A PRELIMNARY STUDY ON THE PARASITIC MITES OF GRASSHOPPERS IN COIMBATORE

By

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Certificate of bonafide Research Work

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Introduction

INTRODUCTION

Phylum Arthropoda in which class Arachnida is included consists of two subclasses namely Aranea which includes all spiders and the subclass Acari which included all ticks and mites. Ticks are purely parasitic on higher animals while mites have varied habits and habitats. The first article on mite was by Aristotle who is considered as Father of Zoology around 300 B.C. who reported the mites observed on honey combs. In the Systema Naturae, Linnaeus gave taxonomic descriptions of 31 species of mites under the genus Acarus. During World War II and Korean war the need to understand the biology of chiggers belonging to Trombiculidae and to develop control measures arose due to their vector activity in spreading the scrub typhus and haemmorhagic fever among army men.

Mostly entomologists started studying mites and turned Acarologists. The invention of the Phase Contrast microscope by Zoernicke around 1950 and the developments in the Transmission electron microscopy and Scanning electron microscopy in viewing and understanding Acarine structures paved way for the rapid development of the science of Acarology. The medical importance of the house dust mites and the veterinary importance of ticks and mites which are

parasitic on animals and act as vectors of diseases and the agricultural importance of mites injurious to plants as well as vectors of virus diseases was well understood and a lot of work has been done in the past 50 years.

The mites associated with insects may be broadly classified into two groups. The first group consists of mites in their adult stage or in their deutonymphal stages attach themselves to insects and move from one location to another. This type of transport of the mites on insects is called as Phoresy. Phoretic mites do not feed during their phoretic phase; and usually the phoretic deutonymphs are specialised morphologically for attachment to their hosts and their mouth parts are reduced or absent since they do not feed at this stage. The phoretic deutonymphs are called as hypopi which are usually highly resistant to adverse conditions. When these hypopi reach the suitable location they moult into adult mites and develop.

The second group of mites are purely parasitic on insects, They attach to their host insects, insert their mouth parts into their body and suck the body fluids for their development. In these type of mites, all developmental stages of the mite may be encountered on the

host body. Some species of mites are parasitic in their nymphal stage or larval stage and later becomes free living in their adult stage when they usually leave their hosts. Several Erythraeids have such parasitic larvae.

The work on the parasitic and predatory mites on insects has received the attention of the Acarologists in recent years. Several families of mites like Erythraeidae, Podapolipidae etc are purely parasitic on insects specialy on grasshoppers. Grasshopers are important pests of agricultural, horticultural, forest as well as plantation crops. In India very few reports are there on mites associated with insects. Hence the present study was taken up to collect and study the mites associated with the common grasshopers found around Coimbatore.

Review of Literature

REVIEW OF LITERATURE

Information on parasitic mites of Arthropoda are reviewed hereunder. Only a few mites have established a truly parasitic association with invertebrates. Species of the prostigmatid families like Trombidiidae; Erythraeidae; Smaridiidae and Johnstonianidae and Iolinidae which are parasitic on insects but only in their larval stages (Southcot 1961); while the nymphal and adult forms are predatory. In Hydrachnellae also the larval forms are found parasitising acquatic insects or in some cases molluscs (Mitchell 1961).

Woolley (1974) recorded a water mite to be parasitic on mosquitoes in acquatic conditions. There are several reports on the external parasites of housefly. Axtell (1961) reported a macrochelid mite Macrochelus muscadomesticae as a potential enemy to housefly.

Another parasitic mite Allothrombium parasiticus (Trombidiidae) has also been reported. Jouvenaz and Lyfgren (1987) recorded Pyemotes tritici as an effective parasite to control the red ant Solenopsis invicta.

Species of the prostigmatid families Pyemotiae, Tarsonemidae, Podapolipididae and Pterigosomidae are parasitic on invertebrates through out their lives. Members of the mesostigmatid genera Hemipteroseius and Treatia (Otopheidomenidae) parasitises hemipteran insects (Krantz and Khot, 1962) feeding in the conjunctival regions beneath the hemielytra.

Abro (1984) reported the water mite genus; Arrenurus (Acari Hydrachnellae) as an ectoparasite on the zygopteran imagins and nymphs. Several mites have been found to be associated with household pests as ectoparasites. In the case of cockroaches Egan and Hunter (1975) has reported a mite Proctolaelaps nauphoetae to be always associated with immature stage.

All endoparasitic mites are confined to the orders Prostigmata and Mesostigmata. The Prostigmatid genus Acarapis (Tarsonemidae) comprises at least three species which are parasistic on honeybees of which Acarapis woodii invades the tracheal system injuring the host tissue and eventual suffocation. This condition is called "Isle of Wight" disease and is a serious problem in commerical apiaries throughout Europe and Asia (Hirst, 1921).

Tracheae of other Hymenopterans, Orthopterans and Coleopterans may be invaded by the genera of the Prostigmatid family Podapolipidae namely Podapolipus and Locustacarus

The Mesostigmatid genus Otopheidomenis (Otopheidomenidae) is parasitic in the tympanic and counter tympanic cavities of the phalaenid moths.

ACARINA ASSOCIATED WITH ORTHOPTERA

The orthopterans are very commonly infested with Erythraeid, Trombidiids, Trombiculids, Tarsonemids, Podapolipids, Iolinids, Acarids and Ascidae; of these Trombidiids and Erythraeids are important in terms of extent of infestations and in the large numbers of species and are exclusively external parasites on grasshoppers. Unlike podapolipid mites which inhabit the tracheal system of grasshoppers, these mites infect only the adult female grasshoppers.

The Podapolipid genera like Ocharus, Porsipes, Utarsopolipus, Tetrapolipus, Bakerpolipus, Coxypolipus, Archipolius, Podapolius and Locustacarus, occur as parasites

of grasshoppers. These genera are unique in their reduction of legs and complete enlargement of the female body in their adult stage.

Pritchard (1956) erected a new super family Iolinoidea and the family Iolinidae which are ectoparasitic on grasshoppers. Later Price (1972) erected a new genus Anolina under the same family. Iolinoidea seems to occupy a systematic position intermediate between predatory Raphignathoidea and phytophagus Tetranychoidea.

Ewing (1925) recorded Locustacarus trachealis from tracheae of grasshopper Phyllostachys bambersodes from Kansas in U.S.A. Wherle and Welch (1925) recorded Podapolipus grassie from the Acridid grasshopper Hippiscus apiculatus and Arphia carinata from Java. Moss (1962) recorded several Trombidiidae mites like Allothrombuim leromxi, A. neapolitanum, A.ignatum, A.pulvinum A.metal, A.fuliginosum from several species of grasshoppers and small arthropods.

Pritchard (1956) recorded Iolina nana as ectoparasite of the grasshopper Blaberus ganifer and Diplotera dytiscoides. Price (1972) recorded Anolina

linneata on Schistocerca sp. from Galapagos Islands. Lawrence (1940), Southcot (1961,1965) have recorded several species of Erythraeus, Ceaculisoma, Charistoma from locusts. Newell and Trevis (1960) recorded Angenothrombium pandorae from locusts. Fain (1969) recorded the Acsid mite Aceodromus sp. from the cone nosed grasshoppers. Kawashima (1958), Southcot (1984) have recorded several species of Leptus from Oxya sp.

Husband (1986) reported six new species of Podapolipidae (Acari), parasites of tenebrinoid beetles cockroach and grasshoppers from Australia and Hawaii. Podapolipus platyzosteriae n.sp from Platyzosteris sp. (Blattidae), P.womersleyi n.sp from Anamesia sp. (Blattidae), P.pacificus n.sp from Gonocephalum carpentariea (Blackburn) (Tenebrionidae), P.haramotoi n,sp, from Blapstimus dilatus Le Conte (Tenebrioniadae), P.monistriae n.sp from Monistria pustulifera (Pyrgomorphidae) and P.naudoi n.sp from Coryphistes cyanopteroides Tepper (Acrididae).

The genus Podapolipus includes species of mites parasitic on Orthoptera (Acridiadae) and Coleoptra (Tenebrionidae) in many parts of the world (Husband 1980).

In a collection of Orthoptera from islands in the Western Pacific Ocean made by R.D.Alexander of the University of MIchigan and D.Otte of the Academy of Natural Sciences of Philadelphia, a collection of Tetrapolipus representing a new species of Nicsara was recorded. This is the first world record of Podapolipidae from the family Tettigoniidae (Husband 1988).

Husband (1990) recorded six new species from Australia: P.brevichelus from Schizobothrus flavovittatus Sjostedt, P.houstoni from Locusta migratoria (L), P.alatus and P.barmounti from Austracris guttulosa (Walker) and P.valangus from Valanga meleager (Sjostedt) and from New Zealand P.ramsayi from L.nugratoria. All hosts are Acrididae (Orthoptera).

Lo, (1990) described Podapolipoides (Locustapolipus) patangae from Patanga succinata and Podapolipoides acridae, from Acrida chinensis. A new species of Podapolipoides from Jordon P.jordani was described by Lo (1992) from Acrida sp (Acrididae) and compared with related species by Husband (1992)

In India the earliest record of parasitic mites on grasshoppers is by Peswani(1960) who recorded Eutrombium

trigonum (Trombididae) as a predator on the immature stages of grasshoppers Heiroglyphus nigrorepletus. Ghai (1964) recorded Trombidium grandiossimum parasitic on locusts in India. Chandra and Mittal (1981) recorded Caloglyphus sp. (Acaridae) attacking the grasshopper Chrotogenus trachypterus, in all its developmental stages.

In Coimbatore Vishnupriya and Mohanasundaram (1988) recorded Leptus oxyae on the grasshoppers Oxya nitidula and Nephotettix sp.

Mohanasundarum and Parameswaran (1989) recorded several species of mites infesting grasshoppers occuring in different ecosystems in Coimbatore.

Methodology

MATERIALS AND METHODS

Periodical collections of grasshoppers were made around Coimbatore in the dryland, gardenland, wetland and forest ecosystems. These grasshoppers were anaesthetized with chloroform and observed under a low power stereobinocular microscope around 20-40X magnification. The grasshopper body was examined externally on the head, thorax, abdomen, legs, antennae, beneath the forewing, in the folds of hindwing and in the tympanic cavities for mites. Whenever mites were encountered these were picked and preserved in 70% alcohol for further study. The grasshopper was pinned and dried for host species identification.

The grasshoppers were identified by comparison with the standard reference collections of museum specimens maintained in the Department of Agricultural Entomology, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore.

The mites preserved in alcohol were later processed and mounted in Hoyer's medium on micro slides. The composition of Hoyer's medium is as follows:

Gum arabic	-	50gms
Chloral hydrate	-	200 gms
Glycerine	-	30 gms
Distilled water	-	50 ml.

The mites from alcohol were directly mounted in the Hoyer's medium on microslides and covered with a coverslip. These slides were dried at 50-60°C for about 4-5 hours for drying of the medium as well as clearing of the specimens. Then the coverslip is ringed with Canada Balsam to seal the medium and to make the slide permanent. The slides were labelled properly.

The slides were studied under a Phase Contrast microscope around 600-1500 magnifications to fix their identity. Drawings of the mites were made with the help of a mirror type of cameralucida using a monocular tube fixed to the Phase-Contrast microscope. The photographs of live mites were taken under a low power Trinocular microscope.

The measurements of various structures of the mites were done using precalibrated ocular micrometer in the Phase Contrast microscope.

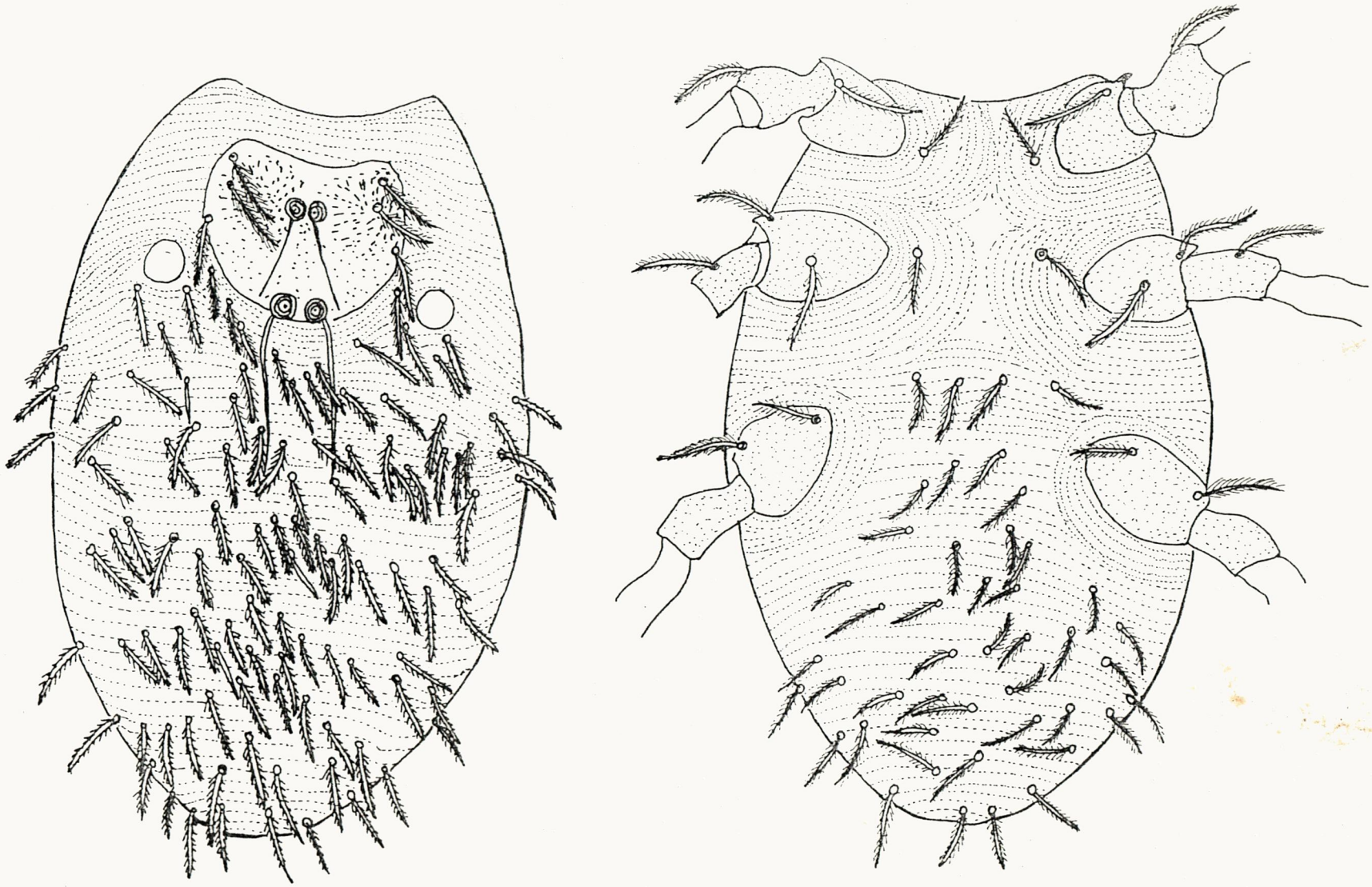
Table: 1

List of grasshoppers species collected and examined

1.	Oxya nitidula	Acrididie	Orthoptera
2.	Hieroglyphus banian	"	"
3.	Chrotogonus sausseri	"	"
4.	Colemania sphenarioids	"	"
5.	Neoorthacris simulans	"	"
6.	Cyrtacanthachris tatarica	"	"
7.	Catantops annexus	"	"
8.	Attractomorphs crenulata	"	"
9.	Oxya japonica	"	"
10.	Poecilocerus pictus	"	"

Results and Discussion

Fig 1 Leptus sp (1)

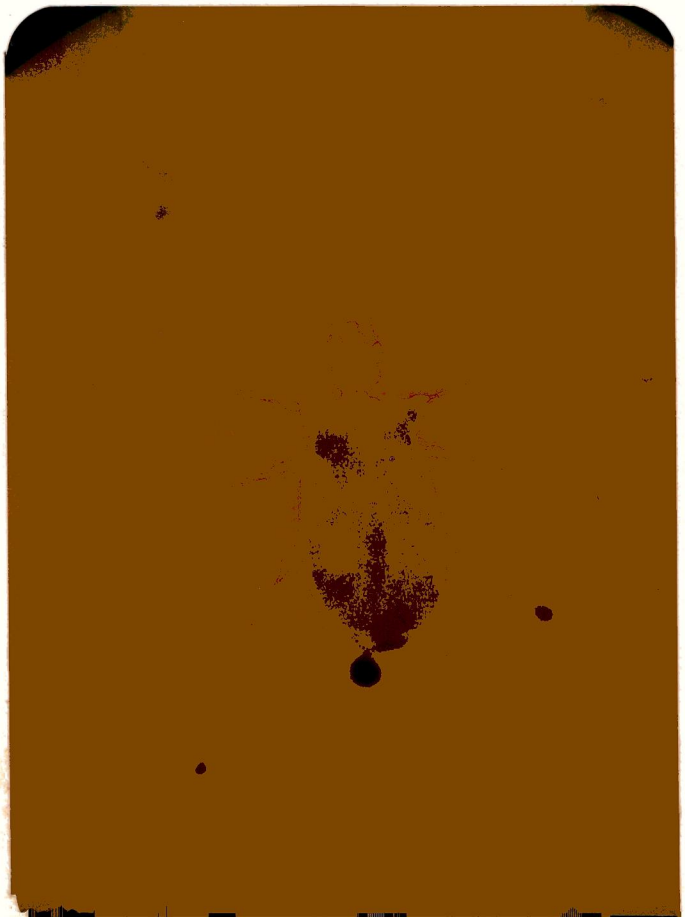


Dorsal view

Ventral view.

02mm.

PLATE I : Leptus sp. 1



RESULTS

The different species of grasshoppers collected for screening for mites were identified and the list is given in Table 1.

The mites collected were studied under a Phase Contrast microscope and their identity upto genus level was fixed. All the species collected seems to be new to science and hence, the descriptions and measurements are given. Out of several collections made, five distinct species were identified and described below.

1.Leptus sp. (1) (fig 1 & 2)

Larva:

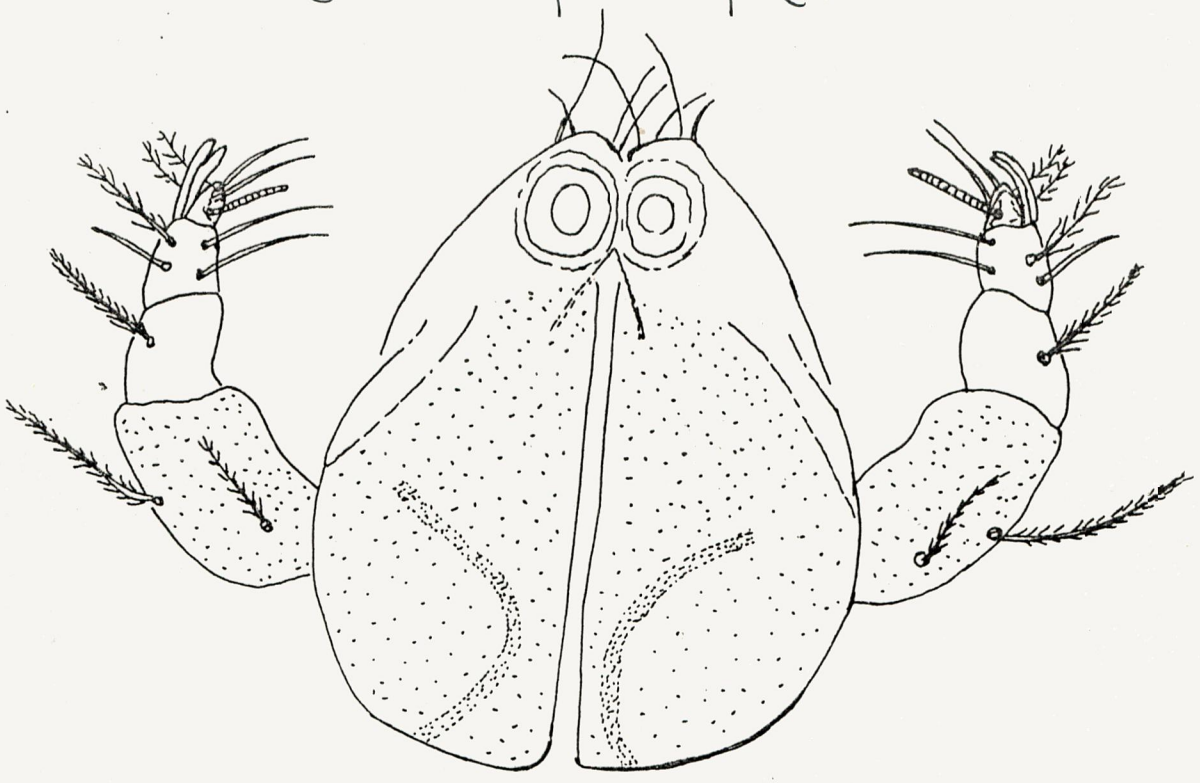
Idiosoma ovaid., 336 long by 270 wide. A pair of eyes, set one on each side of the prodorsal sclerite (18 long). Dorsal setae long and densely setulate and vary in length. The setae present in the anterior portion of idiosoma measures about 24 long; the setae in the middle 32 long and the setae present in the posterior side is 42 long. The dorsum with more than 90 setae, prodorsal sclerite 76

long and 90 wide with numerous small punctuations over entire surface, with some striations; anterior margin concave with lateral shoulders widest in the middle. AM setae trichobothrial, not flagellate, but long and needle like without setules. Second pair of trichobothria (s) near posterior margin; (S>AL>AM>PL>) (70, 44, 41, 40); prodorsal shield bears three pairs of lateral setae ; two pairs of anterolateral setae measuring 44 and 42 long and a pair of posterolateral setae measuring 40 long. One pair of (1a) setulate intercoxal setae between coxal field I 36 long, and one pair of (2a) between coxal field of leg I, 40 long and also two pairs of (3a) between the coxal field of leg III, outer pair 30 long, inner pair 22 long. Setae 1b on coxal field of leg I 60 long; coxal field of leg II and III each with one seta (2b & 3b) 50 long and 42 long respectively. Totally the dorsal idiosoma has 52 pairs of long setulate setae.

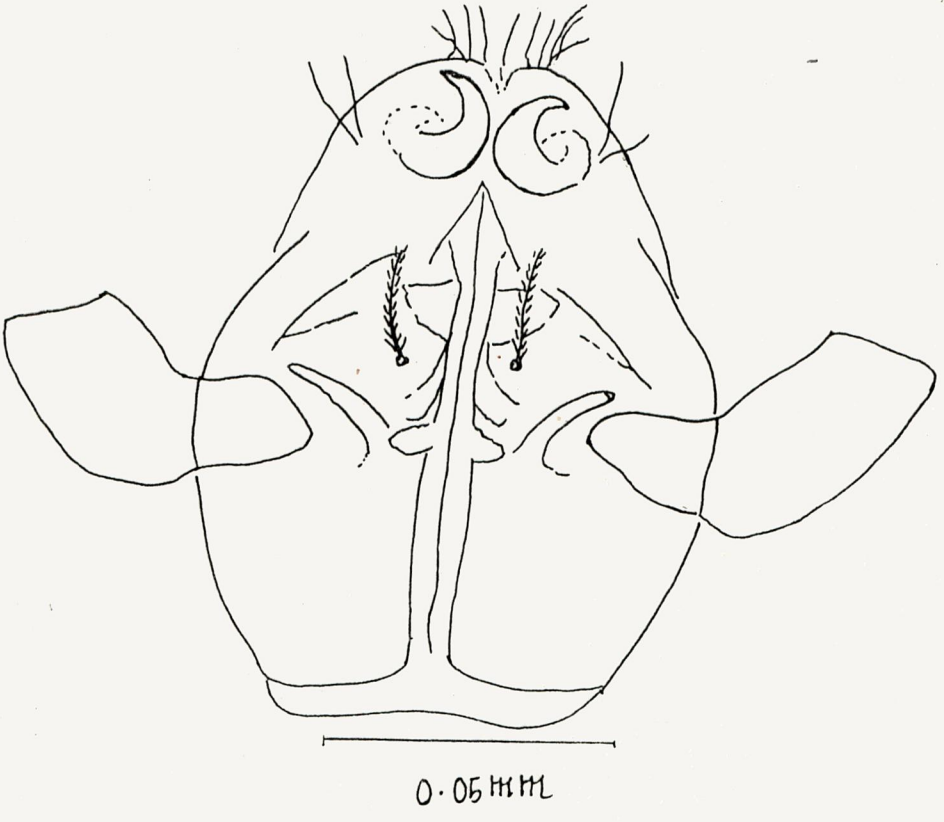
Gnathosoma:

Measuring about 122 long by 90 wide at the base. The anterior end of gnathosoma with frings and more than 10 pairs of dorsal and ventral setae. On the ventral side of the gnathosoma a pair of long prominant setulate setae

Fig 2. Leptus sp.(1) Gnathosoma



Dorsal view



Ventral view

present, palpal setal formula; fpp = 0-BB-B-BNss2-BB2sW. Palpal tibial claw is two pronged cheliceral blade is robust and curved.

Legs:

Leg characters general to Erythraeidae, in having 7 prominant segments.

Leg I:

520 long (from coxal base to the tip of claws). Coxal field with one barbed seta (1B); trochanter 1B, basifemur, 3B, telofemur 6B, genu 11B, 1K 6 long 1 ϵ 5 long 6 12 long tibia 14B, ϵ 4 long 2 ϕ 25 and 23 long.

Tarsus:

B 15, 1sh 10 long with 1 Z 6 long ventral eupathid 12 long; tarsi ends in a pair of claws and fringed embodial structure.

Leg II:

470 long; coxal field 2B ; trochanter 1B, basifemur 4B, telofemur 6B, genu 13 B, 2C of 7 long;

Tibia:

14B, 1 11 long one microseta of 7 long; tarsus 14B, W 15 long, Sh 16b long with 27 long and Sp 12 long, a pair of claws and a fringed empodial structure.

Leg III:

540 long ; coxal field WB, trochanter 1B, basifemur 2B telofemur 5B, genu 8B, tibia 14 B, 15 long; tarsus 17 B. One dorsal eupathid Sh 14 long ; Z 6 long, Sp 12 long; tarsi end in a pair of claws and fringe embodial structure; third pair of legs longest of all the three.

Material studied:

Collected on Chrotogonus sausseri (Acrididae) April - 93, Coimbatore.

Diagnosis:

The present species resembles Leptus oxyae in general structure and striations on the dorsum and ventrum of idiosoma but differs from the numbers of dorsal and ventral setae. The new species differ in having more than 90 dorsal setae. This also resembles Leptus chrotogonae in general structure but differs in prodorsal sclerite setae and pattern. In the new species three pairs of lateral setae and the trichobothria (both the pairs) needle like, long non-setulate, differs also in number of dorsal and ventral setae and in leg chaetotaxy.

Relationship to the Host:

The blood engorged, red velvetty soft bodied mites isolated live from Acridid grasshoppers collected from garden land ecosystems. These mites were found between the wing folds lying freely unlike the other species which attaches to the leg segments. From the observations it is proved to be an ectoparasite on the grasshoppers taking the blood as the nutrient. In blood engorged live condition the setae looks white in colour.

Fig 3 Leptus sp. (2)

Dorsal view

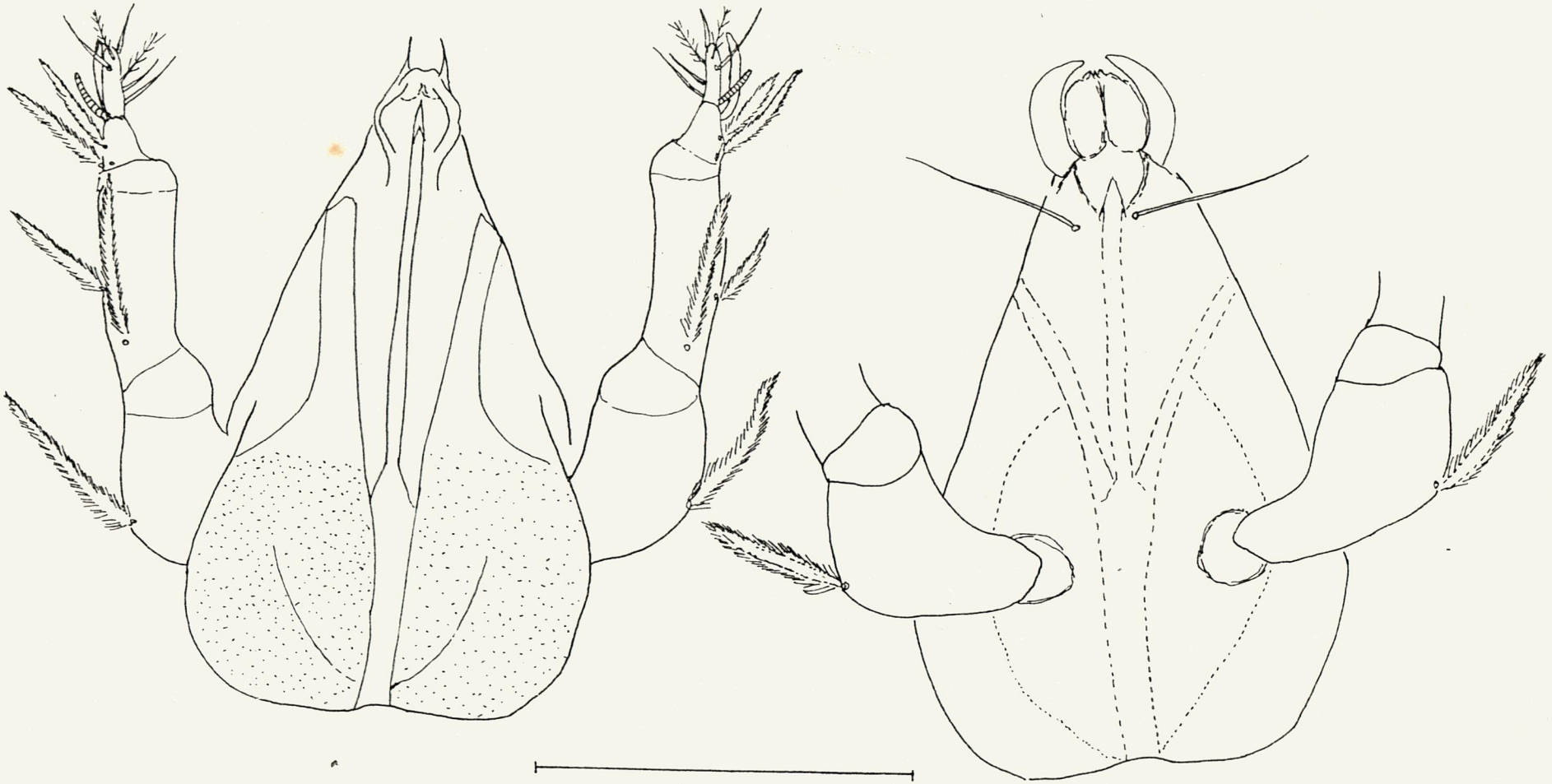
PLATE II : Leptus sp. 2

Leptus sp. (2) (fig 3 & 4)

Larva:

Idiosoma 480 long and 320 wide. A pair of eyes set in the ocular sclerite one on each side and just below the prodorsum measuring 20. The distance between the eyes 156. The dorsum neotrichous with 135 idiosomal setae. The dorsal setae measuring about 24 long each and heavily setulate; cupulues absent. One pair (1a) of setulate inter coxal setae between coxal field of leg I, 34 long, and two pairs (2a) between coxal field of leg III, 22 long. Seta 1b on coxal field of leg I; II and III each with seta (2b & 3b) 22 and 30 long respectively. Totally more than 90 pairs of setulate setae are present on the venter of idiosoma. Prodorsal sclerite with numerous small punctuations over entire surface, without striations, anterior margin slightly concave with lateral shoulders, widest at level of PL setae; AM (anteromedian) setae trichobothrial, second pair of trichobothria (S) near posterior margin ; X>AM>AL>PL; (70, 47, 43, 36); both pairs of prodorsal trichobothria (S) flagellate, with setules.

Fig 4 Leptus sp (2) Gnathosoma



Dorsal view

Ventral View.

Gnathosoma:

Measuring about 172 in length and 112 wide at the base. Palpal setal formula; fpp=0-B-BB-BB1-2B ; 2N2S palpal tibial claw is single, palpal tarsus with and one pair of eupathid; 2 pairs of nude adoral setae, distal pair 20 long, proximal, pair (or 2) - 40 long, cheliceral blade somewhat robust, curved with a single tooth. Distal end of subcapitulum with fringe, measures 12 long.

Legs:

All legs with seven prominant segments (Cox, Tr, BF, TF, Ge, Ti, Ta). Legs 1 to III with paired claws and fringed empodium.

Legs I

600 long (from coxal base to the tip of claws). Coxal field with one barbed seta (1B) ; trochanter 1B; basifemur 3B; telofemur 5B; Genua 7B; 2 14 long and 10 long ; 2K, six long each; tibia 14B 2, 2 18 long and 24 long microsete absent; tarsus 19B, 2,20 long and 14 long, famulus absent, dorsal eupathid (ɸh 12 long) with a companion setae (z) 6 long. Sub terminal eupathid (ɸp) 12 long.

Leg II:

508 long coxal field 1B trochanter 1B, basifemur 3B, telofemur 5B, genu 9B 2K 6 long; tarsus 16B, sh 13 long sp 12 long.

Leg III:

634 long, Coxal field 18, trochanter 1B, basifemur 3B, telofemur 5B, genu 7B, tibia 11B, with one 22 long 20 B sp 14 long, tarsus.

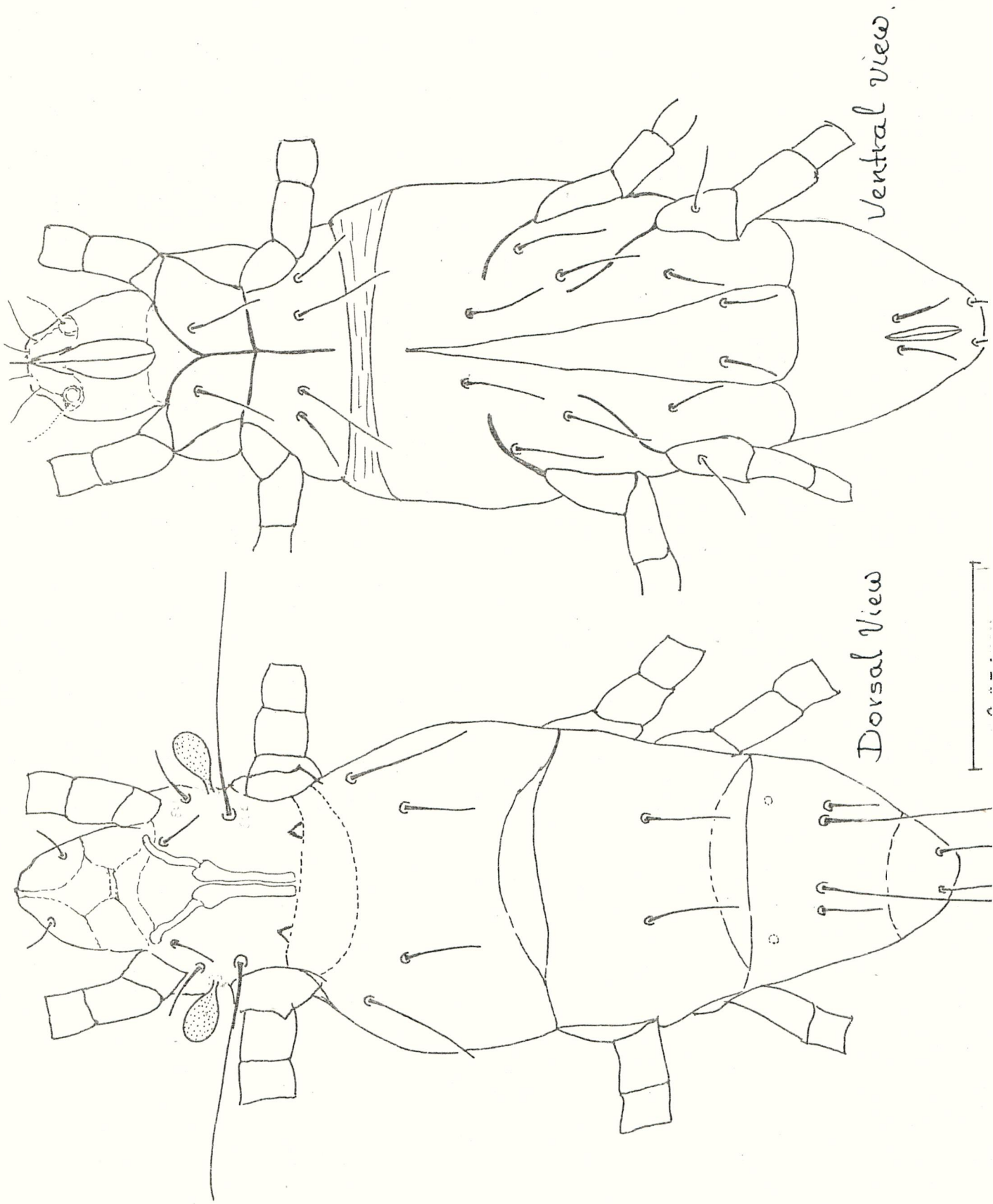
Material Studied:

Collected on Chrotogonus sp (Acrididae) March '93 at Coimbatore.

Diagnosis:

The new species resembles Leptus oxyae in general structure and prodorsal shield but differ in many characters like the size of the setae on the dorsum and ventrum of idiosoma also in the prodorsal shield setae and pattern.

Fig 5. Pyemotes sp.



Relationship to the Host:

The reddish blood engorged soft bodied mites found attached to the leg of the soil grasshopper. Collected from the gardenland ecosystem. All mites were very firmly attaching to the host inserting the gnathosoma, and it was also difficult to remove the mite from the grasshopper as live. All mites collected were only larvae and hence it is an external parasite on grasshopper taking the blood from its host.

3. Pyemotes sp. (fig. 5)

Female Adult :

The size of idiosoma 180 long and 84 wide at the middle. This form belongs to the Ventricosus group. The idiosoma of the non gravid female is flattened and oval, tapering towards the posterior. The propodosoma bears the pairs of setae and a pair of pseudostigmatic organs, (12 long, which have globular heads joined to fine stalks which are inserted into cup-shaped structure. The scapular setae arranged just above and behind the pseudostigmatic organs. The external scapular are longer (70) than the internal (14). The stigmata open laterally at the base of the

gnathosoma. The hysterosoma is more than twice as long as the propodosoma and is divided into four segments, which decrease in size towards the posterior end of the body. The first segment of the hysterosoma bears two pairs of setae, the second one pair, the third two pairs of unequal setae and a pair of setae arise from the posterior margin of the body. No humeral setae are present. The hysterosomal setae are about 16 in length excepting the one the third segment of hysterosoma. (40 long).

Venter:

The apodemes of legs I are joined to a long sternum, those of leg II are joined to the epimerites I and almost reach the sternum. The genital opening lies at the posterior end of the body with a pair of genital setae arranged as figured. Coxae I bears a pair of setae and coxae two with two pairs of setae.

Gnathosoma:

The gnathosoma (36 long and 30 wide) is rounded with three pairs of setae. The chelicerae are stylet-shaped and the segments of the pedipalps are indistinguishable.

Legs:

The legs are five segmented. The first pairs of legs (70 long) functions as an antennae and the remaining legs II to IV used in walking. The tarsus of leg I is blunt and bears a stout hooked claw. It bears several fine setae at its apex along with one short striated sensory structure namely solenidion on its external margin; a similar solendion is found in the same position on tibia I. Tarsi II to IV have bifid claws arising from a slender pretarsus which is further expanded into a bilobe pulvilus. The tarsi IV also bears a long flagellate seta of 86 length.

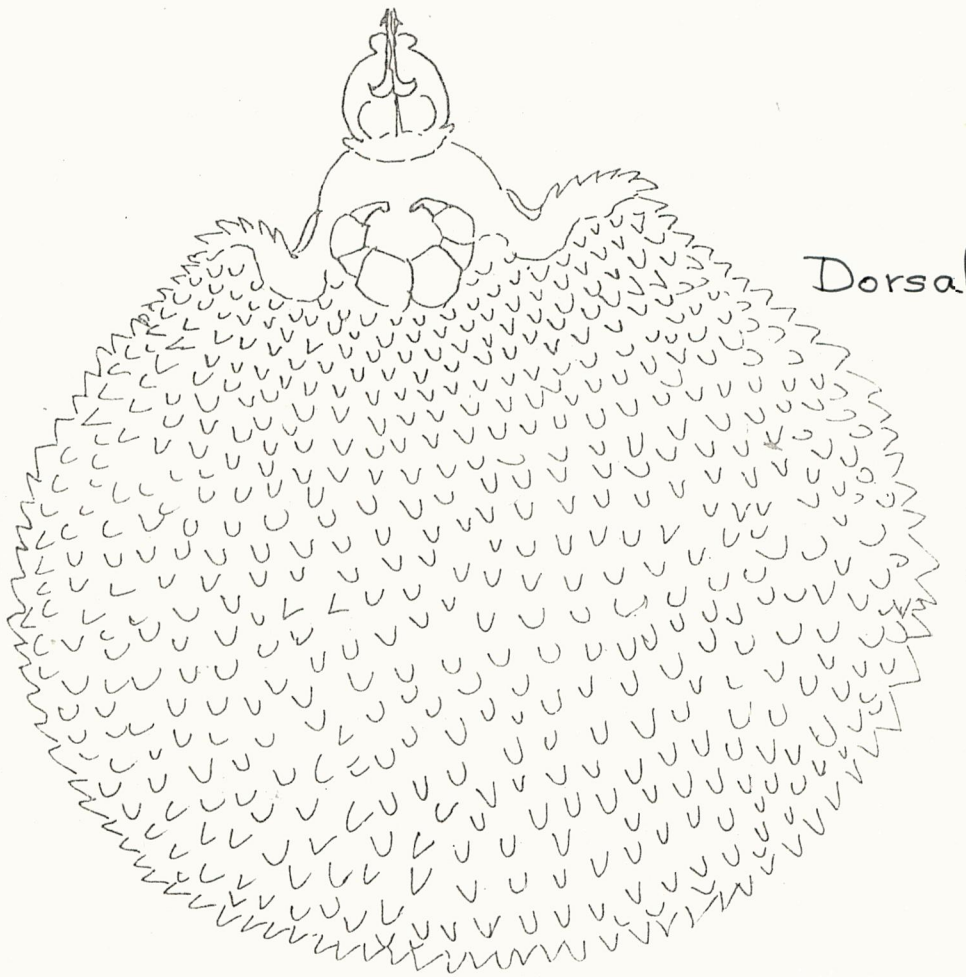
Material studied:

Collected on Attractomorpha crenulata (Acrididae), March '93 at Coimbatore.

Diagnosis:

This new species closely resembles Pyemotes tuberculatus Cross and Moser (1973) in general facies and dorsal and ventral chaetotaxy, but it is differentiated by the leg chaetotaxy. P. acridivorus has only a pair of short solenidion, one on the tibia I and the other on tarsi I

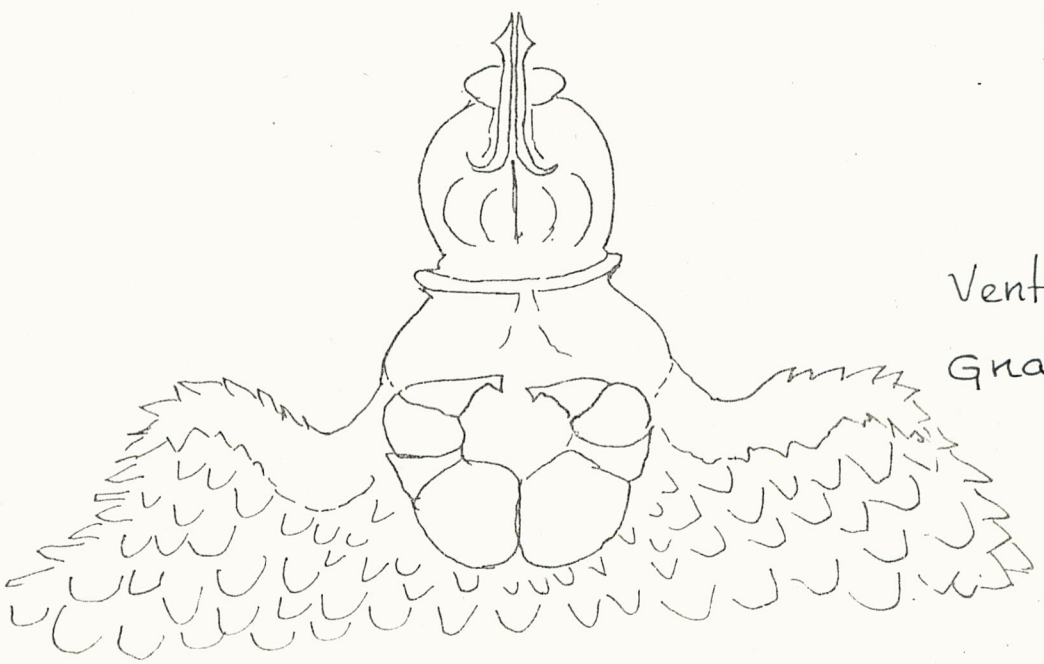
Fig 6. Podapolipus sp.



Dorsal view

0·3 mm

1



Ventral view
Gnathosoma

0·2 mm

2

where as P. tuberculatus has many number of solenidion on legs I. more over the setae on the gnathosoma is only three in P. acridivorus (5pairs in P. tuberculatus)

Relationship to the host:

These light colured, less sclerotized active mites are isolated from the Acridid grasshoppers, collected from garden land eco system for the routine observation of the ecto parasitic mites. These mites were found actively moving about the body and since no other stages like egg, gravid females, and males could not be collected from the grasshoppers it is speculated that the non gravid female mites turn to be phoretic on the grasshoppers.

4. Podapolipus sp. (fig. 6)

Female:

Globular grey coloured with mosaic like pattern while alive; 550 wide, 500 long, gnathosoma in a sunken pit like anteriorend, body covered over with semi-circular scale like protuberances; gnathosoma longer than wide, 70 long; 38 wide; palp 19 long, curved towards the stylets. Stylets smooth with a harpoon-like barb at the distal end, 47 long

Table 2

TABLE 2 : Total state on legs on larval female of Podapolipus sp.

	Leg I				Leg II				Leg III			
	F	G	Ti	Ta	F	G	Ti	Ta	F	G	Ti	Ta
Setae	2	1	3	0	0	0	3	2	0	0	3	3
Solenidia	0	0	0	2	0	0	0	0	0	0	0	0
Spines	0	0	0	1	0	0	0	2	0	0	0	2

stigmata open at the base of gnathosoma, 70 apart. Legs with hook like terminal claw 46 long, femoral seta 10 long.

Larval female:

Gnathosoma 50 long 50 wide, dorsal setae 30 long ventral setae 18 long; palp curved 10 long, proximal setae 12 long distal setae 6 long; stylets 40 long barbed and harpoon like at its distal end.

Idiosoma 140 long; 140 wide; Predorsal plate triangular setae vl 6 long; v2 6 long; sc 270 long. Plates C and D separate, seta c1 10 long; c2 5 long; d 10 long; plate H triangular setae h1 absent; setae h2 230 long. Idiosomal dorsum with fine punctuation (seen as lighter coloured dots under Phase Contrast) Venter with anterior sternal apodeme and apodemes 1 and 2 moderately developed, coxae III closely approximated, coxal setae 1a 5 long; 2a 8 long and 3a 6 long. Anterior venter with a characteristic pattern of fine punctuations as in the dorsum.

Legs:-

Leg I 58 long; leg II 60 long; leg III 75 long; Leg I with two parallel terminal claws, solenidion 12

long; solendion ϕ 5 long; tarsus I with one and tarsus II and III with two spine like setae ventrally at their tip. Ventral spine in tarsus III bifid.

Material studied

Collected on Oxya nitidula (Acrididae), March '93 at Coimbatore.

Relation to host:-

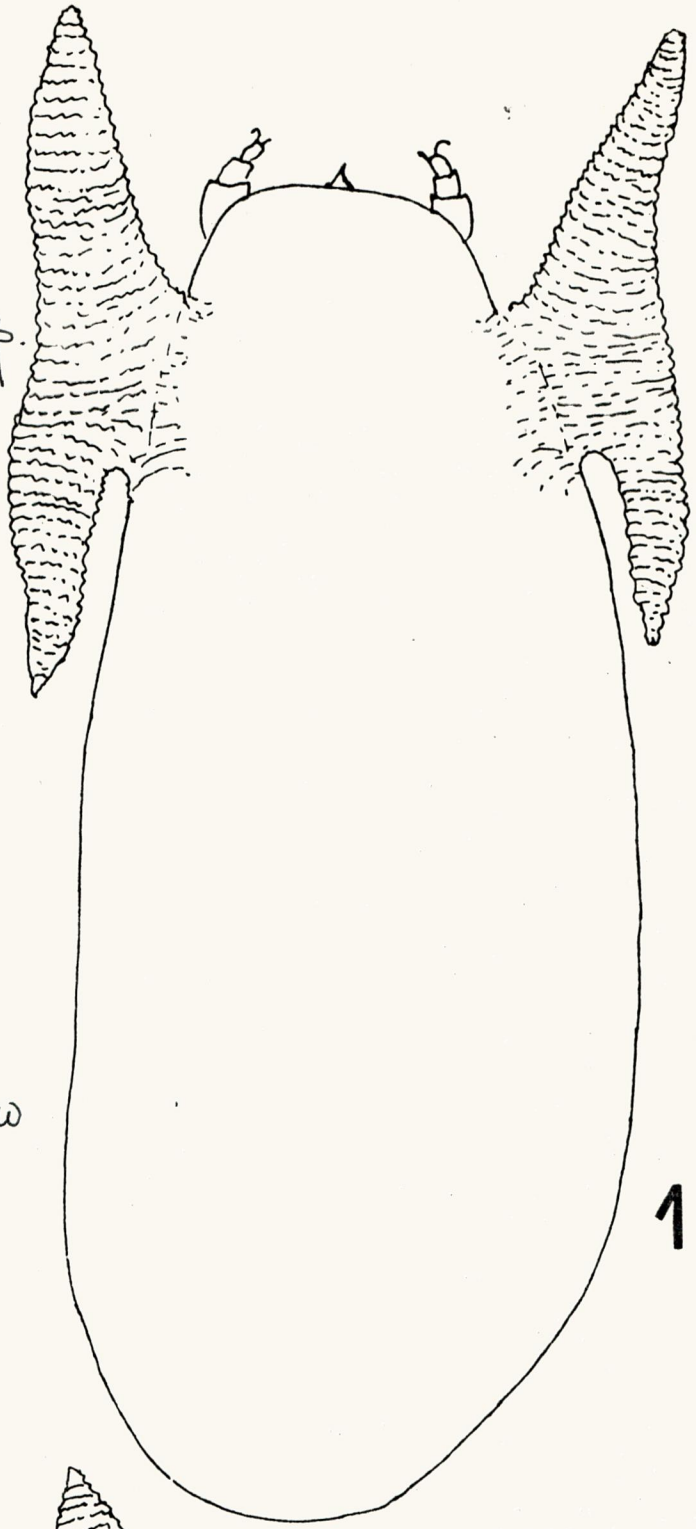
The mature females are found attached to the thoracic and abdominal segments ventrally near the hind leg base. While alive the mature females are grey coloured, globuular with mosaic pattern on their body, attached with their stylets to the host body and could be removed with some force. The larval females dull white in colour are found on the thoracic and abdominal segments ventrally moving about slowly.

Diagnosis:-

The larval females of the new species resemble Podapolipus welbourni Husband (1987) but differs from it by

the lengths of v1, v2, sc2, c1; c2 and a setae ; by the fine punctuations present on the dorsum and ventrum and in the leg setation. It is also differentiated in the adult form by the characteristic globular shape and the scale like projection on the body surface as well as the stigmal opening which are blunt without any stalk.

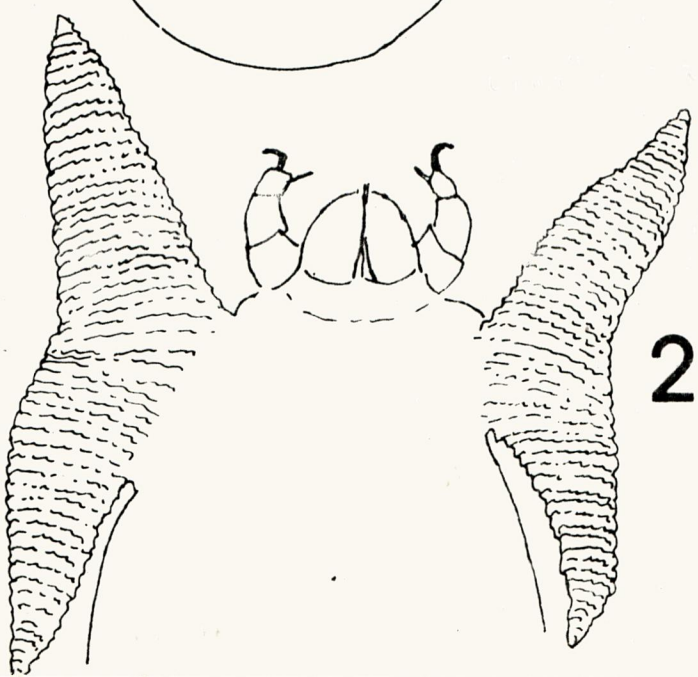
Fig 7
Podapolipus. sp.



0·4 mm

Dorsal view

1



Gnathosoma

2

5. Podapolipoides sp. (fig. 7)

Female :

Elongate, dirty white to light brown 500 long, 250 wide, with an anterior wing like bifurcate lobe on either side; the anterier propodosoma covering the gnathosoma and base of the legs. Gnathosoma about 50 long, without any setation chelociral stylet 16 long.

LEG:

One pair, about 60 long including coxae, segments clear, tarsal tip with two thick setae of which one is hook like femoral seta 12 long. Dorsum and ventrum of idiosoma fairly smooth without any ornamentation or setae.

Material Studied:

Collected on Catantops annexus(Acrididae) March '93 at Coimbatore.

Diagnosis:

This species is differentiated from other species of Podapolipoides by the elongated form, the wing like

anterior lobes having crincles and by the smooth body surface.

Relationship to host:

This mite was found attacthed to the hind wing base of the grasshopper.

DISCUSSION

During the short period and limited collection areas, the available mites associated with the commonly occurring grasshoppers were studied. The study revealed the presence of Erythraeids very commonly among the grasshoppers while Podapolipids were less frequent and the Pyemotid encountered only once. Earlier studies on the mites associated with grasshoppers in the different cropping ecosystems in the Coimbatore area by Mohanasundaram and Parameswaran (1989) revealed the presence of Leptus spp. (Erythraeidae); Iolina spp. (golinidae); Locustacarus spp ; Podapolipus spp, (Podapolipidae); Pyemotes spp. (Pyemotidae) and Tarsonemus sp. (Tarsonemidae) of Acridid grasshoppers. In the present study eventhough ten species of grasshoppers commonly occurring in the fields at Coimbatore were collected and screened for mites; only 5 species of grasshpppers were found infested with mites. This indicates that either these species of mites are host specific occurring on specific groups of grasshoppers or these mites do not occur on grasshoppers which occur and live as pests of crops where in they are exposed to the insecticides applied over the crops for the control of crop pests. To clarify the above view further studies on grasshoppers

collected from cropped areas where insecticide, are applied and non-cropped areas where no pesticides are applied are needed.

The mites collected in the present study seems to be new species and as such they have to be compared with the known species recorded under the respective genera. Hence at present they have not been assigned any specific name.

The study revealed that all erythraed mites encountered were found attached either to the wing base, legs or on the exposed body regions. The gnathosoma were found deeply embedded in the host cuticle and thus directly sucking the body sap of their host. The podapolipid mites were found usually below the fore wing base and in the folds of the hind wing. In this case also the mouthparts were found inserted in the host cuticle. The Podaplipid mites were never found in exposed situation on their host body.

The Pyemotid mites were found moving about over the body of the grasshopper at the time of collection and observation. These mites were quite active. In the present study no physogastric pyemotid mite or forms fixed to the host tissue was encountered. Hence it is presumed that pyemotid mites are accidental parasites.

During the present study no phoretic mites of any form was encountered. This is in conformity with nature that phoretic mite, always are found attached to fast flying and highly dispersing species of insects like Hymenopterans and coleopterans.

Summary and Conclusion

Summary:

The commonly occurring grasshoppers namely, Oxya nitidula, Hieroglyphus banian, Chrotogonus sausseri, Colemania sphenarioids, Neoorthacris simulans, Cyrtacanthachris tatarica, Catantops annexus, Attractomorpha crenulata, Oxya japonica, Poecilocerus pictus, belonging to the family Acrididae were collected around Coimbatore and screened for mites associated with them. Five species of mites namely Leptus sp.(1); Leptus sp (2); Pyemotes sp; Podapolipus sp; Podapolipoides sp. were found on the grasshoppers which were studied and described with illustrations.

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