INTRODUCTION

I. A brief account of the localities surveyed

A. General Account

The localities surveyed for the taxonomic studies of soil Oribatid mites are the districts of Cachar, North Cachar and Karbi Anglong (Mikir Hills) of Assam and adjoining areas in Northeastern India. As there is no account of soil oribatid fauna in Assam, a survey was undertaken to explore the acarine fauna from different places of these three districts during the period of January, 1977 to December, 1978. According to Ward (1934) the North Cachar Hills and Mikir Hills are formed by Himalayan thrusting and override the weaker folding of the Naga-Patkai arcs. The district of Cachar is bounded by swamps mainly on the valley of river Barak and its tributaries. These three districts of Assam are in the Northeast India and the climatic factors are high humidity (80-90%), frequent rainfall and moderate to mild temperature without extremities of heat or cold (generally 19-20°C) and edaphic factor like high fertility of soil. In Assam, the average rainfall is 2000 mm, whereas in Cachar district is 2900 mm.

The topography, climate and altitudinal modulations of these three districts of Assam harbours the enriched faunal treasure of this group of soil micro-arthropods. Mani (1962) is of opinion that the optimal conditions for different soil associations are primarily governed by the depth of the soil, the nature of the soil, the gradient of the ground, temperature, humidity of the soil. Considering all these, taxonomic study of soil Oribatid mites seemed most interesting and of profound scientific interest in these three districts of Assam. Sampling were done from different ecological niches as per locality indicated in the maps.

B. Geographical account of Cachar, North Cachar and Karbi Anglong (Mikir Hills)

These three districts of Assam are located at 26°30' N latitude to 24°15' N latitude and 92°E longitude to 93°45' E longitude. According to Census 1961, the area of Cachar district is 6961.92 sq.km. and North Cachar and Karbi Anglong 15218.84 sq.km.

Geographically they are important for the most complex tectonic environment for the spatial association of land forms as follows :-

The Shillong horst with the south facing scrap in the north; the Naga-Lushai Hills with intrenched drainage following west; the lacustrine terraces flanking the Shillong horst; the gentle plain exhumed by river Barak and its tributaries; the swamp interlaced with alluvial levees formed by the prominent rivers which act as distinct high grounds in contrast to the depressions in interfluve tracts.

The principal river of Cachar is Barak which rises on the southern slopes of the lofty ranges of Nagaland. From there it flows a westerly and southerly course to Tipaimukh, where it sharply turns to the north and for a considerable distance, forms the boundary line between Cachar and Manipur. The tributaries of the Barak are the Jiri, Chiri, Madhura, Jatinga, Dhaleswari and Longai.

The Barak valley consists for its main part largely of swampy flats broken by numerous low isolated hills and ridges. The Garo hills mark the limit of the valley - abruptly in the north, but the south eastern boundary is of a different character - long spur of high land project from Tripura and the Mizo Hills and between them are broad valleys usually diversified with many low isolated hills. There is a monoclinal fold separating the tertiaries of the Barak valley from the older rocks of the Shillong plateau. In the south, the strata have been folded into north and south wave-like corrugation which give rise to alternate rows of hills and valleys.

The strata of the Barak valley belong entirely to the newer division. The oldest rocks found within the valley are the sandstones of the Barail series and even this occupies a small area to the southeast of the Halflong-Disang fault in the North Cachar Hills. The lower beds of the Surma series above the Barails consist of a series of alternations of shale, sandy shale, mudstone, shaly sandstone and their conglomerates, having a maximum thickness of 12,000 ft. (3,660 m) or a fairly high and usually compact group of Hills. The upper beds of the Surma series are mainly soft sandy shales with their sand stones. They give rise to a long strip of swampy ground broken by a series of Tilas. Many of the lower and scattered hills are made up of sand and clay belonging to the Tipam series. Most of the tea cultivation in the Barak valley is on the Tipam bed. Another interesting feature is the presence of gravel in the plateau deposited by the Barak and its tributaries. The flat ground is largely occupied by clayey alluvium. Depressions here form "bills" (marshy places) of different shapes and sizes. The streams follow a tortous and unstable course in the alluvial ground.

Near Halflong, the difference between the plateau - land and the hilly region is well marked due to the presence of a thrust-fault known as Halflong-Dissang fault. This block of land is regarded as being a part of the ancient Gondwana land. A large portion of the plateau is covered by metamorphic rocks such as gneiss, schist, quartzite etc. and granite into which peridotite and dolorite have sometimes intruded. Schist, slates, quartzites and conglomerates are less ancient and they are grouped together as the Shillong series. These rocks are found in the Mikir Hills (Karbi Anglong).

C. Climate

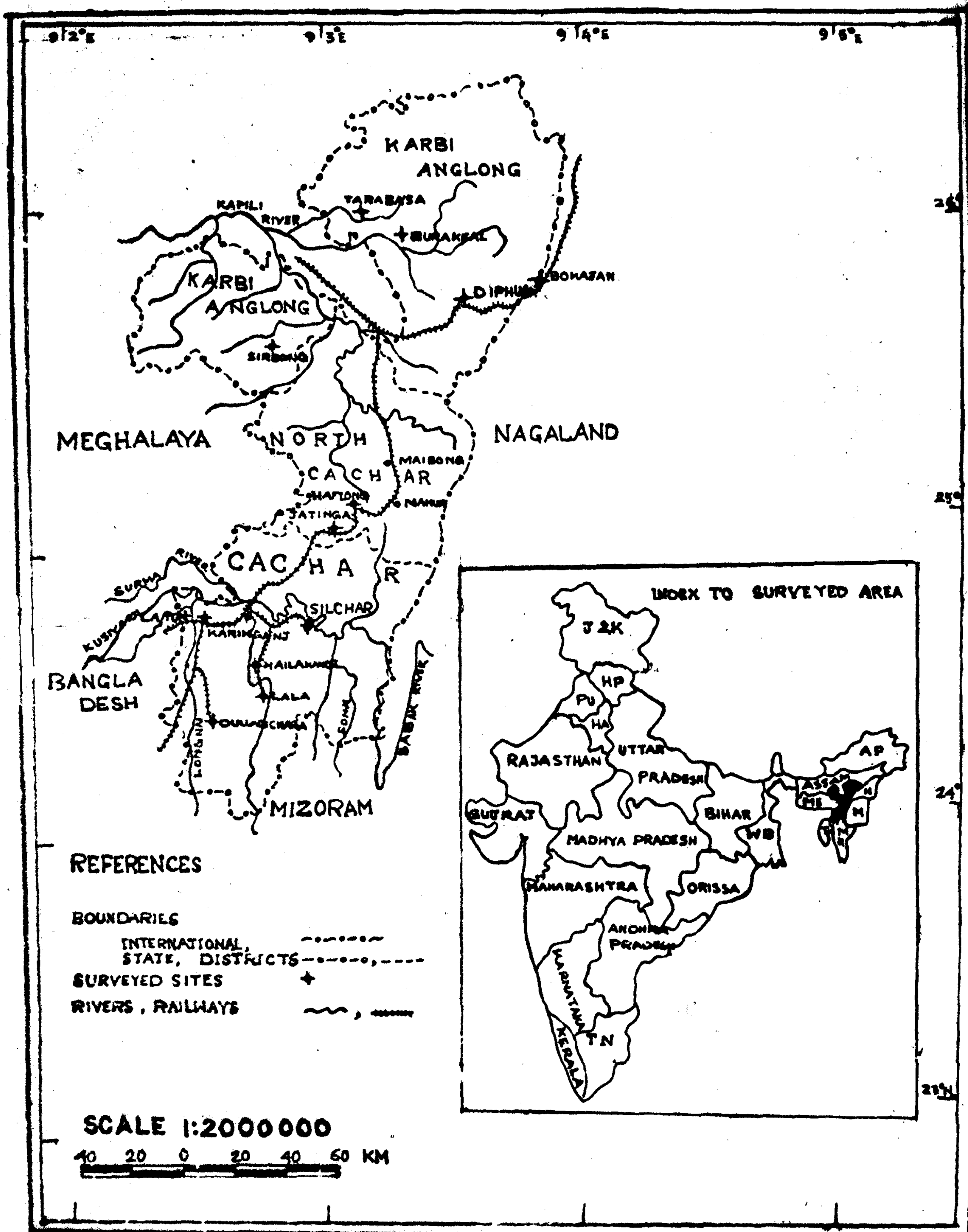
The weather and climate of Assam are quite distinct from that of the rest of areas of the country. The pioneer climatologist Dr. W. Koppen has recognised the climate of this region as humid meso-thermal Gangetic type (Cwg).

The climate of Assam is controlled by five dominant factors, such as (a) the orography, (b) the alternating pressure-cells of N.W.India and the Bay of Bengal; their periodic oscillations, (c) the predominance of maritime tropical air mass (mT), (d) the roving periodic western disturbances and (e) the local mountain and valley winds. Besides these five important factors, the latitudinal position, its extensive water bodies and the local storms play a remarkable role in creating variable weather conditions in the State.

The seasons in Assam can easily be distinguished from the nature of distribution of (a) temperature, (b) rainfall, (c) rainy days and (d) fog. These four elements of weather vary quite conspicuously from season to season and from place to place. On these basis, the year may be divided into four distinct seasons, viz., (a) winter, (b) pre-monsoon or summer, (c) monsoon and (d) retreating monsoon.

The winter season sets in with the beginning of the month of December and continues till February. This season is characterised by cool weather, with occasional scattered thunder-

KEY TO SURVEYED DISTRICTS



showers and frequent morning fog.

D. Type of soil

The soil of Cachar district is sandy and clay loam type. The average pH of the soil is 5.00, the average organic carbon is 1%, P_2O_5 (available) is 15-20 kg/hectre, K_2O (available) is 100-125 kg/hectre, Fe, Mn, Cu, B. Zn content is adequate.

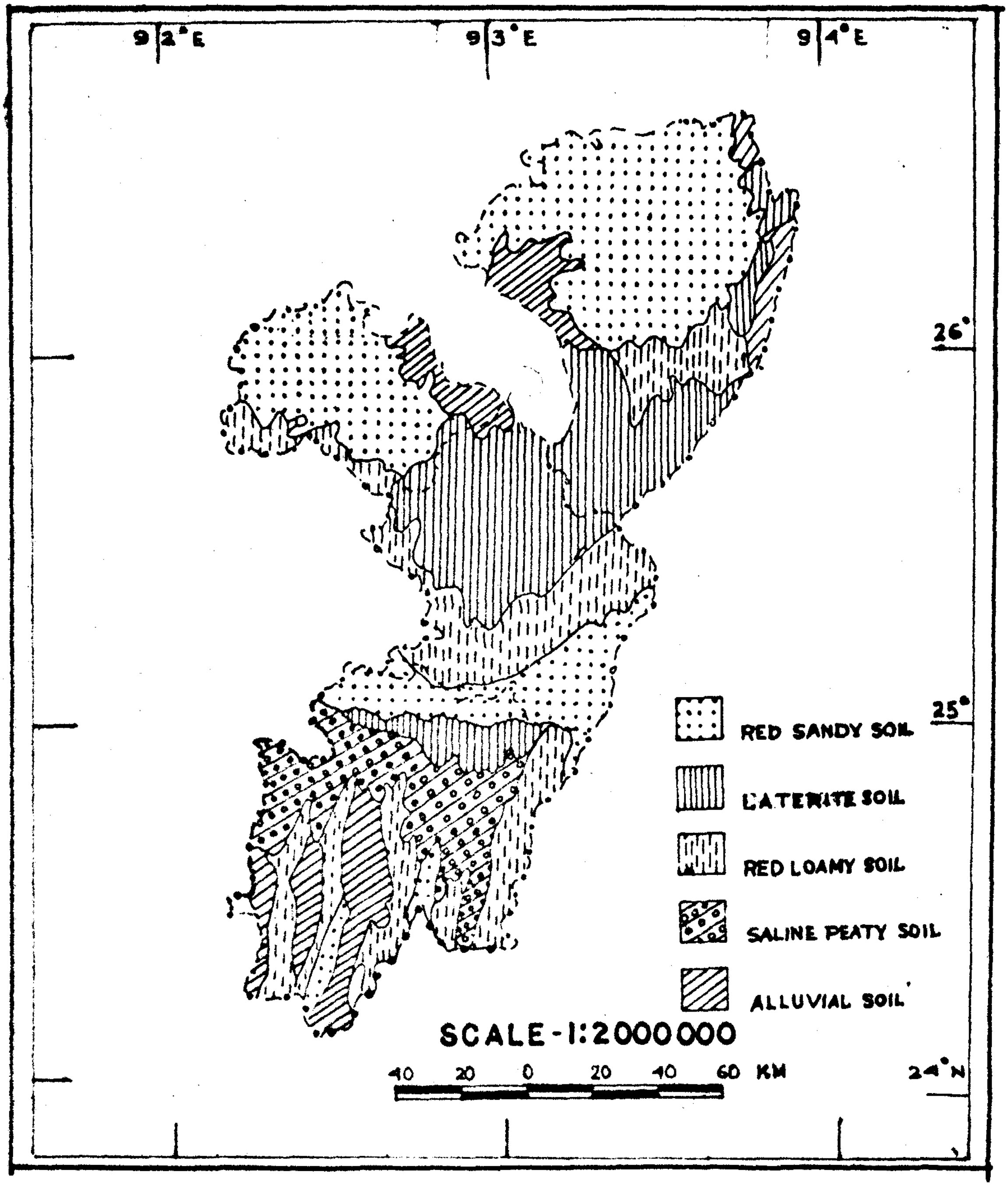
Due to deformation of rock, the soil of North Cachar Hills and Mikir Hills is loam, clay loam and sandy loam with high acidity and pH of soil varies in different parts of these two districts.

In most parts of the district of Cachar, the soil is peaty and saline peaty; and on the southern part older alluvial soils are predominent. Red sandy soil and red loamy soil are also found on south-eastern part of Cachar district. Red sandy soils are predominent on the northern part of Cachar district and south-eastern part of North Cachar district, rest of the North Cachar district is covered by laterite soil. Red sandy type of soil is also well predominent on the entire northern belt and some middle part of the Mikir Hills. A portion of Mikir Hills, surrounding Diphu (Headquarter of Karbi Anglong district) is covered by red loamy soils.

E. Phytogeographical region

The phytogeographical region of these three districts

SOIL REGIONS OF STUDIED AREA



of Assam may be divided into the following regions according to the flora.

(a) Evergreen forest of North Cachar Hills and Mikir Hills

The forests are composed of a very large number of plant species and present a 3-storeyed appearance. The top storey consists of some isolated tall evergreen or decidous trees (some 46 meters high) of which *Dipterocarpus macrocarpus*, *Artocarpus chaplasha*, *Tetrameles nudiflora*, *Terminalia myriocarpa* etc. are well represented. The middle storey consists of several medium sized trees (upto about 23 meters) such as, *Calophyllum*, *Mesua*, *Amoora*, *Cinnamonum*, *Phoebe*, *Machilus*, *Duabanga*, *Ficus* and other species, *Michelia*, *Magnolia*, *Schima* etc. The lowest storey is made up of several shrubs, climbers and lians are very common, as also epiphytes (many orchids, some ferns and oroids).

(b) Deciduous forests of Cachar, North Cachar Hills and Mikir Hills

In the dry regions, the forests are of mixed types and consists of *Dipterocarpus turbinatus*, *Bombyx*, *Adina*, *Stephegyne*, several species of *Ficus*, *Cassia nodosa*, several grasses and bamboos (*Bambusa* and *Melocanna*), *Coffea bengalensis*, *Strobilanthus*, *Mussaenda*, *Holmskioldia*, etc.

(c) Swamp forests of Cachar district

The swamp forests are mainly on the valley of river Barak and its tributaries. Various aquatic and semi-aquatic grasses, e.g., Panicum, Phragmites, Arundo, Erianthus, Vossia, Hygrorhiza, Ceratopteris, Azolla, Salvinia, Marsilea, flowering plants, i.e., Euryale, Alpinia, Nymphaea, Nelumbo, Barringtonia, Cehalanthus, Ficus heterophylla, Dracaena etc. are almost the swamp vegetations.

F. Associated fauna

The soil fauna associated with the soil oribatid mites in the district of Cachar, North Cachar and Karbi Anglong (Mikir Hills) are as follows.

Collembola (Entomobryidae, Isotomidae, Hypogastruridae, Onychiuridae, Sminthuridae and Neelidae), Prostigmata and Mesostigmata mites, Protura, Symphyla, Pauropoda, soil nematodes, enchytraeids, thrips, scolopendra, aphids, pseudoscorpion, Isopoda, Coleoptera, Coleopteran larvae, Diptera, Dipteran larvae, Hymenoptera and different larval and nymphal stages of Insecta.

G. Meteorological Account

The topography and several geographical factors control the climate of a particular region. The principal climatic factors are temperature, rainfall, relative humidity, wind velocity etc. Due to altitudinal modulation, the climate of these three districts vary considerable. However, the average monthly

TABLE I : Average monthly temperature, rainfall and humidity in the district of Cachar, North Cachar and Karbi Anglong (Mikir Hills) for the year 1977

Months	Mean temperature		Mean total rainfall (mm)	Mean relative humidity (%)	
	Maximum Temp. (0°C)	Minimum Temp. (0°C)		Maximum	Minimum
January	24.00	11.30	26.70	93.66	57.33
February	26.76	13.46	37.66	85.66	48.60
March	30.26	17.90	103.73	83.30	45.65
April	29.96	21.16	323.53	86.32	63.00
May	31.40	23.26	343.86	80.30	63.30
June	30.16	24.13	780.70	91.60	79.33
July	30.50	24.80	540.90	93.00	79.30
August	30.40	24.40	680.40	91.60	76.00
September	30.60	24.63	305.53	91.00	72.00
October	26.83	22.53	329.26	73.00	69.60
November	27.40	16.73	45.40	89.66	53.33
December	26.00	12.70	0.40	92.38	50.35

TABLE II : Average monthly temperature, rainfall and humidity in the district of Cachar, North Cachar and Karbi Anglong (Mikir Hills) for the year 1978

Months	Mean temperature		Mean total rainfall (mm)	Mean relative humidity (%)	
	Maximum Temp. (0°C)	Minimum Temp. (0°C)		Maximum	Minimum
January	20.80	9.73	29.53	85.32	53.80
February	23.00	11.64	35.20	80.23	42.05
March	30.21	13.42	89.63	64.70	41.33
April	28.75	20.50	254.08	74.32	52.85
May	31.23	22.16	312.63	86.35	63.32
June	30.12	23.26	637.83	92.77	77.35
July	30.89	24.13	735.25	94.85	76.48
August	30.50	24.25	703.20	81.56	79.21
September	29.85	24.69	236.03	90.81	53.84
October	25.30	20.50	85.84	75.03	52.33
November	24.00	11.30	49.00	83.54	52.05
December	23.21	11.05	20.30	89.00	57.36

temperature, rainfall and relative humidity for these three districts in Assam is computed here. (Data from Regional Meteorological Office and other sources). Computed separately.

II. Habitat

The oribatid mites occupy a variety of habitats, in almost all ecological niches and occur predominently in soil where vegetative material decay with sufficient moisture. Majority of these are terrestrial in habitat. Some are hydrophilic and some inhabit the sea (Willmann, 1931b), in saline water vegetation (meadow) (Polderman, 1978). The terrestrial soil oribatid mites occur in soil litter, humus, compost heaps, in moss, lichens, under the bark of trees, in the nests of birds (Aoki, 1966; Yaroshenko et Kharchenko, 1970), higher plants (Aoki, 1971), caves (Moritz et al., 1971), lava caves (Yamamoto et Aoki, 1971), nest of small mammals (Bulanova-Zachvatkina et al., 1974) and various other places viz., pasture soil coniferous taiga forest, arctic tundra (Bregetova, 1965) and even the subantarctic zone (Wallwork, 1973).

The soil oribatid mites are the most abundant soil microarthropods and they may be found in a great diversity of habitat ranging from tropical rain forests (Willmann, 1941) to deserts (Trägårdh, 1905; Hammer, 1975), temperate zone to arctic tundra (Hammer, 1944, 1952), intertidal zone (Aoki, 1974a) to high altitude in the mountains (Franz, 1943, 1944).

III. Habit

Oribatid mites feed mainly upon fungal spores. Forsslund (1939) and Schuster (1956) discovered fungal mycelia from the gut of oribatid mites during the course of examining the gut contents of some oribatids. These mites also feed on decaying leaf, humus, lichens, moss and nematode eggs. Riha (1951) noticed that some species feed on decaying wood. Murphy (1954) observed that a number of Ptyctima-mites feed on raw-humus and also observed them to feed on litter, wood and decaying stems.

IV. Percentage of occurrence in soil in relation to other associated fauna

van der Drift (1951) estimated that soil mites constitute about 80 per cent of the soil fauna. In the opinion of the soil zoologist the oribatids are most predominant among the soil acarine fauna. Bregetova (1965) opined that soil oribatid mites comprise 40 to 70 per cent of the fauna in coniferous taiga in the soils of U.S.S.R. In India, this view has been substantiated by Chakrabarti et Raychoudhuri (1965), Choudhuri et Roy (1970, 1971), Sing et Mukherji (1971) and Bhattacharya (1974).

V. Economic importance

Soil oribatid mites although once considered as harmless plant feeders, are now known as an economically important group of soil micro-arthropods. In recent years, attention has been paid to this group by Acarologist throughout the globe.

The economic importance of the oribatid mites lies in the discovery of their beneficial and harmful role. These mites contribute greatly to the soil fertility by breaking down organic matter. The importance of the oribatid mites in the fertility of forest soil has been reported by Sellnick (1928). Spencer (1951) concluded from his experiment with Stegenacarus magnus that the mite helps in disintegration of decaying leaf tissues. Murphy (1955) emphasized that the immature stages of the oribatid mites are more important in so far as decomposition of organic matters is concerned. On the other hand, they also have a significant role in aeration of the soil where they are found. Jacot (1930a) recorded the injurious effects caused by this group of mites. He detected many of the oribatid mites as carriers of fungal spores which get entangled mainly in their body projections, bristles and mouthparts. He (1930b) also reported that Udetaliodes species (Liodidae) and species of Galumninae lodge spores in their 'leg cup-boards' and certain species even ingest spores. Aoki (1960) observed some plant injury due to these mites and he (1970a) described a new species Oribatula sakamorii causing 'the spot disease' of melon. Rockett et Woodring (1966) stated that a new species of Pergalumna consume both saprophytic and plant parasitic nematodes and they suggested that this mite may be used as biological agent for controlling soil nematode population.

Wallwork (1965) reported that Orthogalumna terebrantis burrows in the leaf parenchyma of water hyacinth. Due to this plant burrowing nature, this mite may be considered as an agent in the biological control programme for this serious aquatic weed pest. Humerobates rostrolamellatus Grandjean was reported by Massee (1932) as a pest of cherries. The damage to the root tissues of potato, tulip and strawberry caused by Perlohmannia dissimillis (Hewitt) has been recorded by Evans et al. (1961).

Anantaraman (1951) mentioned of a new species of Oribatid mites, Scheloribates madrasensis from Madras, India, which was known to act as intermediate host of Moniezia, the large tapeworm of domestic ruminants. Takaoda et al. (1977) reported that about 4% of house dust mites consists of oribatids causing respiratory diseases in human beings.

VI. General biology

The works on the biology of oribatid mites are poor. Jacot (1930c), Pérez-Iñigo (1969), van der Hammen (1972a) have done some worth mentioning work on biology of these mites. Oribatid mites are mainly monocious and reproduce parthenogenetically though majority of acarina are diocious. Amongst more than fifty thousand discovered species a few number of males have been discovered till now.

Three nymphal stages, viz., protonymph, deutonymph and tritonymph are found in the life cycle of Oribatid mites. These nymphal stages can be distinguished from each other by the number of genital suckers present on genital plates. The protonymph has one, deutonymph two and tritonymph three pairs of genital suckers. The tritonymphal stages are usually similar to the adults, but some nymphs differ markedly from the adults.

VII. Morphology and Terminology of Adults

The body of Oribatid mite consists of two parts, the propodosoma or prosoma, the dorsal covering of which is termed as prodorsum, situated anteriorly and opisthosoma or hysterosoma comprising the abdominal region, the dorsal covering of which is called hysterosoma situated posteriorly.

The prodorsum and notogaster are demarcated by the dorsosejugal suture in most of the Oribatei.

Propodosoma : The propodosoma is articulated to the hysterosoma movably (Perlohmannoidea) or immovably (Nothroidea). In Phthiracaroidea and Euphthiracaroidea the propodosoma termed as aspis (Figs. 1,2) can be folded like the blade of a penknife to the hysterosoma. In most cases the prodorsum is smooth, but it may be ornamented variably viz., punctate (Fig. 9), foveolate (Fig. 35), granulate (Fig. 23), reticulate (Figs. 11, 15) or with protruding areae porosae (Fig. 7). Anterior extremity of prodorsum is called rostrum which sometimes bears teeth (Suctobelba, Suctobelbella, Ceratoppia, Ceratozetes). Rostrum may be pointed (Xiphobelba), very acute (Rhynchoribates), tubiform (Nasobates), rounded (Fig. 23), mucronate (Oppia), truncate (Truncopes), dentate (Rhynchoppia) or incised (Suctobelba). From the base of the prodorsum and towards the rostrum, there usually remains on either side flat, lath-like or expanded structure (in most poronoticae), or rib-like, narrow costula (in most pycnonoticae). Sometimes the lamellae are connected apically by narrow transverse ridge called translamella (Chaunoproctus, Mycobates, Sphaerozetes). Translamella may be linear (Melanozetes, Unguizetes, Baloghobates), wide (Opsioristes), long (Porozetes), ribbon-shaped (Chaunoproctus, Trichoppia, Calyptozetes). The development, shape and position of lamellae is variable viz., weakly sigmoid (Kodiakella), ribbon-shaped (Chaunoproctus, Oribatula), linear (Lucoppia, Phauloppia), narrow (Limnozetes), wide (Joelia), very wide, covering entire prodorsum (Cuspitegula), intricate form (Fig. 20, Hippobodes), meeting at one point only (Cepheus, Sadocepheus), meeting along a common line (Eremaeozetes, Topalia), wholly fused along median line with a 'V'-shaped incision medially (Umbellozetes), straight, convergent (Ceratoppia, Pyroppia), situated medially (Fig. 23) situated marginally (Fig. 11). The apical part of the lamellae is called cuspis. Cuspis may be long (Opsioristes), short (Hypozetes), rounded (Fig. 33), with external apex (Ferolocella), with two points (Oribatella, Fenstrobates), outwardly pointed (Fig. 35, Microzetes), outwardly obtuse (Brasilozetes), arcuately incised (Fuscozetes, Cosmozetes), with short teeth (Undulozetes), with pointed teeth (Schizozetes), obliquely truncate (Rugozetes), arcuately truncate (Parahypozetes), or projecting beyond rostrum (Eupterolegaeus).

Costulae is characteristic of the family Fremulidae, Basilobelbidae, Suctobelbidae, Oppudae, Costulae may be parallel (Megeremaeus), divergent (Kodiakella), long (Anderemaeus), short (Veloppia), 1 pair usually, 2 pairs (Cristeremaeus), wide (Cosmogneta), introrsely arcuate (Operculoppia), lyriform (Lyroppia), trapeziform (Quadroppia).

3-5 pairs of setae are always present on the prodorsum (i) rostral (ro), (ii) lamellar (la), (iii) interlamellar (int), (iv) anterior exobothridial (exa), (v) posterior exobothridial (exp). The latter two setae (exa and exp) may sometimes be reduced or absent.

The rostral setae is absent (Amnemochthonius). It may arise from below (Saxicolestes) or above (Litholestes) the rostrum and may be simple (Figs. 3, 7, 15, 20, 25, 29, 31) or bifurcate (Zetorchestes, Hardybodes, Nothrolohmannia). The rostral setae may be folliate (Javacarus, Paulinacarus), strongly elbowed (Ramusella, Suctobelbella), buldge in the middle (*Heterobelba*), barbed (Figs. 13, 33, 35) either all over (Figs. 33, 35, *Annectacarus*) or proximally (*Ramusella*) or leaf shaped (Fig. 7 , *Haplacarus*).

Lamellar setae is absent (*Poroliodes*, *Liodes*) or reduced (*Angullozetes*). It may be foliate (*Lohmannia*), bifid with flagelliform tips (*Masthermannia*), stout (*Heterobelba*) or thin (Fig. 7). It may be placed on rostrum close to the rostral setae (Figs. 7, 13, 20, 23, 35) or on prodorsum far backward from rostral setae (Figs. 3, 25) or adjacent to dorsosejugal suture (*Cuneoppia*), Lamellar setae are generally located in the vicinity of lamellar apex or on lamellar cusps (Figs. 33, 35). It may be situated on a prominent knob-like lamellar apophyses (Fig. 33), barbed (Figs. 23, 33, 35), proximally barbed (*Ramusella*), distally barbed (*Hoplophthiracarus*). It may originate marginally (*Pedrocortesia*), dorsally (*Pedrocortesella*) or near interlamellar setae (*Rhinosuctobelba*).

Interlamellar setae arise from interbothridial region in between the lamellar bases. It may be foliate (*Lohmannia*), feathered throughout (Fig. 5) of leaf shaped (Fig. 3), may be extremely long (*Globozetes*), minute (*Ampullobates*). It is absent (*Ameriobppia*, *Hypovertex*, *Phalacrozetes*, *Orthozetes*, *Dinozetes*, *Porrhotegaeus*, *Pterozetes*, *Cantharozetes*, *Cuspitegula*) or may be reduced (*Rhabdozetes*, *Metrioppia*). It may be fusiform (*Sacculobates*), papilliform (*Papillonotus*), long barbed (Figs. 13, 15, 23, 33, 35), plumose (Plumobates, Cosmobates), willow-leaf-shaped (Papillocepheus), apically bifurcate (Parapelops), short (Sadocepheus), long (Cepheus), longer than lamellae (Megalozetes, Jugatala), longer than prodorsum (Stenoxenillus), setiform (Peloptulus, Magnobates, Clavazetes), erect (Notophthiracarus).

Higher Oribatidae have a single pair of exobothridial setae while in the lower forms both the anterior and posterior exobothridial setae are present. Both may be present (Fig. 7), absent (Figs. 11, 20, 25, 29, 33, 35) or only the anterior one may be present (Figs. 3, 5, 13, 15).

A small cup-like structure situated generally near the base of prodorsum laterally, called bothridium or pseudostigmata (Figs. 1, 3, 5, 7, 11, 13, 15, 23, 25, 27, 29, 31, 33, 35). Bothridium is absent (Fig. 9). Trimalaconothrus, Zeanothrus, Fossonothrus, Mucronothrus, Trhypochthoniellus, Hygroribates), extremely small (Ameronothrus)or may be reduced (Fig.). Sometimes the opening of bothridium is covered by a lid (Operculoppia). Bothridial scale (Fig. 1) may be present (Euphthiracaroidea).

The sensillus or pseudostigmatic organ originate from the bothridium. Sensillus is absent (Fig. 9, Trimalaconothrus, Mucronothrus, Fossonothrus, Zeanothrus, Hygroribates, Trhypochthoniellus), extremely small (Fig. 29, Ameronothrus, Hydrozetes). It may be (Figs. 1, 15) unbranched or with 3 (Trizetes) or with 2 (Fig. 29) or with many branches (Fig. 27, Gitella, Multioppia, Brachioppia) at its distal half. Sensillus may be setiform (Ceratoppia, Magnobates, Eremobodes), rod-shaped (Phylhermannia), fusiform (Fig. 23, Oxyoppia, Liacarus, Licnocepheus, Solenoppia, Pedrocortesia), flagelliform (Eremulus, Metabelba, Novonothrus), Pectinated (Fig. 7, Trichthonius, Ctenobelba, Tripiloppia, Synoppia, Ramusella, Ctenogalumna, Lohmannoidea). The head of the sensillus may be spoon-shaped (Dolicheremaeus), club-shaped (Fig. 33), licheniform (Licnodamaeus, Licneremaeus), capitate (Amerioppia, Eremella, Aeroppia, Belloppia, Procorynetes), clavate (Oppia), disc-shaped (Multioppia), bacilliform (Suctoribates), lanceolate (Lanceoppia, Minunthozetes). Sensillus may be proclinate (Microzetes, Papuazetes, Rugozetes, Schalleria), reclinate (Oxyzetes, Mysterozetes, Stylozetes, Miracarus, Mellacarus), exclinate (Austrozetes) or fully covered (Cryptobothria).

Eyes are not known to occur in Oribatids but presence of e eyes has been reported in Heterochthonius gibbus Berlese, 1910 (vide Grandjean, 1928a).

The prodorsum is usually separated from the notogaster by a suture, sutura dorsosejugalis or dorsosejugal suture (Figs.

7, 9, 11, 13, 15, 20, 23, 25, 27, 29, 31, 33, 35). It is absent (Tectocepheus, Litholestes, Strenzkea, Belorchestes, Cavernocepheus, Paraphauloppia, Sellnickia, Grandjeania, Allozetes, Acanthozetes, Brachyoripoda, Oxyamerus, Beckiella, Dampfiella, Pteramerus, Neamerus, Andesamerus) or interrupted medially, (Nasobates, Eporibatula, Unguizetes, Rhopalozetes, Brachyoripoda, Terrasetes, Podoribates, Constrictobates, Dynatozetes, Tentaculozetes, Trichogalumna).

It may be straight (Figs. 13, 15, Pyroppia, Oribatodes, Nemacepheus, Megaremaeus, Pseuderemulus, Heteremulus, Oribella, Cristeremaeus, Ctenobelba, Proteremaeus, Mesoribatula, Siculobata, Dometorina, Protoripoda), arcuate (Kodiakella, Fosseremus, Damaeolus, Granuloppia, Operculoppia, Hamoppia, Octoppia, Laminoppia, Ramuloppia, Mancoribates), cuneate anteriorad (Cuneoppia, Podacarus, Epimerella, Kasszabobates, Lincneremaeus), convex anteriorad (Glanderemaeus, Bulleremaeus), usually with a single arch (Fig. 9) or with three arches (Rostrozetes).

The propodosoma bears gnathosoma or capitulum, epimeral or coxisternal plates and legs in the ventral side. Gnathosoma is composed of chelicerae, pedipalpi, hypostomal and epistomal structure. Generally chelicerae is simple but may be peloptoid (Fig. 15, Eupelops, Peloptulus, Cuneoppia, Metrioppia, Xiphobelba, Beckiella), or attenuating (Suctobelbidae). Epimeral region consists of 4 (I-IV) epimeral or coxisternal plates.

Epimeral setae may be simple (in most cases) or may be bi- and triradiate (Fig. 14) or penta- and hexaradiate (*Eremobelba*). The number of setae on epimeres I-IV is represented by a formula, called the epimeral setal formula, which in most cases is 3-1-3-3 (denoting number of setae in epimeres I-IV). Generally 4 epimeral plates are attached to each other but in case of (Figs. 4,6,8 , *Paulianacarus*, *Haplacarus*, *Malacoangelia*, *Cosmochthonius*, *Malaconothrus* in between I, II and III, IV epimeral plates there is a gap. The epimeral plates are bordered by chitinous thickenings, the apodemata which are usually 5 in number, viz., apo_1, apo_2, apo_{sj}, apo_3 and apo_4.

Legs may be monodactylous (*Malaconothrus*, *Platynothrus*, *Dolicheremaeus*, *Megalotocepheus*, *Pseudotocepheus*, *Tectocepheus*, *Zetorchestes*, *Microtegeus*, *Liobodes*, *Lamellobates* etc.) or tridactylous (*Ceratoppia*, *Ameronothrus*, *Zygoribatula*, *Eupelops*, *Peloribates*, *Chamobates*) but rarely bidactylous (*Passalozetes*, *Arthroplophora*, *Phyllochthonius*). Legs I-III monodactylous, and leg IV tridactylous (*Heterobelba*, *Heterogalumna*). Leg I monodactylous and leg II-IV tridactylous (*Heterozetes*, *Cultrobates*). Legs I-III monodactylous, leg IV bidactylous (*Onychobates*); all legs bidactylous (*Passalozetes*, *Arthroplophora*), leg-I monodactylous. II-IV bidactylous (*Cosmochthonius*), Leg I monodactylous and others without claw (*Strenzkea*). Legs consist of 6 segments, viz., coxa, trochanter, femur, genu, tibia and tarsus, arranged uniformly. In primitive oribatids it may be cylindrical but the length and shape may vary in cases of higher mites. In Palaeacaroidea, the femur is divided into 2 parts viz., basifemur and telofemur. A typical hollow sensory (most probably chemoreceptor seta is present in the distal segments of the legs, termed as "Solenidien" by Vitzthum and "Solenidions" by Grandjean.

Hysterosoma : Hysterosoma or notogaster is generally undivided but sometimes it may be divided by one (*Gehypochthonius*, *Sphaerochthonius*), two (*Trichthonius*, *Liochthonius*, *Brachychthonius*) or three (*Haplochthonius*, *Pterochthonius*, *Cosmochthonius*) sutures. On its posterior border there may be one (*Sellnickia*), two (*Grandjeania*) or four (*Cyrthermannia*) tubercles. Notogaster may be smooth (Fig. 1 *Suctobelbilla*) punctate (Fig. 9) foveolate (Fig. 33) pitted (*Peloribates*), granulate (Fig. 23) with protruded areae porosae (Fig. 7), reticulate (Figs. 11, 15) tuberculate (*Cepheus*), with large tubercle (*Neocarabodes*), with Chitinous crests (*Apotomocepheus*), with sculpture (*Scapheremaeus*), with semicircular depression (*Fossoremus*), with cerotegumental granules (Fig. 15, *Ctenobelba*, *Granuloppia*, *Granizetes*) with 2-4 longitudinal ridges (*Fossonothrus*, *Platynothrus*) with 4 transverse crests (*Arthrovertex*), with scattered light spots (*Licneremaeus*), with carina at shoulder (*Saxicolestes*, *Litholestes*, *Strenzkea*), with fine parallel or radiating lines (*Striatoppia*), with areolate or polygonal chitinous structure (*Licnocepheus*, *Eremella*), with a hexagonal structure anteriorly (*Anoribatella*), with a median pore (*Allogalumna*), with a deep hollow anteriorly (*Spinozetes*, *Cavernocepheus*, *Charassobates*) with laticulus (Fig. 3, *Arthrovertex*, *Scutovertex*), with nymphal exuviae (Figs. 15, 18, *Xiphobelba*, *Heterobelba*, *Haplobelba*).

Primitive oribatids have usually 16, higher oribatids generally 10 or 14 pairs of notogastral setae. Sometimes the number may be upto 14 pairs or may be less than 10 pairs, 8 pairs (*Heterobelba*)2-7 pairs (*Ceratoppia*),7-10 pairs (*Eupelops*), 9 pairs (Figs. 11, 20, *Nippobodes*), 10 pairs (Fig. 23), 11 pairs (Fig. 13, *Ceratozetes*, *Zetorchestes*), 14 pairs (Fig. 5, *Rhysotritia*, *Spinoppia*, *Zygoribatula*), 15 pairs (Fig. 7, *Neocerabodes*), 16 pairs (*Nanhermannia*, *Cyrthermannia*, *Masthermannia*), or even 32-36 pairs (*Neotrichozetes*). Notogastral seta is absent (*Gustavia*, *Vilhenobates*, *Parapelops*, *Phalacrozetes*, *Baloghobates*, *Conozetes*, *Pergalumna*, *Xenogalumna*, *Cryptogalumna*, *Allogalumna*, *Aerogalumna*) or sometimes 50-55 pairs of alveoli present (*Multoribula*).

In primitive Oribatids, 16 pairs of setae are devoted in their order of six transversal rows with the following notation.

row 1 : c_1, c_2, c_3

row 2 : d_1, d_2, d_3

row 3 : $\underline{g_1}$, $\underline{g_2}$

row 4 : $\underline{f_1}$, $\underline{f_2}$

row 5 : $\underline{h_1}$, $\underline{h_2}$, $\underline{h_3}$

row 6 : $\underline{ps_1}$, $\underline{ps_2}$, $\underline{ps_3}$

In higher oribatids 14 or 15 pairs of setae are arranged according to their relative position, 2nd, 3rd and 4th row are arranged into three transverse (anterior, median, posterior) rows.

row 1 : $\underline{c_1}$, $\underline{c_2}$, $\underline{c_3}$

anterior row : $\underline{da}$, $\underline{la}$

median row : $\underline{dm}$, $\underline{lm}$

posterior row : $\underline{dp}$, $\underline{lp}$

row 5 : $\underline{h_1}$, $\underline{h_2}$, $\underline{h_3}$

row 6 : $\underline{ps_1}$, $\underline{ps_2}$, $\underline{ps_3}$

In some higher Oribatids with 10 pairs of setae, 4 setal groups are distinguished, denoted by 't', 'p', 'r' and coupled letter ms. The rows 'P' and 'r' are supposed as transverse rows; the setae ms is single. The setae 't' are denoted by their relative position (a = anterior, e = exterior, i = interior).

Setal group t : $\underline{ta}$, $\underline{te}$, $\underline{ti}$

Setal group ms : $\underline{ms}$

Setal group r : $\underline{r_1}$, $\underline{r_2}$, $\underline{r_3}$

Setal group P : $\underline{p_1}$, $\underline{p_2}$, $\underline{p_3}$

Notogastral setae may be simple (Fig. 7) phylliform (Fig. 3, Striatoppia, Stachyoppia), fan-shaped (Suctobelbella), widening like a knife-blade (Phyllhermannia), fusiform (Ampullobates, Sacculobates), setiform (Oribella, Reticuloppia, Diapterobates), papilloform (Papillonotus), dilated (Phyllocarabodes, Eremella, Sacculoppia), spatulate (Aokiella, Mystroppia), blade-shaped (Pseuderemulus), incrassate (Carabodoides), or even bifid with long flagelliform tips (Masthermannia). These may be extremely long (Fig. 5, Neotrichozetes), reduced to alveoli (Gymnobodes) or absent (Sphaerogaluma). Occasionally, especially in primitive oribatid mites there appear on the pygidium numerous setae generally of different shape than the notogastral ones and this is termed pygidial neotrichy (Cryptacarus, Thamnacarus), Usually in higher Oribatids there are 4 pairs of areae porosae termed as Aa, A_1, A_2 and A_3 (Phauloppia, Subphauloppia, Zygoribatula, Ceratozetes, Eupelops, Flagellozetes, Cerachipteria), or they may be 2 pairs (Pseudoppia, Scutovertex), 3 pairs (Passalozetes), 5 pairs (Reticuloppia), 8 pairs (Spinoppia, Neotrichozel) or even 15-20 pairs (Rykella). The shape of these areae porosae are generally circular but may also ribbon-shaped (Capilloppia) or only posterior two areae porosae (A_2 and A_3) are ribbon-shaped (Terrazetes). Sometimes sacculi, slit or dot-like openings on notogaster may be present, these are 4 pairs viz., *Sa*, S_1, S_2 and S_3 (Fig. 31, *Rostrozetes*, *Scheloribates*) generally, but may be 5 pairs (*Nannerlia*) or 6 pairs (*Fissurobates*), sometimes pores may be reduced to pin-heads termed as pori (*Trachygalumna*, *Pseudachipteria*). Frequently 3-5 pairs of slit like fissure are found on notogaster in higher Oribatids, namely *ia*, *im*, *ip*, *ips* and *ih* (Figs. 9, 15,23, 25). Orifice of latero-abdominal gland termed as *gla* is sometimes present on notogaster (Figs. 22, 23).

Antero-laterally on the notogaster there appear in many Oribatids (*Scheloribates*, *Rostrozetes*, *Pilobates*, *Galumna*) a characteristic wing-like appendage, the pteromorpha, which may be movable (Fig. 31, *Peloptulus*, *Parapelops*, *Rostrozetes*) or immovable (*Ceratozetes*, *Scheloribates*, *Microzetes*), horizontal (*Mulforibates*) or bent downwards laterally (*Cosmobates*). The anterior margin of the pteromorph may be straight or concave and lateral margin may be parallel with the body or wavy (*Scheloribates*).

Ventral plate

The ventral part of the hysterosoma may be entire or divided either completely or partly by a transverse suture which may be parabolic (*Eulohmannia*) or semicircular (*Cyrthermannia*, *Masthermannia*) or straight (*Epilohmannia*). The area behind the epimeral region of the ventral side is called the genito-anal region. Depending upon the genito-anal region, 2 types of Oribatids may be distinguished : *Macropyline* type (Figs. 1, 7, 9) (the genital and anal plates touch each other and occupy the entire length of the genito-anal region) and Brachypyline type (the genital and anal plates usually fail to meet each other and are situated on a distinct ventral plate (Figs. 11, 13, 15, 20, 23, 25, 27, 29, 31, 33, 35). Macropyline type is the characteristic of the primitive Oribatids, whereas Brachypyline type is the characteristic of the higher Oribatids.

Genital plates

In extreme cases genital plates may be circular (*Mesoplophora*) or narrowly triangular (*Rhysotritia*); these may be divided in primitive oribatids by a transverse suture (*Lohmannia*, *Cryptacarus*) or may be undivided (*Annectacarus*, *Javacarus*, *Haplacarus*, *Dendracarus*, *Mixacarus*, *Millotacarus*, *Annectacarus*). The number of genital setae is generally 4-6 pairs, sometimes reduced to 1 pair (*Pirnodus*) or increased to 18-20 pairs (*Muconotus*), 2 pairs (*Constrictobates*), 3 pairs (*Pseudotocepheus*), 4 pairs (Figs. 24, 32), 5 pairs (Figs. 16, 30), 6 pairs (Figs. 14, 36, *Hymenobelba*, *Neocarabodes*, *Zetorchestes*, *Tectocepheus*), 7 pairs (*Heterobelba*), 8 pairs (*Flammeremaeus*), 8-9 pairs (*Rhysotritia*), 9 pairs (*Hoplopthiracarus*), 10 pairs (Fig. 8) or may be sometimes 13-25 pairs (*Platynothrus*). Generally genital setae are simple but these may be barbed (Heterobelba) or biradiated (Fig. 14). Posterior to genital plates are usually found the aggenital setae, which may be 1 pair in most cases, 2 pairs (Camisia, Acronothrus) or may be 3 pairs (Pilobates, Tripiloppia) or these setae may be absent (Archegozetes, Allonothrus, Nothrus, Malaconothrus).

Anal plates:

Posteriorly to the genital plates there is a pair of elongated anal plates. An unpaired plate without setae is situated in front of anal plates termed as preanal plate (Fig. 8). It may be a small triangular (Annectacarus, Cryptacarus, Dendracarus) or wide, transverse strap-like (Fig. 8, Javacarus, Haplacarus, Millotacarus). Anal plates may be fused with lateral adanal plates (Cryptocarus) or may be separated from each other (Meristolohmannia, Thamnacarus, Lohmannia, Lepidacarus, Papillacarus, Meristacarus, Mixacarus). Anal setae are usually 2-3 pairs. These may be absent (Javacarus) or 1 pair (Fig. 36, Haplacarus), 2 pairs (Figs. 4, 12, 13, 16, 24, 30, 32, 34), 3 pairs (Hoplophorella, Rhysotritia), 4 pairs (Steganacarus). These may be simple in most cases but may also be barbed (Dolicheremaeus). Adanal setae are generally 3 pairs (Figs. 4, 6, 12, 21, 24). It may be one pair (Gymnobates, Exoripoda), 2 pairs (Figs. 11, 34, Zetorchestes), 4 pairs (Fig. 8), 5 pairs (Torpacarus), or 8-9 pairs (Psammogalumna).

A slit like pore found at the outer vicinity of adanal plate is called adanal pore, *iad*, which may be parallel (Figs. 16, 21, 24, 26, 36) or oblique (*Dolicheremaeus*) to the lateral border of anal field or aligned nearly transversely close to the anterior margin of anal opening (*Phyllhermannia*).

Abbreviation used :

For abbreviations of notations Grandjean (1934a), Knülle (1957), Wallwork (1960, 1967a, 1967b), Aoki (1965c, 1967b), Balogh (1972) and Hammer (1972) are followed : *ro* = rostral setae, *la* = lamellar setae, *int* = interlamellar setae, *exa* = anterior exobothridial setae, *exp* = posterior exobothridial setae, *ss* = sensillus, *bo* = bothridium, *tbd* = dorsal bothridial plate, *tbv* = ventral bothridial plate, *sc* = bothridial scale, *lc* = lateral carinae, *Spa. l* = lateral lamelliform expansion, *tu* = tutorium, *pd 2-3* = pedotecta-complex II-III, *co. pl* = lateral prodorsal condyles, *co. pm* = median prodorsal condyles, *co. nl* = lateral notogastral tubercle, *n* = thong of buckle attachment, a = arm of buckle attachment, *pt* = pteromorph; c_1, c_2, c_3, cp, d_1, d_2, d_3, e_1, e_2, f_1, f_2, h_1, h_2, h_3, ps_1, ps_2, ps_3 = notogastral setae in primitive Oribatids, *ta*, *te*, *ti*, *ms*, r_1, r_2, r_3, p_1, p_2, p_3, c_1, c_2, cp, d_1, d_2, *da*, *dm*, *la*, *lm*, *lp*, e_1, e_2, f_1, f_2, h_1, h_2, h_3, ps_1 ps_2, ps_3 = notogastral setae in higher Oribatids; vm = marginal ridge; *ia*, *im*, *ih*, *ips*, *ip* = dorsal lyrifissures; *Aa*,

$\underline{A_1}$, $\underline{A_2}$, $\underline{A_3}$ = areae porosae on notogaster; $\underline{sa}$, $\underline{S_1}$, $\underline{S_2}$, $\underline{S_3}$ = sacculi on notogaster; gla = orifice of lateroabdominal gland; an = anal plate; $\underline{an_1}$ - $\underline{an_2}$ = anal setae; ad = adanal plate; $\underline{ad_1}$- $\underline{ad_3}$ = adanal setae; iad = adanal fissure; gen = genital plate; g_1 - g_{12} = genital setae; $\underline{ag_1}$ - $\underline{ag_2}$ = aggenital setae; 1a, 1b, 1c, 2a, 3a, 3b, 3c, 3d, 3e, 4a, 4b, 4c, 4d, 4e, 4f, 4g = epimeral setae on epimeres I, II, III and IV respectively, $\underline{apo_1}$, $\underline{apo_2}$, $\underline{apo_3}$, $\underline{apo_4}$ = apodemata; ntg = notogastral setae; S_1 - S_{10} = notogastral transverse bands; vent. neo. = ventral neotrichy.

VIII. Short historical background :

Taxonomic studies of the Oribatid mites have come to the limelight of scientific investigation from several corners of the globe chiefly through the devoted works of Koch (1836-1841, 1842); Michael (1880, 1884-1888, 1898, 1908); Berlese (1884, 1885, 1888, 1892, 1895, 1896, 1903, 1904, 1905, 1908, 1910, 1913, 1916); Ewing (1908, 1909, 1910, 1913, 1917, 1918); Oudemans (1896, 1900, 1902, 1903, 1906, 1915, 1916, 1917, 1923); Willmann (1918, 1919, 1925, 1928, 1929, 1930, 1931, 1935, 1936, 1938, 1939, 1940, 1941, 1943, 1951, 1953); Jacot (1923, 1924, 1925, 1929, 1930, 1933, 1934, 1936, 1937, 1938, 1939); Sellnick (1919, 1922, 1923, 1925, 1928, 1950, 1955, 1958, 1959, 1960); Grandjean (1928, 1931, 1933, 1934, 1936, 1941, 1942, 1948, 1950, 1954, 1958, 1967, 1971); Balogh (1937, 1943, 1958, 1959, 1960, 1961, 1962, 1963, 1965, 1966, 1968, 1970, 1972); van der Hammen (1952, 1959, 1963, 1968, 1971, 1972); Hammer (1944, 1952, 1953, 1955, 1958, 1961, 1962, 1966, 1967, 1968, 1970, 1971, 1972, 1973, 1975, 1977, 1979); Woolley (1957, 1958, 1961, 1967, 1969); Kunst (1957, 1958, 1959, 1961, 1962, 1971); Aoki (1958, 1959, 1961, 1962, 1963, 1964, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1973, 1974, 1975, 1976, 1977, 1978, 1980); Wallwork (1960, 1961, 1962, 1963, 1964, 1965, 1966, 1968, 1969, 1970, 1971, 1974); Pletzen (1963, 1965); Pérez-Iñigo (1964, 1967, 1968, 1969, 1973, 1974, 1975, 1976, 1977, 1978, 1979, 1980); Balogh *et* Mahunka (1965, 1966, 1967, 1968, 1969, 1974, 1975, 1977, 1978, 1979, 1980); Engelbrecht (1972, 1973, 1975) and others.

There are approximately fifty thousand species of Oribatid mites which belong to near about 800 genera, over 140 families and 44 superfamilies so far known through the devoted works of the Oribatidologists of the world.

Historical Resume from India :

Taxonomic studies of the Oribatid mites became the topic of scientific investigation in India through the works of Pearce (1906) who described 8 new species of Oribatid mites along with 12 known species from Sikkim Himalaya. Jacot (1933b) correctly identified the 2 species, *Galumna tessellata* and *G. nilgiria*, previously described by Ewing (1910) from topotypic material at Nilgiri Hills in South India. Later, Baker (1945) described a new species Scheloribates chauhani from Bareilly in Uttar Pradesh. Anantaraman (1951) mentioned Scheloribates madrasensis as a vector of Moniezia from Madras in South India. Aoki (1965a) reported 4 new species viz., Platynothrus numatai, Liacarus inermis, Leobodes annulatus and Unduloribates hebes and 6 known species from Nepal Himalayas. Prasad (1965) reported 3 Oribatid mites i.e., Cosmochthonius, Oppia and Tectocepheus from Bhagalpur in Bihar. Bhaduri et Roychoudhuri (1967) reported 6 oribatid mites (diagnosed upto generic level) i.e., Oppia, Lamellobates, Basilobelba, Conoppia, Xiphobelba and Hoplophorella for the first time from West Bengal in India. They (1968) described one new subgenus Paralamellobates under the genus Lamellobates (Later given generic rank by Balogh in 1972), one new species Allonothrus indicus, one new subspecies Archegozetes magna indicus and 4 known species from Calcutta in West Bengal. Singh et Mukharji (1971) recorded 10 genera (without mentioning species), 3 species and 1 subspecies from Varanasi in Uttar Pradesh. Hafeez-Kardar (1972) described one new species Papillacarus indicus from Aligarh in Uttar Pradesh. 11 species (one without specific determination) of oribatid mites were reported by Chakrabarti et Bhaduri from the districts of Nadia and 24-Parganas in West Bengal. Chakrabarti, Bhaduri et Raychoudhuri (1972, 1973) described one new species Cosmochthonius bengalensis and 2 new subspecies *Malacoangelia remigera indica* and *Eupelops acromios minor* and recorded 9 known species and 3 genera (without specific determination) for the first time from India. Bhaduri, Chakrabarti et Raychoudhuri (1974) described one new species, *Basilobelba indica* from Calcutta and suburbs. Hafeez-Karder (1974) described 2 new species, *latilamellaris* and *translamellaris* under the genus *Tectocepheus* from Aligarh in Uttar Pradesh. Bhattacharya, Bhaduri et Raychoudhuri (1974) reported 3 new species viz., *Annectacarus longisetosus*, *Cryptacarus dendrisetosus* and *Papillacarus simplirostratus*, a new subspecies *Haplacarus foliatus bengalensis* and 2 known species from Santiniketan, West Bengal. Prasad (1974) published a catalogue of mites of India and there possibly inadvertently he mentioned that only 19 species of Oribatid mites were found in India till 1972. Bhaduri, Bhattacharya et Chakrabarti (1975) described 2 new species, *abalai* and *clavisetosus* under the genus *Chaunoproctus* from Calcutta in West Bengal. Deb et Raychoudhuri (1975) described 2 new species *Galumna crenata* and *G. parascaber* and reported one subspecies from West Bengal in India. Hafeez-Karder (1975) reported 2 new species *Oribatella alami* and *O. kashmiriensis* from Jammu and Kashmir in India. He (1967) added 4 new species of *Oppia* viz., *samadi*, *aligarhiensis*, *sensiclavata* and *alamellata* from Aligarh in Uttar Pradesh. He (1976) further described 4 new species, *Scheloribates bicuspidatus*, *S. translamellaris*, *S. baloghi* and *S. rufafulvus* from India. Haq (1976) described 6 new species viz., Annectacarus trivandricus, Cyrthermania bicornuta, Allonothrus giganticus, Eremobelba nagarcorica, Multeppia indica, and Dolicheremaeus indicus and one new subspecies, Suctobelba semiplumosa indica from Kerala in South India. Chakrabarti, Bhaduri et Raychoudhuri (1977) described 2 new species Cyrthermannia quadricornuata and Nanhermannia himalayensis and reported Masthermannia mamillaris from West Bengal in India. Chakrabarti, Bhaduri et Raychoudhuri (1977) described one new species Haplacarus intermedius and simultaneously recorded 14 known species from West Bengal. Chakrabarti, Kundu et Roy Talukdar (1977) recorded one new species under the genus Dolicheremaeus and recorded 9 known species from Darjeeling in West Bengal. Chakrabarti, Mondal et Kundu (1978) described 2 new species of Pseudotocepheus viz., hammerae and gobletus from West Bengal in India. 2 new species, viz., Eremobelba indica and Allonothrus movensis, 2 known species and one known subspecies were reported by Ghosh et Bhaduri (1978) from Nagaland in India. Chakrabarti, Kundu et Mondal (1978) described one new genus Sigmonothrus under the family Camisiidae with 3 new species i.e., quadristriatus, bistriatus and ovatus from Darjeeling in West Bengal. Chakrabarti, Chanda et James (1979) recorded 12 known species of Oribatid mites from Darjeeling in West Bengal. Chakrabarti et Roy Talukdar (1979) described one new species *Malaconothrus assamensis* and recorded 7 known species from the district of Cachar in Assam, India. Haq (1979) described one new species, *Xiphobelba ismalia* from Kerala in South India. Bhattacharya et Banerjee (1979) reported one new species *Pilobatella berlesei*, one new subspecies *Epilohmannia pallida indica* and one known species of *Zygoribatula* from Birbhum district in West Bengal. Bhattacharya (1980) recorded 22 known species, 1 known subspecies and 16 known genera (without mentioning species) of Oribatid mites from soils of Santiniketan and its adjacent areas in West Bengal, India. Mishra, Bhaduri et Raychoudhuri (1980) reported 13 known species, 1 known subspecies and 26 known genera (without mentioning species) of Oribatid mites from Orissa in India. Another 2 new species under the genus *Dolicheremaeus* viz., *coronarius* and *himalayensis* were reported from West Bengal, India by Chakrabarti, Bhaduri et Kundu (1981). Chakrabarti et Mondal (1981) described one new species, *Eupelops longisetosus* and recorded 9 known species and 2 known genera viz., *Heterobelba* and *Metabelba* from Darjeeling, West Bengal, India.

Thus the total number of species and subspecies described and reported from India till date stands at 143 and 8 respectively of which 63 species and 6 subspecies have been described as new to science from India.

IX. Material and Method :

Extensive field work has been done by the writer to collect different soil samples in the district of Cachar, North Cachar and Karbi Anglong (Mikir Hills) with some adjoining areas in search of Oribatid mites since 1977-78 (vide map) from various ecological niches. Extraction of soil oribatids from the soil samples was made by using both Berlese funnel modified by Tullgren (1918) and Tullgren apparatus modified by Haarløv (1947). The method of dry behavioural extraction is done by a large galvanised tin funnel, bearing on its upper opening a fine gauged (1.5-2.5 mm) copper wire mesh. A layer of soil sample about 5-6 cm thick were placed on the mesh, and the funnel was fixed to stand. After that the soil samples were put for heating and desiccating the same from above by using an electric bulb (40-60 W). A glass vial containing 75-85% alcohol was placed under the lower opening of funnel. To prevent evaporation of alcohol a small quantity of 5% glycerol was added to the alcohol. As a result of the dry funnel extraction method, a large number of soil microarthropods were deposited on the collecting glass vial. Then Oribatid specimens were sorted out from other associated fauna and were transferred into an equal amount of 90% alcohol and lactic acid in a small vial for desclerotization as advised by Balogh (1955, 1972). For rapid desclerotization, the vial containing the specimens were kept in a hotbath for a few hours. When the mites became transparent, almost vitreous, a certain amount of concentrated lactic acid was used as a mounting medium for microscopic studies following Grandjean (1949) and Balogh (1965, 1972). Some other known permanent mounting media e.g. Canada balsam, polyvenyl alcohol, Hoyer's mounting medium etc. were also used but the results were not satisfactory. Finally Balogh's (1965, 1972) temporary mounting method was preferred.

After microscopical examination, the specimens were kept in the Darham's tube (2.5 x 0.7 cm.) containing 80% alcohol and plugged with absorbent cotton with tissue paper for final preservation and they were put into large tube (5 x 1.2 cm.) with labels giving details of the species i.e., locality, habital, date of collection, name of collector, name of the species etc. Further, alcohol was added and the tube was plugged with either cork or cotton wool, and finally the plugged tubes were preserved in glass jars in 80% alcohol.

Measurements were taken with the aid of ocular and stage micrometers. Camera-lucida drawings were made for every specimen (both new and known species) and that of new species are provided as photocopies in this dissertation.

The collections, after final examination with proper labels, are kept in the laboratory of the Department of Zoology, Presidency College, Calcutta.

X. **Systematics :**

The systematic position of Oribatid mites is still somewhat controversial, although Vitzthum (1931) proposed the following systematic position for the Oribatid mites.

Acarina Nitzsch

Order Acarina Nitzsch

Suborder Sarcopteformes Reuter

Supercohors Oribatei Duges

Bedford (1950) and Baker et Wharton (1952) also supported Vitzthum's proposal. van der Hammen (1972) elevated the group to the status of an Order, but proposed a new name, Oribatida instead of Oribatei. While doing so van der Hammen (1972) rejected the names Cryptostigmata, Mesostigmata, Prostigmata, etc., proposed by Evans, Sheals et Macfarlane (1961) for classifying mites and divided the mites into two suborders viz., Anactinotrichida and Actinotricha, the former consisting of the Orders Opiliocardia, Holothyrida, Gamasida and Ixodida and the letter Actinedida, Oribatida, Acaridida and Tarsonemida.

Grandjean (1954a) proposed a new system of classification on the basis of the ontogenic stages of this mites. But unfortunately life history stages of about 98% of Oribatei are still unknown and all taxonomic units are erected on the basis of adult characters. So in recent years most of the Oribatidologists follow Balogh's (1961b, 1963a, 1965, 1972) system of artificial classification which is based on simple, easily recognisable morphological adult characters.

The Order Acarina is diagnosed as follows: The mouth parts more or less distinctly set off from the rest of the body on a false head or capitulum or Gnathosoma. Posterior segmentation is greatly reduced or absent. Primary sclerites are largely replace by secondary plates of devices origins. /divers
Larval stages usually have three pairs and nymphal stages and adults have four pairs of legs.

The Order Acarina is divided into five suborders viz., (i) Onychopalpida, (ii) Mesostigmata, (iii) Ixodides, (iv) Trombidiformes, (v) Sarcoptiformes.

Suborder Sarcoptiformes is divided into two Supercohors, i.e., Acaridiae and Oribatei. The former containing the cheese mites, itch mites and feather mites and the latter the Oribatid mites. Although the two groups can be separated easily, their relationship is close and they possess many characters in common, such as the body shape, mouth parts (chewing), arrangement of coxal plates and Claparide organ in larval form etc.

<u>Key to the Sarcoptiformes</u>

1(2) Weak skinned, non-armoured, without pseudostigmata and prominent club-like pseudostigmatic organs (except Pediculochelidae); tarsi with caruncles; sexual dimorphism at times strongly marked; many males with copulatory suckers on tarsi or anal region

... Acaridiae Latreille, 1802

2 (1) Leather-like or strongly sclerotised, with prominent club-like pseudostigmatic organs; tarsi without caruncles; sexual dimorphism not marked; the gnathosoma is usually concealed with camerostome. The coxal apodemes are sunk beneath the skin but still are visible; the tarsi have one (monodactyle) or three (tridactyle) claws; three pairs of genital suckers are present; males do not possess adanal suckers; both sexes generally have the genital and anal opening covered by lid-like shields; pteromorphs or wings are present in some genera

... Oribatei Duges, 1833

XI. Key to the families

1(6) Prodorsum capable of being shut back like the blade of penknife to notogaster

2 (4) Genital and anal plates wide, body not much compressed laterally

3 (5) Ano-genital region is broad and short

... Phthiracaridae Perty, 1841

4(2) Genital and anal plates narrow, body considerably compressed laterally

5(3) Ano-genital region long and narrow

... Eupthiracaridae Jacot, 1930

6(1) Prodorsum incapable to be shut back like the blade of pen-knife to notogaster

7(14) Prodorsum movable, not fused with notogaster

8(11) Notogaster with transverse suture

9(10) Notogaster with 1 transverse suture; notogastral setae never exceptionally long; genital plate with or without transverse suture

... Hypochthoniidae Berlese, 1910

10(9) Notogaster with 2-3 transverse suture; some notogastral setae very long, as long as or hardly shorter than the length of notogaster

... Cosmochthoniidae Grandjean, 1947

11(8) Notogaster without transverse suture

12(13) Preanal plate present between genital and anal plates; genital setae 10 pairs, arranged in two longitudinal rows; lateroabdominal gland absent

... Lohmanniidae Berlese, 1916

13(12) Preanal plate absent; genital setae fewer than 10 pairs, if more than invariably arranged in a single row; lateroabdominal gland present

14(7) Prodorsum and notogaster immovably fused

15(17) Bothridium absent

16(19) Genital and anal plates meeting each other and occupying the entire ventral surface

... Malaconothridae Berlese, 1916

17(15) Bothridium present

18(21) Aggenital setae absent

19(16) Genital and anal plates not meeting each other

20(22) Notogaster slightly convex; only part of the genital setae have a marginal position; setae f_1 present; the last joint of the palp has 10 setae

... Trhypochthonidae Willmann, 1931

21(18) Aggenital setae present

22(20) Notogaster flattened, or slightly concave; genital setae have distinct marginal position; seta f_1 absent; last joint of the palp has 8 setae

... Camisiidae Oudemans, 1900

23(44) Notogaster without areae porosae, sacculi or pori and pteromorphae

24(25) Genital setae 7-9 or more pairs; notogaster with 6 or less pairs of notogastral setae in a posteromarginal position with concentric or excentric exuvia; genital plates with transverse suture

... Liodidae Grandjean, 1954

25(24) Genital setae 7 or less than 7 pairs; notogastral setae more than 6 pairs; without concentric or excentric exuvia; genital plates without transverse suture

26(35) Prodorsum with true lamellae; situated medially or more or less approaching prodorsal margin

27(32) Shoulder without tubercle or any other excresence

28(29) Lamellae marginally situated

... Microtegeidae Berlese, 1917

29(28) Lamellae situated medially, removed from prodorsal margin

... Otocepheidae Balogh, 1961

30(31) Lamellae of an intricate form; interlamellar setae originating on lamellae

... Nippobodidae Aoki, 1959

31(30) Lamellae normal; interlamellar setae not originating from lamella

32(27) Shoulder with tubercle

33(34) Tubercles low, not projecting from the outline of the body; lamellae situated medially, may connected with translamella

... Tectocepheidae Grandjean, 1954

34(33) Tubercles high, projecting from the outline of the body; lamellae more or less parallel, hardly convergent, not connect with translamella

... Carabodidae C.L. Koch, 1837

35(26) Prodorsum without true lamellae, with a hardly elevated linear costula

36(39) Ventral neotrichy present

37(38) Notogaster without exuviae

... Eremulidae Grandjean, 1965

38(37) Notogaster with exuviae

... Basilobelbidae Balogh, 1961

39(36) Ventral neotrichy absent

40(41) Mandibulae with attenuating chelae

... Suctobelbidae Grandjean, 1954

41(40) Mandibulae normal

42(43) Crista, a chitinous teeth, laths or lines in dorsosejugal region may be present; genital and anal plates small; genital setae 4-6 pairs; notogastral setae 9-10 or exceptionally 13-14 pairs

... Oppiidae Grandjean, 1954

43(42) Crista absent; genital and anal plates large; genital setae 5-6 pairs; notogastral setae 16-17 pairs

... Hydrozetidae Grandjean, 1954

44(23) Notogaster with true areae porosae or sacculi or pori and pteromorphae

45(51) Lamellae covering most of the prodorsum

46(49) Lamellae hinged or joined at the base, and not connected with one another, variously shaped and can be folded lengthwise

... Microzetidae Grandjean, 1936

47(53) Pteromorphs curving ventrally

48(50) Lamellae with free cuspids, cuspids not truncated, without translamella

49(46) Lamellae entirely fused in the middle, forming a large scale, almost wholly covering prodorsum or meeting only in median line or fusing basally

... Oribatellidae Jacot, 1925

50(48) Lamellae with truncated cuspids, may be connects with translamella or fused medially

... Ceratozetidae Jacot, 1925

51(45) Lamellae not covering most of the prodorsum

52(54) Pteromorphs extending anteriorly and posteriorly to the line of attachment to the body; lamellae situated marginally; genital setae 5 pairs

... Haplozetidae Grandjean, 1936

53(47) Pteromorphs not curving ventrally

54(52) Pteromorphs in one plane only; lamellae straight, situated medially; genital setae 4-5 pairs

... Oribatulidae Thor, 1929