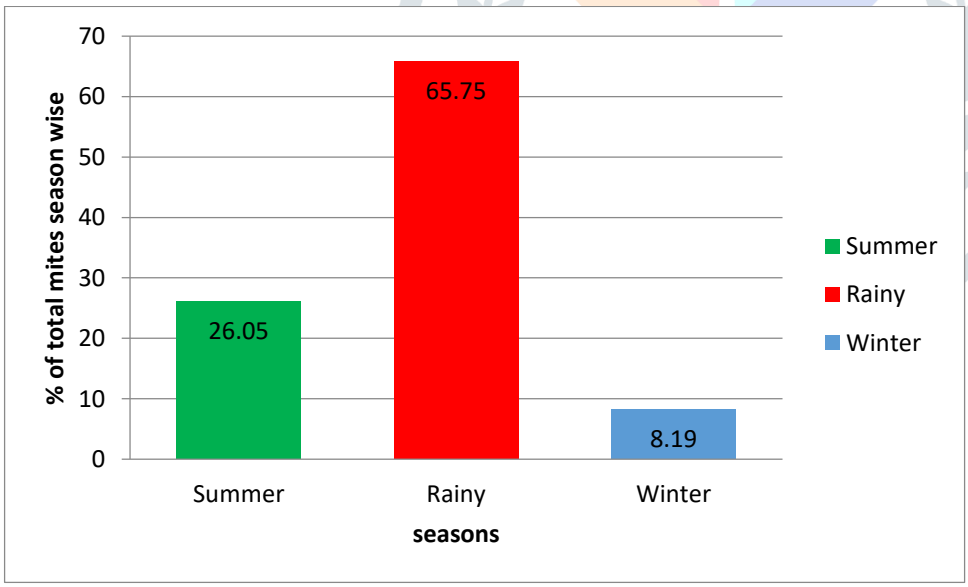

Fig. 3b showing % of total mites season wise from astigmata.