STUDIES ON GROUND BEETLES (COLEOPTERA : INSECTA) OF DOOARS AREA (JALPAIGURI : WEST BENGAL) WITH SPECIAL REFERENCE TO THEIR TAXONOMY, SEASONAL ACTIVITY AND DENSITY BY PITFALL EXPERIMENT

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Certified that Mr. Anup Kumar Datta worked out his dissertation on " Studies on ground beetles (Coleoptera : Insecta) of Dooars area (Jalpaiguri : West Bengal) with special reference to thir Taxonomy, Seasonal activity and Density by pitfall experiment " for fulfilment of the requirements of the degree of Doctor of Philosophy (Science) of the University of North Bengal under my supervision and that he has fulfilled the requirements of regulations relating to the nature, period of research and presentation of seminer talks. It is also certified that this research work incorporates the results of original investigations made by Mr. Datta and has not been submitted previously anywhere for any degree whatsoever by him or anyone else. He has a thorough knowledge on the literature in existence in his field of specialisation. I assure that he will be able to carry on researches in this field in future independently.

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S Y N O P S I S

TITLE : STUDIES ON GROUND BEETLES (COLEOPTERA : INSECTA) OF DOOARS AREA (JALPAIGURI : WEST BENGAL) WITH SPECIAL REFERENCE TO THEIR TAXONOMY, SEASONAL ACTIVITY AND DENSITY BY PITFALL EXPERIMENT.

Very little attention has been given to explore rich and diverse beetle fauna of Dooars area of Jalpaiguri district of West Bengal. Although many species have been described from this area and published in scattered literatures specially from folieges, flowers and barks etc. but no comprehensive work has been published on the beetles of North East India. Moreover, practically nothing is known on the ground beetles of North Bengal. A work has been undertaken since 1976 to survey and collect ground beetles by pitfall trapping.

A suitable place has been selected near Gayarkata, 42 Km. North East of Nagrakata meteorological office in the Jalpaiguri district, West Bengal in the foot hills of North East Himalaya.

A totel of 27 pitfall traps have been placed in the forest floor and neighbouring Tea garden and Rice field. A regular collection has been made forthightly. After bringing back the collection in the laboratory, the materials have been sorted out into different groups of families. So far, a totel of 16 thousand beetles have been collected belonging to the families : Scarabaeidae,

Staphylinidae, Carabidae, Histeridae, Pselaphidae, Ptiliidae, Tenebrionidae, Chrysomelidae, Silphidae, Elateridae, Nitidulidae etc. A data sheet has been prepared to study the seasonal variation of dominating and rare species. Major objectives of the present study are : 1) correct identification of species 2) taxonomic description of the species 3) preparation of charts and histograms of population density and seasonal variation. This would be the first comprehensive work on ground beetles collected from pitfall traps from India.

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I N T R O D U C T I O N

Pitfall traps are one of the convenient methods and have been widely used for investigating soil arthropods, especially those living on the ground surface. In recent years several works have been carried out in different parts of the world to study the seasonal incidence of surface dwelling insects by this pitfall experiment. Detailed investigations of pitfall trap efficiency were reported by Fichter (1941), Williams (1958 and 1959 a), Grum (1959), Morris (1960), Williams (1961), Briggs (1961), Mitchell (1963), Greenslade (1964 a), Pearson and White (1964), Richard and Haverfield (1965), Joose (1965), Southwood (1966), Urbretel (1968), Mays (1970), Gist and Crossley (1973), Hoff (1973 a and 1973 b), Wilber and Landwehr (1974), Morril (1975), Thomas and Sleeper (1977), Tolbert, Tolbert and Ambrose (1977) and others. Most of these investigators concluded that this method is useful for studying the distribution, abundance, dispersal and density of arthropods and also for measuring population changes in behaviour but was of limited value for quantitative estimations of population size. Southwood (1966) summarised some critical studies on the efficacy of pitfall trapping and he concluded that pitfall traps suffer from its disadvantage of comparison communities. The total catches depend both on the density of the population being sampled and the activity of individual in it (Greenslade, 1964 a). Morris (1960) has stressed that the desirability of obtaining estimates of absolute population in sampling

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programme, that is the number of individuals per unit of habitat. These are largely because of the fact that the vagility of individuals appearing is much influenced by the change of seasonal activities which vary with the variation of temperature, reinfall, humidity, food resources, area, etc. It is evident that numerous physical and biological factors may influence the total pitfall trap capture of arthropods. Greenslade (1963 b) noted that pitfall catches vary with the amount of locomotor activity shown by carabid beetles as they are influenced by weather. Briggs (1961) and Taylor (1963) noted correlation between catches and temperature. Williams (1940) concluded after a comprehensive 4 years' study of the effect of weather on insect activity that rainfall and minimum ambient temperature were two main climatic factors having the greatest influence on total catches of nocturnal insects in England. Williams (1959 a, 1959 b), Mitchell (1963) and Greenslade (1963 a, 1963 b and 1964 a) made an extensive analysis of environmental and organismic interactions and their effect on pitfall trap capture of carabid beetles. Ahearn (1971) pointed out that important factors determining the total catches in pitfall trap include weather conditions, daily and seasonal activity cycles, behaviour pattern and types and density of ground vegetation. Thomas and Sleeper (1977) added that methodological precautions are also one of the most important factors for determining the total catches. Some specific comments on these methodological precautions have also been

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suggested by Turner (1962), Gist (1967), Nelson (1970) and Ahearn (1970). In the present study those precautions have been much effortly incorporated throughout the year.

Inspite of these limitations, pitfall traps are still in use to study surface activity, population and behaviour of beetles fauna inhibiting different ecological areas. Pitfall traps have been used by Hawkin (1936), Campbell and Stone (1939), Cohen (1942), Drift (1951 and 1959), Boyd (1960), Nivard (1966), Gillard (1967), Evans (1967, 1969 and 1971), Norman (1969), Oppenheimer (1978 unpublished), Shubeck (1969) and Kirk (1971 a) to study the surface activities of beetle fauna in forest floor and agricultural field. Similarly, population and behaviour study of scarabaeid dung beetles have been studied by Landin (1961), Bornemissza and Williams (1970), Oppenheimer (1972 and 1977), Upadhyaya and Tripathi (1973), Gorden and Oppenheimer (1975), Macqueen and Berino (1975) and Hanski and Koskela (1977). These traps have been also used extensively for ecological studies of Carabidae and Tenebrionidae. Walsh (1931 and 1933), Kaufmann (1937), Nihimiuk (1948), Drift (1951), Scherney (1959 and 1960), Gilbert (1956 and 1958), Skuhravy (1956), Kabacik (1957), Briggs (1957), Crum (1959), Williams (1959 b), Thiele (1960), Mitchell (1963), Nivard (1964)a, 1964 b and 1966), Greenslade (1963 a, 1963 b, 1964 a, 1964 b, 1964 c and 1965), Penny (1966), Norman (1966), Grilm (1967), Lopain (1968), Rickard (1970 a and 1970 b, 1971), Nelson (1970), and Kirk (1971 b and 1973) used these traps in the population

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study of carabid beetles, whereas, Turner (1962), Rickard and Haverfield (1955), Gist (1967), Ahearn and Hadley (1969), Ahearn (1970 and 1971), Kramm and Kramm (1972), Rickard, Cline and Gilbert (1974), Rogers and Rickard (1975), Thomas and Sleeper (1977) and Rogers and Fitzner (1980) used these traps in population study of tenebrionid beetles. Pitfall traps have also been used to study movement and population of spider (Araneae), Harvestman (Phalangidae), Scorpion, Sand isopod and Collembola. Duffey (1962), Williams (1962), Bixiller (1970), Schmoller(1970), Oppenheimer and Tikader (1976) used these traps to study ground spider and harvestman. Williams (1968) Hadley and Williams (1968), Allred and Gertsch (1976) studied nocturnal activity of scorpion, whereas Joose (1965) and Hays (1970) utilized these trap devices in studying surface activity of Collembola and Sand isopod respectively.

The present research work was proposed to author by Dr. T. Sengupta of Zoological Survey of India, Calcutta, while author was working as a school teacher at Birpara High School of Jalpaiguri District, West Bengal. It was only possible to complete the present project because enormous help from the school boys of Birpara High School and co-operation from the local people of Gayerkata was obtained throughout the study since 1976. A constant co-operation was also obtained from the forest department of West Bengal. Taxonomic part of the present study was completed in the Coleoptera Section, Zoological Survey of

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India, Calcutta, when author obtained fullest facilities, guidance and advice, specially for indentification of the various Coleoptera. The author started this present project in the year 1976, during the year various pitfall traps were standardised and site selection was made. In the same time the author collected various families of Coleoptera of Dooars area and foothills of North East Himalaya by hand picking, butterfly nets and other collection equipments and got himself well acquainted with beetles of Dooars area. But the present work includes the result of the experiment conducted during 1977-1978 only; previous years' experience helped author to conduct the experiment more methodically and taking precautions as much as possible, as suggested by early workers.

Inspite of richness on its geographical resources in the foothills of North East Himalaya, little attempt has so far been made to explore the rich and diverse beetle fauna of this region; moreover very scanty informations are available about the ground dwelling beetles of this locality. The present attempt was undertaken with an aim to study the seasonal activity and density of the ground dwelling beetles and also their morpho-taxonomy. It is certain that many species are common and have wide distribution but at the same time there must be a few which would be characteristics of the place. It is also observed that a large number of insects in this belt are still unexplored. The present account is mainly based on beetles collected with the

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pitfall traps operated during March 1977 to February 1978 in the three different ajoining areas, forest floor, tea garden and paddy field of Boxa area of foot hills of North East Himalaya, Jalpaiguri District of West Bengal.

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S I T E

Dooars area lies on the foot hills of North East Himalaya, West Bengal, that stretches from the North of Siliguri town to the West of Coochbehar town in the East. It spreads over the Eastern part of three districts, namely Darjeeling, Jalpaiguri and Coochbehar. It is wedged within the location latitude 26 32' N to 88 43' E long, at 83 metres above the sea-level. The present study was done at Khutimari, Cayerkata of Dooars area, 42 kms. North East of Hegrakata meteorological office of Jalpaiguri District, West Bengal. Three different adjoining areas, namely forest floor, tea garden and paddy field were selected for this study (Fig. 1).

The forest floor site was 850 metres further in the North Eastern side of the tea garden. A continuous stream (locally called Mechhuya River) made a clear distinction between the forest floor and tea garden. Dooars area of Jalpaiguri district is chiefly covered with tropical deciduous moist forest and the timber species of the forest gave a dense canopy over it. The most common and important timber species of this forest are: 1) Shorea robusta Gaertn. 2) Schima wallichi Choisy. 3) Castanopsis tribuloides A. DC. var feroxking 4) Millesia pentagyna Roxb 5) Terminalia belerica Roxb. 6) T. tomentosa Bedd. 7) Amoora wallichi Roxb. 8) Sterculia villosa Roxb. 9) Gmelina arborea L. 10) Macaranga denticulata Muell.Arg. 11) Litsaea polyantha Juss. 12) Premna integrifolia L. 13) Careya arborea Roxb. 14) Callicarpa arborea Roxb.

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15) Albizzia procera Benth. 16) Albizzia sp. 17) Salmalia malabarica Schtt. 18) Syzygium sp. 19) Zizyphus mauratiana Ham. Other scatteredly distributed timber species are: 1) Toona ciliata Roem. 2) Bauhinia purpurea L. 3) Artocarpus chaplasa Roxb. 4) Turpinia pomifera D.C. 5) Cinnamomum Sp. Undergrowth was densely covered with several species of common ground flora, namely 1) Lantana camara L. 2) Murraya koeningi Spreng. 3) Clerodendrum infortunatum Gaertn. 4) Eupatorium odoratum L. 5) Coffea bengalensis Roxb. 6) Albizzia lucida Benth. 7) Acacia pennata Willd. 8) Strobilanthes sp. 9) Morinda citrifolia L. 10) Costos speciosus Smith 11) Globba bulbifera Roxb. 12) Kaempferia rotunda L. 13) Curcuma aromatica Salisb. 14) Alpinia malaccensis Roscoe 15) Indigofera pulchella Roxb. 16) Setaria sp. 17) Eriigmonus compositus Beauv. 18) Imperata arundinacea Cyrill. and other Compositae plants. The majority of these shrubs were under 75 cm to 1 metre in height and this dense shrub layer covered the ground except the area immediately around the traps. The floor was densely covered with a layer of decomposed leaf litter. Besides these there were some patches of marshy land (Fig. 1), at the entry of the forest which were moderately densely covered by Pandamus fasicularis L. and Calamus tenuis Roxb. and Pteridophyte plant species like Selaginella and Ferns. The soil of forest floor was clay loam (slightly blackish in colour) and pH of this soil was 5'55 (Table 1).

The tea garden site was at the South Western side of the forest floor. It was well protected by a wire fence

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throughout its boundary. In addition to levelled tea bushes, with a length of 1 metre in height, shade trees of the species Albizzia procera Benth. were also there in a distance of 8-10 metres in parallel rows to protect the tea bushes from midday sun, so that the branches and leaves of these shade trees formed a sparse canopy over the tea bushes. The soil of the tea garden was generally sandy loam and gray in colour. The pH of the soil was 6'15 (Table 1). The floor of the tea garden was almost clean except in the sides along the fence, where some weeds grew up to about 40-50 cm in height and provided an open shrub type layer during the monsoon months. Water drainage of the tea garden was regularly maintained by the management.

The paddy field site was 2 kms apart from the Southern side of the forest. It was a bit low land in respect to tea garden and forest floor. Paddy field in this area usually consisted of small plots with crop rows. The slightly elevated crop rows from the original cultivated plot had a layer of grass throughout the year which kept short due to grazing by the cattles and goats. Paddy field was an open yard area. Canopy plants and canopy were lacking. During the monsoon months some weeds grew up but these weeds were destroyed by the farmers. The soil type of this paddy field was clay loam and pH of the soil was 6'05 (Table 1). The fields were devoted to raising of Rice (Oryza sativa L.), Wheat (Triticum aestivum L.)

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and Maize (Zea mays L.). Three varieties of rice were cultivated in a year. Generally they are termed as Autumn, Winter and Spring or locally called as Aus, Aman and Boro type respectively. The cropping seasons of rice, wheat and maize were as follows:

Crop	Sowing	Harvesting
RICE (Oryza sativa L.)		
i. Autumn, locally called as Aus type	April-June	July-September
ii. Winter, locally called as Aman type	June-July	October-December
iii. Spring, locally called as Boro type	November-December	March-April
WHEAT (Triticum aestivum L.)	October-November	May-June
MAIZE (Zea mays L.)	June-July	September-October

C L I M A T E

Doosrs area does not prevail the extreme climatic condition. The climate of this place has four marked seasons, viz., pre-monsoon, monsoon, post-monsoon and winter. The prem-monsoon, months (March to May) are very hot and a dry season which run with rapid increase of temperature during this time along with a few showers of rain. A typical monsoon climate with excess humidity is prevalent for 3 months of the year in this area. It starts in the middle of June and reaches a peak in August. The maximum daily temperatures are lower than May due to the presence of Monsoon clouds and rains but there is a slow increase of night temperatures and the humidity goes on increasing to 88%. The post-monsoon or autumn lasts from September to November, during which period the temperatures gradually decrease but occasional rainfall continues during the first half of October. The cold and dry winter season prevails from December to February and the rainfall during this period is negligible (mean of these three months during this study was 7'7 cm.). The mean maximum and minimum temperatures for the years 1976-1978 were 28'63'C and 18'94'C respectively. The mean daily temperature (Maximum and minimum) of the hot dry pre-monsoon months (March to May) and cold dry winter months (December to February) for three years (1976-1978) were 30'15'C and 19'17'C, and 24'61'C and 11'01'C respectively. The Total annual rainfall (average of these three years) was 3065'15 cm and the average of the monsoon months (June to August) for these three years was 670'91 cm.

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MATERIALS AND METHODS

TRAPS

Unfortunately there is no standard size of pitfall traps. Different authors utilized different sizes of traps in their experiments. Moreover, some authors neglected to mention the size of the trap in the description of their methodology. Miller (1954) used a gallon syrup can for a trap; Doane (1961) used stainless steel funnel traps whose diameter of the funnel and total depth of the trap from the rim of the funnel to the bottom of the can was $7\frac{7}{8}$ inches; Banta (1962) utilized 55-gallon drums; Greensdale (1964a) used 1 lb. jam jars (11'5 cm high with a diameter at the mouth 6'5 cm); Pearson and White (1964) placed honey jars with an internal diameter of 6 cm and 10% glycerol in water at the bottom to reduce carnivores activities of the trapped animals; Stewart (1967) used 1 pound coffee cans; Rickard (1970a) used metal cans of 4-inch diameter and 6 inches height; Gist and Crossley (1973) utilized 5 oz paper cups; Evans (1971) placed 1 lb. jam jars in line; Oppenheimer and Tikader (1976) used a backet of 22 cm height, 23'5 cm in diameter at the top and 15'5 cm in diameter at the lower rim which extended 1 cm below below the bottom; Thomas and Sleeper (1977) utilized 30 cm x 15 cm metal metal cylinder, and recently Rogers and Fitzner (1980) sampled their study area by twenty five 15 cm x 15 cm metal cans with 30 cm boards placed over the opening of the traps to serve as a rainguard.

In the present study the pitfall traps used for

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collection, were made out of galvanised metal sheet. Each pitfall trap consisted of 21 cm deep by 9 cm diameter pit or hole. Its opening flushed with the soil surface. Two small holes (1 cm in diameter) in opposite directions were punched into just above the bottom of the can to allow water from rainy periods to percolate into the underlying soil. These two holes were covered with a fine mesh nylon gauge to prevent loss of specimens during percolation (Fig. 2). A 9 cm diameter metal lid was used to close the trap during transportation of the same back to the field laboratory from the field. When the trap was open, a wooden shade (22 cm x 12 cm) was positioned over the trap to prevent litter deposition inside it. During 1976 when the experiment was started for standardisation, it was observed that mice entered some traps and fed on the trapped beetles and bait, especially in fish baited traps. However, this type of predation was nearly eliminated the following years by using a wire net having 2 cm diameter pore fastened in the mouth of the traps when it was open. Kirk (1971 a) also noted this type of predation by mice during the study in the field.

Initially, 9 traps, 3 of which were baited with 100 grams of fish, 3 with 100 grams of fresh cow dung and 3 without any bait (empty pitfall traps), were placed in three rows, more than 250 feet apart from the nearest edge in each of the forest floor, tea garden and paddy field. Each pitfall trap of the respective rows was 15 feet apart from each other and the distance between

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the rows was 12 feet in each of the three areas. In the forest floor the traps were placed in the shrub layer, within a cleared area of 60 cm diameter from which all vegetation and leaf litter had been removed. In the tea garden the traps were placed inside the tea bushes and in the paddy field traps were placed in the crop row to avoid breakage and disturbance during cultivation or harvest. Since the study started, the traps were replaced in the original holes each trapping period, and adjacent were limited to packing soil firmly around the upper rim of the bucket to make it flush with the soil surface.

In a study of phenology of arthropods, Pearson and White (1964, p.250), stated "the phenological data recorded in this paper largely corroborate the findings of other European authors, Dahl (1908), Duffey (1962) Lohmander (1942), Palmgren (1939), Tretzel (1954, 1955) and Williams (1962) for the spiders and Larsson (1940), Linderth (1946-1949) and Williams (1959) for carabids. Unfortunately, some of these authors used inadequate numbers on which to base their conclusions. It is clear from our data that the trapping should be continuous. Collecting for only one week in four would have resulted in a number of anomalies. The maximum numbers of Phaulothrix hardyi could have been halved, the period of maximum numbers of the lycosids displaced by a month, and species such as Amaurobius atropos, which occur only in

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small numbers over a long period, mixed altogether". In the present study collections were made continuously throughout the year from the three areas, viz., Forest floor, tea garden and paddy field. The traps were emptied and replaced with new baits between 0800 and 1000 hours every forthightly throughout the study. The cow dung for the dung baited traps was collected primarily from the local inhabitant pet Indian cow and the fish for the fish baited traps was bought from the local market. The cow dung was collected each day morning of the trapping scheduled but the fish was bought in the evening, day before the trapping scheduled because the fish market used to open in the evening in that locality.

The galvanised metal can of the pitfall traps were engraved with the code marks, namely FFB (Forest Floor Fish Bait) (Fig. 2B), FDB (Forest Floor Dung Bait) and FEP (Forest Floor Empty Pitfall) and likely TFB, TDB, TEP and PFB, PDB, PEP were used for tea garden and paddy field respectively. Throughout the study the traps were used according to its code marks. The traps, marked with FFB were never used for dung baited or empty pitfall traps. Hence, the idea of maintaining the sanctity of particular trap for particular bait and also for empty pitfall trap, was another precautionary measure to observe the validity of catches.

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TREATMENT OF SPECIMENS

Every fortnightly, when the collection was made, the lids were placed firmly on the traps to avoid mixing and escape of live beetles during transportation. The traps were brought back to the field laboratory at Birpara High School, 15 km apart from the trapping site.

In the laboratory the content from each trap was filtered in a wood framed box 30 cm square and 8 cm deep with wire mesh top and the bottom. The trap, being emptied was washed under running water and kept aside in an inverted position to make it dry. Sorting out of material and spot identification along with all required data collection was made immediately. Alive beetles along with dead ones were kept in 70% alcohol and later were pinned, labelled and identified to the species level in the laboratory (Zoological Survey of India). Quantitative data were recorded for each species from the label on each pin where, in addition to the normal informations, other requisite informations such as bait or empty pitfall trap, season and area of collection, were also mentioned. Identification and taxonomic works have been carried out while the author was a research scholar in Zoological Survey of India. During this period author contacted and received much help from various Coleopterists of the world for confirmation of species especially, Scarabaeidae, Carabidae and Histeridae. A taxonomic series of beetles was deposited in the National Collection of Coleoptera,

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Entomology Section, Zoological Survey of India,
Calcutta, West Bengal.

WEATHER AND MICROCLIMATE

Throughout the year during this study weather data were recorded at the field laboratory, Birpara High School, Birpara, Jalpaiguri, which was 15 km South East of the trapping site. Temperatures were recorded with the use of maximum and minimum thermometer and rainfall was measured with rain gauges. The data were recorded each morning between 0700 and 0800 hours. These data were also confirmed from Nagrakata Meteorological Station, Nagrakata, Jalpaiguri, 42 km North East of the trapping site.

Microclimatic factors in each of the three areas during this study were observed. The forest floor had the lowest sub-soil and soil temperatures. The tea garden had slightly higher sub-soil and soil surface temperature than forest floor, because the exposure of sunlight in the tea garden was slightly higher than the forest floor. The paddy field which had the highest exposure to sunlight than the tea garden and forest floor, resulted in highest subsoil temperatures amongst all. But the shade provided by the thin layer of grass on the crop row where the traps were placed, resulted in slightly lower soil surface temperatures than the original cultivated plot during the day light hours. The chemical and physical analysis of soil of the forest floor, tea garden and paddy field were estimated with the help of

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Bose Institute, Calcutta. The soil analysis of these three studied areas revealed that the tea garden soil had more sand (48'61%) than paddy field (38'11%) and forest floor (35'32%) and organic carbon was higher in the forest floor (2'2584%) than tea garden (0'958%) and paddy field (0'513%) (Table 1).

TREATMENT OF DATA

The data of annual incidence of each species was maintained in a data sheet. The comparative incidence of the species, seasonal incidence, food preference of each species in different areas were estimated from this data sheet. These incidences were represented by graphs and histograms where needed.

PRECAUTIONARY MEASURES

1) Uniformity of the traps was maintained throughout the study.

2) Traps were placed uniformly.

3) To ensure equal catch the distance between the traps was properly maintained in every trap period. This was important to avoid overtrapping and also to help the disruption of the normal behaviour.

4) The length of the trap period was carefully maintained throughout the year.

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C O L E O P T E R A : I N S E C T A

The members of the order Coleoptera are commonly known as beetles. This is not only the largest group of the insects but also most diverse and versatile in their habitats. India being situated in the Tropics, is well-known for her richness of Coleopterous fauna. The dense and evergreen forest of North East India including deciduous forest of Jalpaiguri District of West Bengal have extremely diverse and varied beetle fauna. Junk's Coleopterous catalogue (1910-1940) listed 103 families; Crowson (1955) recognised 4 suborders, 6 series, 22 super families, 157 families plus 3 families with uncertain systematic position. Beetles live almost all types of habitats, some are aquatic, some found in root, stem, foliage, buds, flowers, bush, under barks, wood, decaying logs, beneath logs and stones, decaying vegetables, leaf litter, grass, weeds, moss, fungi, etc.; some found in fresh and old cow dung, manure, carrion, soil litter, moist soil, decayed plants or animal matter and dead birds and animals, store grain and product and some live in bird's nest and mole's nest, and some are parasites on other insects and animals.

In the present study a total number of 16602 examples of beetles have been trapped which represent 18 families belong into 92 species, of which families Scarabaeidae and Staphylinidae are the most predominating ones. The

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details regarding families and their species have been discussed below.

1. Family : Scarabaeidae

Representatives of this large family are commonly known as dung beetles and can be easily recognised by their distinctive features of lamellate segments of antennae which form a club of three to seven leaves that can be expanded or completely folded together to form a compact club. The body is usually robust and species frequently brightly coloured.

Representatives of Scarabaeidae are well known because of the fact that many species of this family are serious pest of agricultural crops and forest. Generally the eggs are laid on the soil in late July and early August in the areas covered with vegetation. The eggs hatch immediately and the larvae specially termed as gurbs begin to feed in the soil. This continues until they hibernate for the winter. When the weather warms up in the April, the larvae come up near the soil surface and continue to feed until they pupate in the June. The adults usually emerge during the late July and mating takes place during summer.

In the present study a total number of 9035 examples of Scarabaeidae were collected (Table 2). These examples represent 3 subfamilies, 7 genera and 29 species. The members of the subfamily Coprinae were the most predominant

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ones than the other two subfamilies Hybosorinae and Aphodiinae trapped during this study. Of the total Scarabaeidae (9035 examples) caught, the Hybosorinae comprises only 7% with 2 species under 2 genera and the Aphodiinae comprises only '04% with single species under the genus Oxynomus Castelnau, whereas the sub-family Coprinae comprises 92% with 26 species under 4 genera. The area of first choice of the family observed was forest floor where 4038 examples (44.69% of the total Scarabaeidae caught) were trapped, whereas in the paddy field and tea garden 2724 examples (30.74% of the total Scarabaeidae caught) and 2273 examples (25.1% of the total Scarabaeidae caught) were trapped respectively (Table 4). This family was mostly caught in fish baited traps constituting 94.69% of the total catches in three areas, whereas in the dung baited and empty pitfall traps it was 3.77% and 1.52% respectively (Table 4). The scarabaeid beetles were fairly abundant from April to November in all of the three areas, forest floor, tea garden and paddy field and its maximum incidence was observed during monsoon (August) and post-monsoon (October) months (Table 7) when recorded rainfall were 976'0 cm and 326'3 cm respectively. The only representative of this family Onthophagus luridipennis Bohemann was caught throughout the year during this study (Table 12), however most of the species were undergone hibernation during the winter months (December to February)

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when recorded maximum and minimum temperatures were 24'12'C and 10'9'C respectively.

Genus Onthophagus Latreille, 1802

Latreille, 1802, Hist. Nat. Crust. et Ins., 3: 141

Arrow, 1931, Fauna Brit. India, Lamell., 3: 159

Balthasar, 1963, Monogr. Scarab. Aphod. Palaearkt. Orient., 2 : 153

The genus Onthophagus Latreille is the predominent genus of Coprinae and one of the largest genera of Coleoptera. In the present study it has been represented by the largest number of species amongst other genera of Coprinae trapped during this study. The genus Onthophagus Latreille is widely distributed throughout the world. Of the 1620 known species (Balthasar, 1963 b), 750 species are found in the Ethiopian region, 690 species are found in Palaearktic and Oriental region with some species being common with Ethiopian region, 200 species are found in Australian region and 110 species are found in Nearctic and Neo tropical regions taken together. A total number of 185 species are known from India (Dr. S. Biswas, Personal Communication). Of the 22 species recorded in this study, only 1 has been discovered as a new to science which is described below. Representatives of this genus are generally very small (2'5 mm.) to large species (25 mm.), of extremely varied forms and colour. Usually of rather short, compact form, smooth or clothed closely

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or sparsely with hairs or setae. Sexual dimorphism usually very well developed. Head rarely unarmed, usually provided with transverse carinae, horns or tubercles. Clypeus fused with the ocular lobes, very variable in shape, rounded bilobed or acuminate in front. Antennae 9-segmented, basal segment fairly long, occasionally with a serrate anterior edge. Mandibles rather short. Maxillae with short and broad terminal lobes and moderately long, 4-jointed palpi. Mentum transverse, labial palpi with basal joint small, not dilated, 2nd moderately elongate, 3rd very minute. Pronotum with lateral margins angulate in the middle, front angles produced, acute or blunt, hind angles generally obsolete, base rounded, obtusely angular or lobed in the middle, puncture on pronotum may be umblicate or asperate. Elytra cover the abdomen and bear a single lateral carina and 7 dorsal striae. Metasternal shield broad, legs usually fairly stout, femora thick, front tibiae usually armed with teeth, middle and hind tibiae dilating greatly from base to extremity, front tarsi slender and short, middle and hind tarsi a little flattened. Abdomen short, the last sternite (6th) extremely short in male. Pygidium generally bearing a transverse ridge parallel to the base and continuous with the lateral carinae of the abdomen.

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1. Onthophagus deflexicollis Lansberge (Pl.I/1)

Lansberge, 1883, Notes Leyden Museum, 5 : 72

Arrow, 1931, Fauna Brit. India. Lamell., 3 : 331

Balthasar, 1963, Monogr. Scarab. Anhod. Palaearkt. Orient., 2 : 327

This species is widely distributed in Northern India and Arrow (1931) noted its distribution as : Haldwani, Kumaon Division : U.P.; Rungbong Valley, Gopaldhara : Sikkim; Gauhati : Assam, during March; Tura and Garo Hills : Meghalaya, during June, July and August; Single, Darjeeling district : West Bengal, during June and recorded from Burma, Tonkin, Malay Peninsula, Sumatra. In the present study this species has been observed quite abundant in Doosra area of Jalpaiguri district : West Bengal.

DIAGNOSTIC CHARACTERS:

This species is small (length, 4-5'5 mm.; breadth, 3-4 mm.), deep brown or chocolate brown, very shining, compact, broadly oval, moderately convex, head and pronotum with a slight metallic tinge. Elytra with an orange spot on humeral callus, femora, pygidium, sides of the abdomen and anterior lateral margin of pronotum sometimes orange.

Head broad and without armeture. Pronotum fairely closely punctured, front angles blunt, anteriorly lateral

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margin more or less rounded and posterior half nearly straight, and basal margin broadly rounded. Elytra finely punctured and striate, interticea flat. Pygidium finely and closely punctured.

In males, head not densely punctured, clypeus strongly reflexed and produced to a point. Pronotum flattened anteriorly and flattened area extended beyond the middle and forming an angular elevation. In females, head rather densely punctured, clypeus anteriorly bilobed and pronotum uniformly rounded.

ECOLOGY:

The species Onthophagus deflexicollis Lansberge was one of the most abundant species (mean per fortnight : 53'12) amongst all of the 29 species of Scarabaeidae trapped during this study. A total number of 1275 examples of this species were trapped. Of the total Scarabaeidae caught, over 14% belonged to this species (Table 8). This species was found throughout the year, except for the month of January and February. It was fairly abundant from April to October in the tea garden and paddy field and from June to October in the forest floor.

It has been observed that this species was mostly caught in fish baited traps constituting 97.17% of the total catches in three areas during this study (Table 9). In the forest floor it represented 48.47%, whereas in the

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paddy field and tea garden it was 26.74% and 21.96% respectively (Table 10). Dung-baited traps attracted only 0'07% of the total catches in the paddy field and none of this species was attracted in dung baited traps in the forest floor and tea garden during this study. In the empty pitfall traps this species was caught 1.01% of the total catches in each of the paddy field and tea garden and 0.7% in the forest floor (Table 10).

The area of first choice of this species observed was forest floor where 627 examples (over 49% of the total individuals caught in three area during this study) were trapped, whereas in the paddy field and tea garden the seasonal incidence was 355 examples (27.84%) and 293 examples (22.98%) respectively (Tables 13 and 9).

The abundance of this species in Dooars area was observed in two peak values in August and October in the forest floor, whereas in the tea garden and paddy field the abundance was observed in single peak value in August and October respectively. Besides these, minor peaks were also observed in June in the forest floor, in April and October in the tea garden and in April and August in the paddy field (Fig. 8).

REMARKS

It has been observed that this species was common and abundant in the Dooars area of Jalpaiguri district

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during this study. The highest annual incidence was observed in the following order:

Forest floor > paddy field > tea garden.

It has been observed that the abundance of this species in Dooars area was maximum during September to November (50.12%), whereas low incidence was observed during March to May (9.33%) and again June to August (40.38%) (Table 11). It appeared that the post-monsoon months, September to November were most suitable for this insect emergence when recorded average monthly rainfall was 237'5 cm. During the cold dry winter months, December to February there was a sudden fall of catch when recorded average daily maximum and minimum temperatures were 24'12'C and 10'9'C respectively. The maximum attraction was observed to fish baited traps and attraction to dung baited traps was almost negligible. Earliest emergence of this species was observed in the month of March.

2. Onthophagus vaulogeri Boucomont (PL.I/2)

Boucomont, 1923, Bull. Soc. ent. Fr. 9 - 11

Arrow, 1931, Fauna Brit. India, Lamell., 3 : 344 - 45

Balthasar, 1963, Monogr. Scarab. Anhod. Palaearkt. Orient., 2 : 576

Arrow (1931) mentioned that this species was recorded from Dehra Dun : U.P., during May; Shillong: Meghalaya, during June and July; Burma, during May. Since then

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author has not seen any published record of this species from India except, Balthasar (1963 b) who also dealt with this species. Recently, Biswas in his unpublished thesis (1978) recorded this species from Meghalaya. In the present study this species is being recorded for the first time from Dooars area, Jalpaiguri district : West Bengal.

DIAGNOSTIC CHARACTERS :

This species is rather small (length, 4-6 mm.; breadth, 2'5-3'5 mm.), body oval, compact and convex, elytra shining black, head and pronotum dark blue or green, mouth-parts, antennae and tarsi reddish.

Head smooth and sparsely punctured, clypeus poorly developed with sides rounded. Pronotum finely, closely and more or less evenly punctured, front angles rather sharp, sides almost straight and basal margin slightly rounded. Elytra finely striate, with orange spots at base, sometimes with small spots adjoining to the apical margin, interstices flat with finely, closely punctured. Pygidium finely and closely punctured.

In males, head dilated and reflexed laterally, posteriorly the apex of triangular plate with a curved short horn, clypeus reflexed anteriorly and bluntly pointed. In females, clypeus separated from forehead and a transverse curved carina present between the eyes.

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ECOLOGY

Onthophagus veuloseri Boucomont was one of the abundant species (mean per fortnight : 42'2) amongst the 29 species of Scarabaeidae trapped during this study. A total number of 1013 examples of this species were trapped which represented over 11% of the total Scarabaeidae caught (Table 8). This species was found more or less throughout the year, except for the months of January and February (Table 12). It was fairly abundant from April to October in all of the three areas and its maximum seasonal incidence was observed during August to October when recorded average monthly rainfall was 557'3 cm.

It has been observed that this species was mostly caught in fish baited traps constituting 96.05% of the total individual caught in three areas during this study (Table 9). This species represented in fish baited traps 48.37% in the forest floor, 27.93% in the paddy field and 19'74% in the tea garden,(Table 10). Dung baited traps attracted only 0'09% of the total catches in the paddy field (Table 10). In the empty pitfall traps, this species was trapped over 3% of the total catches in three areas (Table 9). In the forest floor it represented 3.55%, whereas in the tea garden and paddy field it was only 0.19% and 0.09% respectively (Table 10).

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The area of first choice of this species observed was forest floor where 526 examples (over 51% of the total individual caught during this study) were trapped, whereas in the paddy field and tea garden the annual incidence was observed 285 examples(28.14%) and 202 examples (19.94%) respectively (Tables 13 and 9).

The abundance of this species in Dooars area was observed in single peak value in October in each of the forest floor and tea garden, whereas in the paddy field it had two peak values in August and October. Besides these, minor peaks were also observed in April, May, July, August and September in the tea garden, in April and August in the forest floor and in April in the paddy field (Fig. 9).

REMARKS :

It was observed that this species was one of the common and abundant species of Scarabaeidae trapped in Dooars area during this study. The highest annual incidence was observed in the following order:

Forest floor > paddy field > tea garden.

It has been observed that the abundance of this species was maximum during September to November (50.26%), whereas incidence was low during March to May (18.69%) and again in June to August (30.69%) (Table 11). It

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appeared that the post-monsoon months, September to November was suitable for this insect emergence when recorded average monthly rainfall was 237'5 cm in Dooars area. During the winter months, December to February there was a sudden fall of catch when recorded average daily maximum and minimum temperatures were 24'12'C and 10'9'C respectively. The maximum attraction was observed in fish baited traps and the first appearance was observed in the month of March.

3. Onthophagus orientalis Harold (PL.I/3)

Harold, 1868, Col. Hefte., 4 : 83

Arrow, 1931, Fauna Brit. India, Lamell., 3 : 213-214

Balthasar, 1963, Monogr. Scarab. Aphod. Palaearct. Orient., 2:463

This species is widely distributed in India and it has been recorded from U.P. during July and October; Bihar during June; Manipur and Meghalaya during July; Sikkim, Andaman Islands and Bangladesh during May; Burma during May, September and December; and also recorded from Siam, Malay Peninsula and South China. The species Onthophagus orientalis Harold is fairly common in Dooars area of Jalpaiguri District of West Bengal.

DIAGNOSTIC CHARACTERS:

This is a rather large species (length, 7'5-13 mm.; breadth, 4-7 mm.), body oval, very convex, black and

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shining, clypeus and legs reddish, antennae yellowish, body covered with short yellowish pubescence except pygidium.

Head not broad and clypeal margin strongly rounded. Pronotum markedly convex with a deep median longitudinal groove at the base, front angles blunt, lateral margin anteriorly feebly curved and posteriorly bisinuate, basal margin obtusely angulate and finely margined, puncturation close and deep, towards anterior part they become asperate. Elytra finely striate, interices slightly rounded and irregularly punctured. Pygidium strongly, closely punctured.

In males, posterior margin of the head backwardly produced forming more or less a pair of parallel horns behind the eyes. Clypeus shining, with a few punctures and separated from forehead by a fine feebly elevated carina. In females, clypeus separated from forehead by a strongly elevated more or less straight carina, not shining and rather dull.

ECOLOGY:

The species Onthophagus orientalis Harold was one of the predominent species (mean per fortnight : 11'37) amongst 29 species of Scarabaeidae caught during this study. A total number of 273 examples were trapped, which represented over 3% of the total Scarabaeidae caught (Table 8). This species was found throughout

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the year except for the cold dry winter months (January and February)(Table 12). It was fairly abundant from July to October in each of the three areas, forest floor, tea garden and paddy field. Its maximum incidence was observed during monsoon months when recorded average monthly rainfall was 625'5 cm.

The area of first choice of this species observed was paddy field where 119 examples (over 43% of the total individuals caught in three areas) were trapped, whereas in the tea garden and forest floor the seasonal incidence were 97 example (35'54%) and 57 example (20.88%) respectively (Tables 15 and 9).

The abundance of this species was observed as a single peak value in August in the paddy field, and in September in the forest floor, whereas in the tea garden the abundance was observed in two peak values in April and October. Besides these, minor peak values were also observed in July and October in paddy field, in June in the forest floor and in July and August in the tea garden (Fig. 10).

This species was mostly caught in fish baited traps constituting 97.05% of the total catches in three areas (Table 9). In the paddy field it was 43.58%, whereas in the tea garden and forest floor it was 35.54% and 18.68% respectively. Dung baited traps attracted 2.19% in the forest floor and only 0'3% in each of the

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tea garden and paddy field. Empty pitfall had no yield during this study (Table 10).

REMARKS :

It has been observed that this species was one of the common species of Scarabaeidae in Booars area. The highest annual incidence was observed in following order:

paddy field > tea garden > forest floor.

It was observed that the abundance was maximum during monsoon months, June to August(56.77%), whereas low incidence was observed during post-monsoon months, September to November(21.98%) and again during pre-monsoon months, March to May(20.52%) (Table 11). The monsoon months were suitable for this insect emergence when recorded average monthly rainfall was 625'5cm. in Booars area. During the cold dry winter months, December to February, there was a sudden fall of catch when recorded average monthly rainfall was only 7'7 cm. and daily average maximum and minimum temperatures were 24'12'C and 10'9'C respectively. The maximum attraction was observed to fish baited traps. The first appearance was observed in April.

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4. Onthophagus luridenennis Bohemann (PL.I/4)

Bohemann, 1858, Eugenies Resa., : 45

Arrow, 1931, Fauna Brit. India, Lamell., 3 : 317-318

Balthasar, 1963, Monogr. Scarab. Aphod. Palaearkt. Orient., 2 : 424

Arrow (1931) mentioned that this species was recorded from Dehra Dun : U.P. during November; Cachar district : Assam during May; Bangladesh during May; Burma during December, March and April; and also from Indo-China, Sumatra, Java, Philippines Islands and South China. Biswas, in his unpublished thesis (1978) reported this species from Meghalaya. In the present study this species is being recorded for the first time from West Bengal.

DIAGNOSTIC CHARACTERS:

This species is rather small (length, 5-7 mm.; breadth, 3-4 mm.), body broadly oval, not very shining, convex, brown-yellowish, pronotum dark with metallic lusture but pronotal margins and a median longitudinal line at the base rather pale, the striae and punctures on elytra and ventral surface dark. Head, pronotum and elytra covered with minute pale setae.

Head moderately broad and densely punctured. Pronotum closely, not very finely punctured, front angles more or less sharp, sides rounded in front and sinuate behind, base gently rounded but bluntly angulate in the

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middle. Elytra finely striate, interstices flat with fine and closely punctures. Pygidium strongly punctured.

In males, pronotum markedly convex, with anterior part rather smooth, flat and sloped. Head flat, without carinae, with a pair of flat, widely separated and divergent horns, strongly curved and fitting closely against the pronotum. Minor males with short horns and pronotum with a pair of prominent tubercles. In females, clypeus separated from punctured and hollowed forehead by a straight carina. Pronotum with two blunt tubercles.

ECOLOGY:

Onthophagus luridemennis Bohemann was one of the common and abundant species (mean per fortnight: 11'62) amongst 29 species of Scarabaeidae caught during this study. A total number of 279 examples were caught. Of the total Scarabaeidae caught, over 3% belonged to this species (Table 8). This species was found throughout the year in Dooars area of Jalpaiguri district, West Bengal. It was fairly abundant from April to October during this study (Table 12).

The area of first choice of this species was forest floor where 169 examples (over 60% of the total individuals caught during this study) were trapped, whereas in the tea garden and paddy field the seasonal incidence was

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represented by 90 examples (32.25%) and 20 examples (7.16%) respectively (Tables 13 and 9).

The abundance of this species was observed in two peak values in April and October in the forest floor, whereas in the tea garden the abundance was observed in two peak values in June and August, and in the paddy field in September and October. Besides these, minor peaks were observed in December and January in the forest floor, in April in the tea garden and in July in the paddy field (Fig. 11).

This species was only attracted to fish baited traps. In the forest floor it was collected 60.57%, whereas in the tea garden and paddy field it was 32.25% and 7.16% respectively (Table 10).

REMARKS:

Onthophagus luridipennis Bohemann was one of the common and abundant species in Dooars area of Jalpaiguri District, West Bengal. The highest annual incidence was observed in the following order:

Forest floor > tea garden > paddy field.

It has been observed that the seasonal abundance of this species was maximum during September to October (39.06%), whereas markedly low during December to February (7.52%) and somewhat so in the month of March to May (32.64%) (Table 11). It appeared that the post-monsoon

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months, September to October were suitable for this insect emergence when recorded monthly rainfall were 370'7 cm., 326'3 cm. and 15'6 cm respectively in Dooars area. This species was only attracted to fish baited traps during this study.

5. Onthophagus exquisitus Arrow (PL. I/5)

Arrow, 1931, Faune Brit. India, Lamell., 3 : 225

Balthasar, 1963, Monogr. Scarab. Aphod. Palaearkt. Orient., 2 : 344

This species was described by Arrow (1931) where he noted that this species was recorded from Dehra Dun : U.P. during July and Singla in Darjeeling district : West Bengal during June. Since then, author has not seen any published record of this species from India except Balthasar (1963 b) who also dealt with this species. In the present study this species is being recorded for the first time from Dooars area of Jalpaiguri district : West Bengal and it was the most abundant species of Coleoptera trapped in this area during this study.

DIAGNOSTIC CHARACTERS:

The species is rather small (length, 5-6 mm.; breadth, 3 mm.), body elongate-oval, strongly convex, black, opaque above, head and pronotum coppery-red with golden or greenish reflections, mouth-parts and antennae yellowish.

Head short and broad with posterior margin a little thickened, clypeus broadly rounded and transversely rugulose. Pronotum punctured in the middle and just behind middle, posterior median groove well-marked, front angles blunt, base obtusely pointed in the middle. Elytra finely striate and granular and intertices flat. Pygidium uniformly and closely punctured.

ECOLOGY:

The species Onthophagus exquisitus Arrow was most common and predominent (mean per fortnight : 146'2) amongst the 29 species of Scarabaeidae caught during this study. A total number of 3509 examples were trapped which represented 38.83% of the total Scarabaeidae caught during this study (Table 8). This species was found throughout the year, except for the cold dry winter months, December to February. This species was fairly abundant from April to October in all the three areas : forest floor, tea garden and paddy field. Its maximum incidence was observed during post-monsoon months, September and October when recorded rainfall were 370'0 cm. and 326'3 cm. respectively.

The area of first choice of this species was paddy field where 1454 examples (41.45% of the total individuals caught) were trapped, whereas in tea garden and forest floor 1059 examples (30.17% of the total individuals caught)

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and 996 examples (28.38% of the total individuals caught) were trapped respectively (Tables 13 and 9).

The abundance of this species was observed in single peak value in August in each of the paddy field and forest floor, whereas in the tea garden peak abundance was observed in October. Besides these, minor peaks were also observed in May and September in the paddy field, in July in the tea garden and in May in the forest floor (Fig. 12).

This species was mostly caught in fish baited traps constituting 98.17% of the total catches in the three areas (Table 9). In the paddy field it was about 41%, whereas in the tea garden and forest floor it was about 29% and 28% respectively. Dung baited traps attracted only 0'19% in the paddy field, 0'02% in the forest floor and 0'0% in the tea garden. In the empty pitfall traps this species was caught 0'76% in the paddy field, 0'62% in the forest floor and 0'19% in the tea garden (Table 10).

REMARKS :

It was observed that this species was most common and abundant in the Dooars area of Jalpaiguri district of West Bengal. The highest annual incidence was observed in the following order:

paddy field > tea garden > forest floor.

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It has been observed that the abundance of this species in Dooars area was maximum during September to November (47.64%), whereas incidence was low during March to May (16.95%) and then again during June to August (35.19%) (Table 11). It appeared that the post-monsoon months, September to October were suitable for this insect emergence when recorded rainfall were 370'1, 326'3 and 15'6 cm. respectively. During the cold dry winter months, December to February there was a sudden fall of catch when recorded maximum and minimum average daily temperatures were 24'12'C and 10'9'C respectively and monthly average rainfall was 7'7 cm. During this period this species well might be gone into hibernation. The maximum attraction was observed to fish baited traps. Earliest appearance of this species in Dooars area was observed in the month of April.

6. Onthophagus singhi Biswas (manuscript name)
(PL.I/6)

Biswas in his unpublished Ph.D. thesis (1978) described this species from Meghalaya. In the present study this species has been recorded for the first time from West Bengal and moreover, this was one of the most abundant species of Scarabaeidae trapped during this study in Dooars area of Jalpaiguri district, West Bengal.

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DIAGNOSTIC CHARACTERS:

This species is rather small (length, 5'5-6 mm.; breadth, 3'5-4 mm.), body elongate-oval, moderately convex, black, tarsi and mouth-parts reddish, antennae yellowish, basal part of the pronotum shining.

Head semicircular, clypeus produced to a point, feebly reflexed in the middle, front - clypeal carina absent, forehead with a little prominence in the middle, vertex without carina, a little depressed in front. Pronotum with a little flattened at sides near the base, front angles rather blunt, hind angles obsolete, sides almost rounded in front, sinuate behind, base gently rounded, uniformly but feebly punctured. Elytra deeply striate and intertices minutely punctured. Front tibiae with four external teeth, and with a single denticle between 2nd and 3rd, and 3rd and 4th external teeth. Metasternum slightly punctured in the middle and strongly at sides. Pygidium moderately strongly punctured and margined at the base.

In males, clypeal disc closely and uniformly but not strongly punctured. Last abdominal sternite emerginate and rugosely punctured. Last ventral sternite not emerginate in the middle and rather very broad.

The species closely resembles to Onthophagus crassicollis Boucomont and O. dhari Biswas (manuscript name)

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but differs from the former by its 2nd segment of hind tarsi being longer and from the later in having upper surface of the body without hair or setae.

ECOLOGY:

This species was one of the abundant species of Scarabaeidae (mean per fortnight : 34'41) amongst all of the 29 species of Scarabaeidae trapped during this study. A total number of 826 examples were trapped which represented 9.14% of the total Scarabaeidae caught during this study (Table 8). It was fairly abundant from April to October (Table 12) when recorded monthly average rainfall was 448'6 cm and its maximum incidence was observed in all of the three areas during October when recorded rainfall was 326'3 cm.

The area of first choice of this species was forest floor, where 414 examples (50.14% of the total catches in three areas) were trapped, whereas in tea garden and paddy field the seasonal incidence of each area was 206 examples (24.93%) during this study (Tables 13 and 9).

Earliest emergence of this species was observed in the month of April and continued till November in tea garden and forest floor but in the paddy field it was found till October. The abundance of this species was observed in two peaks in April and October in each of the

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forest floor and paddy field (Fig. 13), whereas in the tea garden the abundance was observed in May and October. Besides these, minor peaks were also observed in May and September in paddy field, in April, August and September in tea garden and in July and September in forest floor.

This species was mostly collected in fish baited traps constituting 98.54% of the total catches in three areas (Table 9). In the forest floor it represented 48.91% whereas in the tea garden and paddy field it represented 24.69% and 24.93% respectively. Dung baited traps attracted only 0'8% of the total individuals catches in the forest floor, whereas in the tea garden and paddy field none of this species was attracted in dung baited traps. In empty pitfall traps, this species was caught 0'14% in the forest floor and 0'24% in the tea garden but none in the paddy field (Table 10).

REMARKS :

It was observed that this species was one of the common species of Scarabaeidae trapped during this study. The highest annual incidence was observed in the following order:

forest floor > tea garden > paddy field.

It has been observed that the abundance of this species in the Doors area was maximum during September

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to November (39.86%), whereas incidence was low during June to August (25.28%) and again during March to May (35.55) (Table 11). It appeared that pre-monsoon months, March to May and post-monsoon months, September to November were suitable for this insect emergence when average monthly rainfall was recorded 190'3 cm and 237'9 cm respectively. During the cold dry winter months, December to February there was a sudden drop of catch and only 1 example was caught in February. During winter months this species well might gone for hibernation. The maximum attraction was observed in fish baited traps and first appearance was recorded in the month of April.

7. Onthophagus gangeticus Gillet (PL.II/7)

Gillet, 1925, Ann. Soc. Sci. Brux., 44 : 231

Arrow, 1931, Faune Brit. India, Lamell., 3 : 190-91

Balthasar, 1963, Monogr. Scarab. Aphod. Palaearkt. Orient., 2 : 364

Arrow (1931) mentioned that this species was recorded from Chhapra and Pusha : Bihar, during August and September; and Calcutta : West Bengal. Since then author has not seen any published record of this species from India except, Balthasar (1963 b) who also dealt with this species. In the present study this species has been recorded for the first time from Dooars area of Jalpaiguri district : West Bengal.

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DIAGNOSTIC CHARACTERS :

This species is rather small (length, 5-6 mm.; breadth, 3'5-4 mm.), body elongate-oval, convex, bluish-green, head and pronotum moderately shining, antennae, mouth-parts and tarsi reddish, covered with fine setae.

Head flat, rugose, clypeal margin angulate, sides evenly rounded, clypeus separated by fine curved carina from forehead. Pronotum with front angles blunt, anteriorly lateral sides gently rounded, posteriorly sinuate and base little produced; covered with close oval granules. Elytra finely striate, intertices flat, rather closely and finely granulated. Pygidium strongly punctured. Both the sexes are alike.

ECOLOGY:

The species Onthophagus gangeticus Gillet was found more common in the paddy field than tea garden and forest floor of Boears area during this study. A total number of 77 examples (mean per fortnight : 3'2) were trapped, which represented 0'85% of the total Scarabaeidae trapped during this study (Table 8). This species hibernated during cold dry winter months and its maximum incidence was observed from April to June in the paddy field.

The area of first choice of this species observed was paddy field which represented 76.64%, whereas in the forest floor and tea garden the seasonal incidence was

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20.77% and 2.59% respectively (Table 9).

This species was mostly trapped in fish baited traps constituting 94.8% of the total catches in three areas (Table 9). In the paddy field it represented 72.72%, whereas in the forest floor and tea garden it was 20.77% and 1.29% respectively. Dung baited traps attracted only 3.89% in the paddy field and none was attracted to dung baited traps in the forest floor and tea garden. In empty pitfall traps this species was caught 1.29% in the tea garden, whereas none of this species was trapped in empty pitfall traps in the paddy field and forest floor (Table 10).

The abundance of this species was observed in two peaks in fish baited traps during May and June in the paddy field (Fig. 14). In the forest floor maximum seasonal incidence was observed in May, whereas in the tea garden only 2 examples were caught, one in the month of April and other in the month of November (Table 12).

REMARKS :

It was observed that this species was common in the paddy field. The highest annual incidence was observed as following order:

paddy field > forest floor > tea garden.

It was observed that the abundance of this species

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was maximum during the pre-monsoon months and monsoon months and had no seasonal incidence during cold dry winter months when recorded average daily maximum and minimum temperatures were 24'12'C and 19'9'C respectively. First appearance was observed in the month of April and maximum attraction was observed to fish baited traps.

8. Onthophagus rudis Sharp (PL.II/8)

Sharp, 1875, Col. Hefte. : 58

Arrow, 1931, Fauna Brit. India. Lamell., 3 : 185

Balthasar, 1963, Monogr. Scarab. Aphod. Palaearkt. Orient., 2: 305

Arrow (1931) mentioned that the species has been recorded from Pusa : Bihar, during September; Patkai Hills : Assam; Maymyo and Kawkareik : Burma; Borneo, Sumatra and Java. Since then author has not seen any published record of this species from India except, Balthasar (1963 b) who also dealt with this species. In the present study this species is being recorded for the first time from Dooars area of Jalpaiguri district : West Bengal.

DIAGNOSTIC CHARACTERS :

This species is rather small (length, 6-7 mm.; breadth, 3-4 mm.), dorsally opaque and ventrally shining,

oval, convex, not very broad, highly constricted between prothorax and base of elytra, dorsal surface deep greenish brown or greenish grey, head golden red or coppery, body covered with fine greyish pubescence.

Head not broad, flat, closely and evenly rugulose and carinae absent, clypeus slightly reflexed in the middle. Pronotum very convex, densely and finely granulated, front angles blunt, lateral margins almost straight in front, bisinuate behind, base obtusely angular in the middle. Elytra finely striate, interstices flat and covered with fine granules. Pygidium closely and finely granulated. Both sexes are alike.

ECOLOGY :

The species Onthophagus rudis Sharp was fairly abundant (mean per fortnight : 7'83) amongst the 29 species of Scarabaeidae trapped in Doors area during this study. A total of 188 examples were trapped which represented over 2% of the total Scarabaeidae trapped during the study (Table 8). This species was fairly abundant from March to June and its abundance was observed in single peak value in April (Fig. 13).

This species was trapped only in the forest floor of Doors area during this study. None was collected in the tea garden and paddy field and also none of this species was trapped in dung baited and empty pitfall traps.

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REMARKS :

It was observed that this species was fairly common in the forest floor of Dooars area of Jalpaiguri district and attracted only to fish baited traps. This species was abundent in pre-monsoon months, March to May when recorded average monthly rainfall was 190'3 cm.

9. Onthophagus bifasciatus (Fabricius) (PL.II/9)

Fabricius, 1781, Spec. Ins., I : 25

Arrow, 1931, Fauna Brit. India, Lamell., 3 : 339-340

Balthasar, 1963, Monogr. Scarab. Aphod. Palaearkt. Orient., 2 : 292

Arrow (1931) mentioned that this species is very common in India and cause Scarabiasis to children. He noted its distribution as follows: Khasi Hills : Meghalaya during May; Darjeeling district : West Bengal during July; Calcutta and Howrah during January - March; Ranchi : Bihar during August and October; and also recorded from Nilgiri Hills, Bangladesh during April. Recently, Biswas (in his unpublished thesis, 1978) recorded this species from human dung from Meghalaya. This species was also recorded from Burma during May.

DIAGNOSTIC CHARACTERS :

This species is small (length, 5-7 mm.; breadth, 3-4 mm.), short, broad and convex, with black spots on the elytra, antennae and tarsi red, body covered with

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small yellowish pubescence.

Head and pronotum coppery. Pronotum with well-marked posterior longitudinal groove and coarsely and densely punctured. Elytra with a transverse median black band, base of the 5th interval with a black spot and posterior part of 3rd, 4th and 5th intervals black. Elytra striate but more or less irregularly punctured. In males, forehead bears a long slender horn curving backward, pronotum broadly flattened in front or lightly excavated at sides and with a median longitudinal carina. In females, clypeus separated from the forehead by a curved carina and pronotum with tubercles placed behind front margin.

ECOLOGY :

The species Onthophagus bifasciatus (Fabricius) was fairly abundant (mean per fortnight : 2'75) amongst the 29 species of Scarabaeidae caught during this study. A total number of 60 examples were trapped, which represented 0'73% of the total Scarabaeidae catches (Table 8). This species was found more or less throughout the year, except for the month of December (Table 12). This species was fairly abundant from March to October in tea garden and paddy field areas. Its maximum incidence was observed in pre-monsoon and post-monsoon months when recorded average monthly rainfall were 190'3 cm. and 257'5 cm. respectively.

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The area of first choice of this species was tea garden where over 56% of the total individuals were caught during this study, whereas in the paddy field and forest floor the seasonal incidence were 37.87% and 6.06% respectively (Table 9).

The abundance of this species was observed in three peak values in March, July and October in the tea garden, whereas in the paddy field the abundance was observed in two peak values in April and October (Fig. 16).

The species was mostly caught in fish baited traps constituting 95.45% of the total catches in three areas (Table 9). In the tea garden it was 51.51%, whereas in the paddy field and forest floor it was 37.87% and 6.06% respectively. Dung baited traps attracted 3.03% in the tea garden, whereas none of this species was attracted to dung baited traps in the paddy field and forest floor. In empty pitfall traps this species was caught 1.51% in the tea garden, whereas none was caught in the paddy field and forest floor (Table 10).

REMARKS :

It was observed that this species was mostly attracted to fish baited traps. The highest annual incidence was observed in the following order:

tea garden > paddy field > forest floor.

It has been observed that the abundance of this

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species in Doonra area was maximum during pre-monsoon and post-monsoon months.

10. Onthophagus chanseiformis Boucomont (PL.II/10)

Boucomont, 1914, Ann. Mus. Civ. Geneva, 46 : 224

Arrow, 1931, Fauna Brit. India, Lamell., 3 : 335

Balthasar, 1963, Monogr. Scarab. Aphod. Palaearkt. Orient., 2 : 478

Arrow (1931) reported its distribution from Burma. Recently, Biswas in his unpublished thesis (1978) mentioned its distribution from Meghaleya. In the present study this species is being recorded for the first time from West Bengal.

DIAGNOSTIC CHARACTERS :

This species is rather small, short and broad (length, 6-8'5 mm.; breadth, 3'5-5 mm.), dark-brown or chocolate-brown, head and pronotum with coppery or metallic green lusture, moderately shining, body covered with short and erect setae, each elytra with yellow spots at base.

Head short and broad, moderately convex, clypeus covered with mixture of small and moderately large punctures. Pronotum with posterior angles broadly rounded, strongly and closely punctured, without margin, well-marked longitudinal median groove continued upto base. Elytra finely striate, intertices strongly convex and

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covered with setiferous punctures.

In males, clypeus very shining, uniformly but not strongly punctured, separated from forehead by a feeble carina, and a long slender horn curving upward and backward. Pronotum with longitudinal median carina, sides flat, hind angles produced obliquely backward and strongly hooked and curved upwards. In females, clypeus rugosely punctured, fronto-clypeal carina strong, posterior carina straight. Pronotum without any process. External teeth of front tibiae stronger and last ventral sternite not emerginate in the middle.

ECOLOGY :

The species Onthophagus phanaeiformis Boucomont was fairly abundant species (mean per fortnight: 2'5) amongst 29 species of Scarabaeidae caught during this study. A total number of 60 examples were trapped. Of the total Scarabaeidae caught, 0'66% belonged to above species (Table 8). This species was found in pre-monsoon and post-monsoon months during this study and fairly abundant in the month of September and October in forest floor (Fig. 17) when recorded rainfall were 370'7 and 326'3 cm. respectively.

The area of first choice of this species observed was the forest floor where 78.33% of the total catches were trapped, whereas in the tea garden and paddy field it was 20.01% and 1.66% respectively (Table 9).

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This species was only caught in fish baited traps, none was trapped in dung baited and empty pitfall traps during this study (Table 13).

REMARKS :

The highest annual incidence of this species was observed in the following order :

Forest floor > tea garden > paddy field.

It was observed that this species was abundant during post-monsoon months and none was trapped during cold dry winter months. During this period it had gone hibernation. Earliest appearance was observed in the month of April during this study.

11. Onthophagus bastifer Lansberge (PL.II/11)

Lansberge, 1885, Ann. Mus. Civ. Genova (2) 11 : 380

Arrow, 1931, Fauna Brit. India, Lamell., 3 : 330-331

Balthasar, 1963, Monogr. Scarab. Anhod. Palaearkt. Orient., 2 : 378

Arrow (1931) redescribed this species and noted that this species was recorded from Rangoon, Bhamo, Minhla near Mandalay : Burma during May and June, and also from China and Formosa. Since then author has not seen any published record of this species from India except, Balthasar (1963 b) who also dealt with this species. In the present study this species is being recorded for the first time from

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India (West Bengal).

DIAGNOSTIC CHARACTERS :

This species is rather small (length, 6-7 mm., breadth, 4-5 mm.), body oval, compact, not very convex, covered with fine, minute greyish setae, reddish brown and slightly shining, mouth-parts and antennae yellowish.

Head broad with distinct fronto-clypeal curved carina, clypeus rogusely punctured and its apical margin rounded. Frontum with its lateral margins more or less straight, basal margin gently rounded, front angles sharp, disc uniformly and finely punctured. Elytra with a basal transverse reddish yellow patch between shoulder and suture, and its posterior margin reddish yellow. Elytra striate intertices flat, disc minutely granulated and lateral sides closely punctured. Pygidium strongly punctured.

In males, head bears markedly long, slender and backwardly directed horn, sometimes short transverse tubercle arising between the eyes. In females, head bears a transverse carina between the eyes.

ECOLOGY:

Onthophagus bastifer Lansberge was a fairly common species (mean per fortnight : 2'62) amongst the 29 species of Scarabaeidae trapped during this study. A total of 63 examples were trapped, which represented 0'69% of the

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total Scarabaeidae trapped (Table 8). This species was fairly abundant from March to September in the tea garden. Its maximum incidence was observed during pre-monsoon and monsoon months. (Table 12). The abundance of this speices was observed in two peak values in April and August in the tea garden (Fig. 18).

The area of first choice of this species observed was tea garden where over 69% of the total individuals were caught during this study, whereas in the paddy field and forest floor the seasonal incidence was 20.63% and 9.52% respectively (Table 9).

REMARKS :

This species was only attracted to fish baited traps similar to Onthophagus phenaeiformis Boucomont, O. bifasciatus (Fabricius), Hybosorus orientalis Westwood etc. Dung baited and empty pitfall traps had no yield in all of the three areas. The area of first choice was tea garden and it has been observed that the annual incidence of tea garden of this species was two times greater than the cumulative annual incidence of paddy field and forest floor. It has been also observed that this species had undergone hibernation during cold dry winter months when recorded average daily maximum and minimum temparatures were 24°12°C and 10°9°C respectively.

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12. Onthophagus krishnai Biswas (manuscript name)

(PL.II/12)

Biswas in his unpublished Ph.D. thesis (1978) described this species from Meghalaya. In the present study this species is being recorded for the first time from West Bengal.

DIAGNOSTIC CHARACTERS :

This species is rather small (length, 6-9 mm. : breadth, 4-5 mm.), body elongately oval, not very convex and black; mouth-parts, antennae, tarsi, legs and ventral surface reddish.

Head broad, clypeus not separated from forehead, head uniformly rather strongly punctured except in the raised posterior disc, punctures near anterior margin of clypeus becoming rugose. Pronotum with front angles blunt, hind angles obsolete, sides almost straight in front but sinuate behind, base gently rounded, closely uniformly and rather strongly punctured. Elytra broadly but shallowly striate, striae minutely punctured, intertices closely but not very strongly punctured and covered with minute hairs. Front tibiae with four external teeth, apical spur truncated at the apex and bent downwards. Pygidium margined at base, uniformly and closely punctured.

In males, clypeal margin entire, feebly reflexed and narrowly truncated in the middle of front margin. Posterior margin of the head with a little raised triangular disc.

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In females, clypeal margin acuminate in the middle, posterior triangular disc more strongly developed than in males. Last ventral sternite not excised in the middle and broad.

The species comes close to Onthophagus singhi Biswas (manuscript name) but differs from it by the presence of triangular raised disc near the posterior margin of the head.

ECOLOGY :

A total number of 12 examples of this species were trapped in the forest floor and paddy field (Table 13). This species was totally absent from tea garden during this study. 11 example, of which 4 examples were caught in the month of August and 7 examples were caught in the month of October in forest floor and only 1 example was trapped in paddy field in the month of October. All the 12 examples of this species were attracted to fish baited traps (Table 13). The emergence of this species was observed in the month of August.

REMARKS :

It has been observed that this species was only attracted to fish baited traps and totally absent from tea garden during this study.

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13. Onthophagus unifasciatus (Schaller) (PL.III/13).

Schaller, 1783, Adh. Hall. Nat. Ges. 1 : 240

Arrow, 1931, Fauna Brit. India, Lamell., 3 : 341-342

Balthasar, 1963, Monogr. Scarab. Aphod. Palaearkt. Orient., 2 : 571.

So far, this species was recorded from Fyzabad : U.P.; Ranchi : Bihar; Nagpur : M.P. ; Poona and Belgaum : Maharashtra; Vizagapatnam : Andhra Pradesh; Yemmiganur, Bellary district (during August), Kinavallore, South Malabar (during April), Coimbatore (during August), Nilgiri Hills : Tamil Nadu; Calcutta : West Bengal (during August); Bangladesh, Srilanka (during December to March, August and October). In the present study 8 examples of this species were collected from Dooars area of Jalpaiguri district of West Bengal.

DIAGNOSTIC CHARACTERS :

This is a rather small species (length, 6-9 mm. ; breadth, 4-5 mm.), body short, compact and convex, shining, dark blue or green, covered with inconspicuous minute setae, elytra yellowish with irregular black median band on each side, base of the 5th intertices with a small black spot and with a transverse spot near the apical margin.

Head semiluner, frontal margin reflexed. Pronotum with three median frontal prominances, a median longitudinal groove extending from the base and two lateral longitudinal

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carinae, puncturation strong and distinct, front angles sharp, and basal margin rounded. Elytra finely striate, intertices flat, closely and strongly punctured. Pygidium strongly and closely punctured.

ECOLOGY:

Onthophagus unifasciatus (Schaller) was totally absent from the forest floor during this study. A total number of 8 examples were trapped (Table 8), of which 4 examples were collected in the month of June and 3 examples in the month of July from paddy field and only 1 example was trapped in the month of September in the tea garden (Table 12). This species was mostly attracted to fish baited traps.

14. Onthophagus vigilans Boucomont (PL.III/14).

Boucomont, 1921, Faune Ent. de L'Indoch., Scar. : 88

Arrow, 1931, Faune Brit. India, Lamell., 3 : 165-166

Balthasar, 1963, Monogr. Scarab. Aphod. Palaearkt. Orient., 2 : 590

Arrow (1931) mentioned that this species was recorded from Chapra : Bihar and Indo-China. Since then author has not seen any published record of this species from India except, Balthasar (1963) who also dealt with this species. Recently, Biswas (1978) in his unpublished thesis recorded this species from Meghalaya. In the present study this species is being recorded for the first time from Dooars area of Jalpaiguri district of West Bengal.

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DIAGNOSTIC CHARACTERS :

This species is rather small (length, 5-5'5 mm.; breadth, 3'5 mm.), body compact, oval and moderately convex, shining black or deep brown, elytral shoulder with indistinct spot, antennae and legs reddish, body covered with yellowish erect hairs.

Head large, with prominent eyes, lateral margins rounded, vertex coarsely punctured, clypeus truncated and slightly rugose. Prothorax with its lateral margins straight in front and behind, front angles sharp, basal margin rounded, pronotum strongly and closely punctured. Elytra finely punctured, interticea flat and punctured or granulated in double rows. Pygidum strongly, sparsely punctured and shining.

In males, clypeus smaller than females, separated by feeble curved carina from forehead, vertex with backwardly directed triangular horn. In females, clypeus separated from forehead by strong curved carina, vertex with an erect and rectangular lamina.

ECOLOGY :

Onthophagus vigilans Boucomont was only trapped in the forest floor area. A total number of 4 examples of this species were caught during this study (mean per fortnight : 0'16) (Table 8). This species was attracted to fish baited traps. Dung baited traps and empty pitfall

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traps had no yield. The emergence of this species at Dooars area was observed in May and continued up to July (Table 12).

REMARKS:

It has been observed that this species was only trapped in forest floor area and attracted only to fish baited traps. The emergence of this species at Dooars area was observed in the month of May.

15. Onthophagus centricornis (Fabricius) (PL.III/15).

Fabricius, 1775, Ent. Syst. Suppl. : 33

Arrow, 1931, Fauna Brit. India, Lamell., 3 : 343-344

Balthasar, 1963, Monogr. Scarab. Aphod. Palaearkt. Orient., 2 : 305

Arrow (1931) mentioned that the species Onthophagus centricornis (Fabricius) has been recorded from Nagpur, Balaghat, Raigarh : M.P. during July; Belgaum and Kanara : Karnataka; Nilgiri Hills : Tamil Nadu, and from Sri Lanka, during April, June, July, October and December. In the present study this species is being recorded for the first time from Dooars area of Jalpaiguri district : West Bengal.

DIAGNOSTIC CHARACTERS :

This species is very small (length 2'5-3 mm.; breadth, 1'5-2 mm.), body broadly oval, compact, somewhat

..64/-

convex, head and pronotum black with coppery tinge, elytra reddish, antennae, mouth-parts and legs reddish yellow or yellow, both upper and lower surface covered with fine greyish pubescence.

Head broad and short, clypeus excised in the middle and sparsely punctured. Pronotum large, moderately strongly and closely punctured, basal margin gently rounded. Elytra finely striate, intertices flat, with very minute asperate punctures, 7th strine strongly curved. Pygidium finely and not closely punctured.

In males, head with short and straight horn originated just before the eyes, pronotum with front angles blunt, front tibia squared at the end. In females, clypeus separated from forehead by curved carina, forehead sparsely punctured and front angles of pronotum more produced, front tibia oblique at the end.

ECOLOGY :

Onthophagus centricornis (Fabricius) was totally absent from forest floor and tea garden, only trapped in paddy field. A total number of 21 examples were trapped in the month of April during this study (Table 12). This species was attracted only to fish baited traps, none was caught in dung baited and empty pitfall traps (Table 9).

..65/-

REMARKS :

It was observed that this species was restricted to paddy field and attracted to fish baited traps during this study.

16. Onthophagus tricornis (Wiedemann) (PL.III/16).

Wiedemann, 1823, Zool. Mag. 2(1) : 10.

Arrow, 1931, Faune Brit. Indie Lamell., 3 : 198-199.

Balthasar, 1963, Monogr. Scarab. Aphod. Palaearkt. Orient., 2 : 560.

Arrow (1931) redescribed this species and noted its distribution as follows : Chapra : Bihar ; Tharrawaddy and Moulmein : Burma; and also form Cambodia, South and Central China, and Java. Since then author has not seen any published record of this species from India except, Balthasar (1963 b) who also dealt with this species. Recently, Biswas (1978) in his unpublished thesis recorded the species from Meghalaya and its surrounding areas. In the present study this species is being recorded for the first time from Dooars area of Jalpaiguri district of West Bengal.

DIAGNOSTIC CHARACTERS :

This species is rather large (length, 13-17'5 cm.; breadth, 8-10 mm.) body oval, very convex, blackish, not very shining, antennae and mouth-parts reddish and covered with coarse faint reddish hairs.

..66/-

Head broad, with clypeus produced in the middle to form a short and blunt process, a median conical elevation present in front of the eyes, hind margin produced backwardly as a broad plate armed with a pair of short horns at the extremities. Prothorax with lateral margins straight at front and markedly sinuate posteriorly, front angles blunt. Pronotum densely covered with granules and with a median horizontal process behind the front margin. Elytra finely striate, intertices flat, not shining and finely and asperately punctured, which are more prominent at sides. Pygidium strongly, closely punctured. Males and females look alike.

ECOLOGY :

Onthophagus tricornis (Wiedemann) was only attracted by the fish baited traps during this study. A total number of 15 examples (mean per fortnight : 0'62) of this species were caught (Table 8). In the forest floor this species was caught 66.68% of the total catches, whereas in the tea garden and paddy field it was 26.66% and 6.66% respectively. Most of the examples of this species (80%) were caught during post-monsoon months, September to October when recorded average monthly rainfall was 237'5 cm.

REMARKS :

It has been observed that this species had the annual incidence in the following manner:

..67/-

Forest floor > tea garden > paddy field.

Attraction was observed only to fish baited traps. Dung and empty pitfall traps had no yield during this study. The emergence of this species was observed in the month of April and none of this species was collected during cold dry winter months, December to February.

17. Onthophagus atropolitus d'orbigny (PL.III/17).

d'orbigny, 1902, Ann. Soc. ent. Fr., : 146

Arrow, 1931, Fauna Brit. India, Lamell., 3 : 250-251

Balthasar, 1963, Monogr. Scarab. Aphod. Palaearkt. Orient., 2 : 281

Arrow (1931) noted its distribution from Dehra Dun : during June and August; Sikkim, Meghalaya, during July ; Darjeeling : West Bengal, during June, and Burma. In the present study two specimens were trapped during June and July.

DIAGNOSTIC CHARACTERS :

This species (male) is rather large (length, 11'5 mm.; breadth, 6 mm.), body broadly oval, compact, not very convex, shining, smooth, black, mouth-parts and legs brownish.

Head fairly large, suborbicular, shining and coarsely punctured, clypeus rounded and its margin reflexed. Clypeus separated from forehead by a nearly straight carina, behind

..68/-

carina a pair of horns present, which are rather broad at the base and tapparing to point at the tip. Pronotum shining, smooth and rather finely punctured at the sides, front angles rather blunt, sides nearly straight, basal margin somewhat rounded. Elytra finely striate, interticos flat and very finely punctured. Pygidium with a few strong punctures. Metasternum smooth at middle and its sides strongly punctured.

Female unknown.

ECOLOGY :

The species Onthophagus atropolitus d'orbigny was trapped in forest floor. Only 2 individuals of this species (0) were trapped during this study in the month of June and July in dung baited traps.

REMARKS:

It was observed that this specieswas less abundant during this study at Dooars area and restricted to forest floor only.

18. Onthophagus furcicollis Arrow (PL.III/18).

Arrow, 1931, Fauna Brit. India, Lamell., 3 : 276

Balthasar, 1963, Monogr. Scarab. Anhod. Palaearkt. Orient., 2 : 359

Arrow (1931) described this species and recorded its

..69/-

distribution as follows : Dehra Dun and Munnadi : U.P. during July; Gopaldhara and Rungbong : Sikkim during September. Since then author has not seen any published record of this species from India except, Balthasar (1963 b) who also dealt with this species. Biswas in his unpublished thesis (1978) recorded the species from Meghalaya. In the present study this species is being recorded for the first time from West Bengal.

DIAGNOSTIC CHARACTERS :

This species is rather small (length, 4-5 mm.; breadth, 2'5 mm.), body broadly oval, compact, highly convex, black, not so shining, elytra with reddish spots near shoulder and another at outer part of the hind margin.

Head not broad, with a few fine punctures, sides rounded, clypeus bluntly bilobed. Prothorax with front angles sharp, sides more or less straight, basal margin gently rounded and pronotum covered with large, close umbilicate punctures. Elytra striate with large annular punctures, intertices seperately punctured. Pygidium covered with large punctures.

In males, head with a stout and erect horn between the eyes. Pronotum with a broad bifurcate process over posterior part of head. In females, clypeal margin more strongly bilobed, clypeal disc rather closely and strongly punctured, horn replaced by a small transverse carina and

..70/-

pronotum devoid of any process.

ECOLOGY:

The species Onthophagus furaicollis Arrow was absent from forest floor in Dooars area during this study. A total number of 64 examples (mean per fortnight : 2'66) were trapped in the paddy field and tea garden, which represented 0'7% of the total Scarabaeidae trapped during the study (Table 8). This species was fairly abundant from April to September and its maximum incidence was observed in April and June (Table 12).

The area of first choice of this species observed was tea garden where 37 examples (57.82% of the total catches) were trapped, whereas in the paddy field it represented 27 examples (42.18%) (Tables 13 and 9).

The species was mostly caught in fish baited traps constituting 98.44% of the total catches in two areas. In the tea garden it was 57.81%, whereas in the paddy field it was 40.62% (Table 10). Dung baited traps attracted only 1.56% in the paddy field. In empty pitfall traps none was caught during this study (Table 9).

REMARKS:

This species was observed totally absent from forest floor of Dooars area during this study. The maximum incidence was observed in the month of April and June when recorded rainfall 239 cm and 507 cm respectively. This

..71/-

species was mostly caught in fish baited traps and the first appearence was observed in the month of April.

19. Onthophagus pectolus Fabricius (PL.IV/19).

Fabricius, 1787, Mant. Ins., 1 : 12

Arrow, 1931, Faune Brit. India, Lamell., 3 : 203

Balthasar, 1963, Monogr. Scarab. Aphod. Palaearkt. Orient., 2 : 466

Arrow (1931) mentioned that this species was recorded from Fyzabad, Bareilly, Dehra Dun : U.P. during July; Sagoda, Purna, Buldana : M.P. during September and also from Bangalore : Karnataka. Since then author has not seen any published record of this species from India except, Balthasar (1963 b) who also dealt with this species. In the present study this species is being recorded for the first time from Dooars area of Jalpaiguri district : West Bengal.

DIAGNOSTIC CHARACTERS:

This species is rather large (length, 11-16 mm.; breadth, 7-10 mm.), body somewhat narrowly oval, convex, opaque, head and pronotum deep green, elytra reddish orange with the suture green and antennae pale yellowish.

Head broad, densely punctured, front margin of clypeus entire and slightly reflexed. Pronotum long, lateral margins somewhat straight, front angles well developed, base

..72/-

medianly flattend and lobed. Elytra feebly striate with juxtasutural intertices carinate, two carinae joined apically and diverging anteriorly. Pygidium densely punctured.

In males, clypeus semicircular, vertex bears a slender horn, spur of front tibia nearly straight. In females, clypeus little produced and not pointed. The spur of the front tibia bent inwards towards the end.

ECOLOGY :

Onthophagus pectolus Fabricius was absent from the forest floor and tea garden at Dooars area of Jalpaiguri district and only one example of this species was trapped in fish baited trap in the paddy field during the month of June.

REMARKS:

It was observed that this species was less abundant and restricted to paddy field of Dooars area during this study.

20. Onthophagus rynthi Biswas (manuscript name)
(PL.IV/20)

Biswas in his unpublished Ph.D. thesis (1978) described this species from Meghalaya. In the present

..73/-

study this species is being recorded for the first time from West Bengal.

DIAGNOSTIC CHARACTERS :

This species is rather large (length, 9-10 mm.; breadth, 5-5'5 mm.), body broadly oval, convex, upper surface glabrous, uniformly black, mouth-parts, tarsi and scanty clothing ventral surface reddish and antennae yellowish.

Head broad, semicircular, clypeal margin gently rounded, medianly reflexed. Pronotum moderately convex, with a median longitudinal groove and a small anterior depression, with a prominence on each side of the depression, unequally punctured, front angles not so sharp, hind angles obsolete, base gently rounded and medianly slightly angulate. Elytra narrowly but rather strongly striate, striae finely punctured, 7th striae strongly curved, interticea slightly convex and feebly punctured. Pygidium margined at the base and uniformly and rather closely and strongly punctured.

In males, clypeus finely, uniformly and closely punctured, with a little rugosity in the anterior portion. Fronto-clypeal carina less strong than in females. Pronotum with a little prominence on each side of the anterior depression. Last abdominal sternite emarginate in the middle to receive the pygidium. In females, clypeus

..74/-

rugosely punctured, fronto-clypeal and clypeo-ocular carina strong. Prominence on each side of anterior depression of pronotum more or less prominent. Last abdominal sternite not emerginate in the middle.

ECOLOGY:

This species was trapped only in the forest floor. A total number of 9 examples were trapped during this study (Table 8). 3 examples were trapped in the month of June and 6 examples were trapped in the month of September (Table 12). This species was only attracted to fish baited traps. None was trapped in dung baited and empty pitfall traps during this study.

REMARKS:

It was observed that this species was restricted to forest floor and only attracted to fish baited traps during this study.

21. Onthophagus shamrupus sp. nov. (PL.IV/21)

This species is closely related to Onthophagus centricornis Fabricius but can be separated by the presence of double prominence near the anterior margin of pronotum, puncturation on elytral interticos simple and dense, and apical tooth of the front tibia oblique in both sexes.

This species is very small, rather minute (length,

3-4 mm.; breadth, 2-2'5 mm.), body broadly oval, compact and not very convex, shining black : head and pronotum with greenish tinge, elytra bright reddish brown with sutural interval black, mouth-parts and antennae golden yellow, dorsal surface covered with pale yellowish brown setae, ventral setae are scattered and minute.

Head short, not very broad, ocular lobes not very prominent laterally ; clypeus a little produced and notched in the middle, fairly closely and not very strongly punctured. Pronotum fairly closely and strongly punctured, front angles acute, lateral margin rounded in front and slightly sinuate behind and basal margin gently rounded. Elytra finely striate, intertices flat, finely, closely and rather numerously punctured, setae arranged in rows. Pygidium strongly and closely punctured. Metasternum finely and evenly punctured.

Holotype ♂ and 24 paratypes collected from fish baited traps, paddy field, Gayerkata, Jalpaiguri district, West Bengal., 16.4.77. A.K. Datta coll., deposited in the collection of Zoological Survey of India.

ECOLOGY:

This species Onthophagus shamrupus sp. nov. was trapped only in the paddy field during this study. A total number of 25 examples (mean per fortnight : 1'04) were trapped (Table 8). The seasonal occurance of this species was

..76/-

observed only in the month of April in fish baited traps during this study.

REMARKS:

It was observed that this species was totally absent from forest floor and tea garden in the Doors area during this study and its attraction was observed to fish baited trap only.

22. Onthophagus sp. near to O. luridipennis Bohemann (PL.IV/22).

This species is nearest to Onthophagus luridipennis Bohemann but can be separated in having broader head, pronotum without any median longitudinal line at the base and elytra without any spot.

DIAGNOSTIC CHARACTERS :

This species is small (length, 8 mm. : breadth, 4 mm.), body oval, compact, convex, covered with minute and pale brownish yellow setae, not very shining, head, pronotum and elytra black suffused with slight coppery tinge.

Head broader than long, broadest at middle, narrowed in front and behind, sides slightly reflexed, dorsal surface strongly, closely and rugosely punctured, clypeus strongly rugose, slightly rounded in front and separated by a well developed feebly curved carina, another straight well developed carina present between the eyes. Pronotum strongly,

closely and uniformly punctured, near lateral margin across middle slight longitudinal elevation present, which forming a pair of longitudinal short depressed area, a blunt transverse tubercle like elevation present just behind the front margins, front angles obtusely rounded, sides gently rounded in front and feebly sinuate behind, basal margin gently rounded and bluntly angulate in the middle. Elytra finely striate, intertices flat, slightly rather finely, moderately closely granulated. Pygidium rather strongly punctured. Metasternum with a very few punctures in the middle and which are rather strongly punctured at the sides and moderately densely pubescent.

REMARKS:

No attempt has been made to establish this species as a new to science because of the fact that this species is represented by single ♀ specimen.

ECOLOGY:

Only one example of Onthophagus sp. near to O. luridipennis Bohemann was trapped in the forest floor in fish baited trap in the month of August during this study.

REMARKS :

It was observed that this species was restricted to forest floor of Dooars area during this study.

..78/-

Genus Catharsius Hope, 1837

Hope, 1837, Col. Man., 1 : 21

Arrow, 1931, Fauna Brit.India Lamell., 3 : 92

Balthasar, 1963, Monogr.Scrab.Aphod.Palaearkt. Orient., 1 : 304

The genus Catharsius Hope is predominant in Ethiopian region, so far, only 11 species are recorded from Oriental region, of which 7 species are recorded from India. In the present study 2 species have been recorded from Doors area of Jalpaiguri district. Members of this genus are moderately large, body broad and very convex, compact, black or blackish brown. Head broad and semicircular, clypeus united with ocular lobes and meeting point marked by a carinate suture, frons provided with horns, tubercle or transverse ridge. Antennae 9-segmented, antennal club long and entirely pubescent. Mandibles with a markedly developed long mola, and small narrow terminal ramus. Maxillae stout, palpi with minute basal joints, terminal joint a little longer than 3rd. Mentum transversely rectangular, labial palpi wide apart, basal joints, ter- of labial palpi about as long as wide, not very large, 2nd a little smaller, oviform, and the 3rd slender and a little shorter. Pronotum completely margined at base and provided, specially in males, with horns, tubercle or transverse ridge. Scutellum not variable. Elytra with 7 striae, 8th being replaced by a sharp longitudinal carina. Legs short and stout, front tibiae armed with three external teeth, tibiae of middle and hind legs strongly dilated from base to extremity, each with two transverse carinae at outer

edge. Middle tibiae with two and hind tibiae with one terminal spur. Unlike Scarabaeius Linnaeus all tarsi present, posterior ones broad, with successively diminishing joints, basal joints much longer than the 2nd. Abdomen completely covered with a lateral carina, continued across the pygidium.

The members of this genus can be separated from Heliocopris Hope by their entirely pubescent antennal club and from Copris Geoffroy by a suplimentary lateral carina in the place of 8th striae upon elytron and the additional transverse carina at the outer edges of the middle and hind tibiae.

23. Catharsius sagax (Quenstedt) (PL.IV/23)

Quenstedt, 1806, Schonh. Syn. Ins. , 1 : 43

Arrow, 1931, Fauna Brit. India Lamell., 3 : 96

Balthasar, 1963, Monogr. Scarab. Aphod. Palaearkt. Orient., 1 : 39

Arrow (1931) recorded this species from Calcutta during October and Burdwan during March (West Bengal), Chapra and Pusha : Bihar, during June to October : Mandla District : M.P. during November : Lyallpur : Punjab, during July : Bassein fort : Maharashtra, during October : Tamil Nadu during July : Kerala : during September. Recently Biswas (1978) in his unpublished Ph.D. thesis reported this species from Meghalaya. In the present study it has been observed that this species was fairly abundant in Dooars area of Jalpaiguri district, West Bengal.

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DIAGNOSTIC CHARACTERS :

This species is large (length, 32-33 mm. ; breadth, 18-19 mm.), body oval, convex, black, opaque, partially covered with reddish hair beneath.

Head broad, without a smooth are adjoining each eye, front margin feebly excised in the middle, clypeus closely and transversely rugulose. Pronotum densely covered with fine granules excepting a small shining area on each side, in males. Elytra opaque and rugosely punctured. Pygidium finely punctured in the middle and granulated at the sides.

In males, cephalic horn placed more anteriorly, anterior declivity almost vertical and upper edge almost straight, thoracic horn absent. In females, cephalic horn very short, pointed, transversely dilated and little angulate on each side at the base. Pronotum with short anterior declivity, upper margin of declivity with nearly straight carina, extremity of which not distinctly produced and lateral hollows absent.

This species comes close to Catharsius molossus (Linnaeus) but may easily be distinguished by more anteriorly placed and forwardly directed cephalic horn and almost straight sharp carina on the upper margin of the declivity in the males and by the absence of smooth area adjoining each eye in the females.

ECOLOGY :

Catharsius sagax (Quensteedt) was fairly common species (mean per fortnight : 18'29) amongst the 29 species of

..31/-

Scarabaeidae caught during this study. A total number of 439 examples were trapped, which represented 4.85% of the total Scarabaeidae trapped (Table-8). This species was fairly abundant from May to September when monthly average rain fall was recorded 514'9 cm.

The area of first choice of this species was the forest floor where 299 examples (68.12% of the total catches in three areas) were trapped, whereas in the tea garden and paddy field the seasonal incidence were 114 examples (25.96%) and 26 examples (5.92%) respectively (Tables 13 and 9).

The abundance of this species was observed as a single peak value during May in the forest floor (Fig.36), whereas in the tea garden the abundance was observed during June and in the paddy field during July.

This species was mostly caught in fish baited traps constituting 92.25% of the total catches in three areas (Table 9). In the forest floor it was 63.78%, whereas in the tea garden and paddy field it represented 25.96% and 2.5% respectively. Dung baited traps attracted 4.32% in the forest floor, 3.41% in the paddy field and 0'0% in the tea garden. None was collected in empty pitfall traps (Table 10).

REMARKS :

It has been observed that this species was one of the common species of Scarabaeidae in Dooars area of Jalpaiguri district during this study. The highest annual incidence was observed in the following order -

..82/-

forest floor > tea garden > paddy field.

It was observed that this species was mostly attracted to fish baited traps (92.25%). The emergence was observed in the month of March and continued till October. The abundance of this species was observed maximum during monsoon months, June to August (50.79%), whereas low incidence was observed during post-monsoon months, September to November (13.66%) and then again during pre-monsoon months, March to May (35.55%) (Table 11). It appeared that monsoon months, June to August, were suitable for this insect emergence when recorded rainfall was 407 cm., 493'6 cm., and 976 cm. respectively. During the winter months, December to February there was sudden fall of catch, when recorded average daily maximum and minimum temperatures were 24'12'C and 10'9'C respectively.

24. Catharsius pithecius (Fabricius) (PL.IV/24)

Fabricius, 1775, Syst. Ent. : 21

Arrow, 1931, Fauna Brit. India Lamell., 3 : 100 - 101

Balthasar, 1963, Monogr. Scarab. Aphod. Palaearkt. Orient., 1 : 30

Arrow (1931) mentioned that this species was recordad from Pusha : Bihar, in May and September ; Dehra Dun : U.P., in July ; Nagpur : M.P., in July - September ; Bangalore :

..83/-

Tamil Nadu, in September, and Coimbatore in August to December. In the present study this species is being recorded for the first time from Dooars area of Jalpaiguri district, West Bengal.

DIAGNOSTIC CHARACTERS :

This species is rather large (length, 15-23 mm. ; breadth, 10-13 mm.), very convex, black and shining, antennae, mouth-parts, legs and ventral surface reddish.

Head semicircular, clypeus rounded and its front margin slightly notched at middle. Pronotum sometimes partly or entirely opaque, sides strongly or uniformly rounded, front angles prominent and hind angles obliterated, base finely margined and rounded. Elytra finely striate, punctures on them hardly visible, intertices smooth except basal part, shining and with minute punctures. Punctuation on pygidium more or less distinct laterally and at base punctures are ill-defined but rather strong.

In males, head slightly sculptured, whereas in females, deeply sculptured, shining and with a slender, more or less straight, backwardly directed horn originated just in front of the eyes. Pronotum with a little sharp, conical protubearance on each side of the median line and midway between two points hollowed, flattened, smooth and shining in front and usually a round, smooth, shining patch present behind each lateral protubearance. In females, head less shining with a little acuminate transverse elevation just in front of the eyes. Pronotum with a median longitudinal furrow at

...84/-

its base, closely and minutely granulated.

ECOLOGY:

Catharsius pithecius (Fabricius) was totally absent from forest floor. A total number of 7 examples, of which 4 in the paddy field and 3 in the tea garden were trapped (Table 13). Attraction was observed maximum to fish baited traps. The highest incidence was observed in the month of April (Table 12).

REMARKS:

It was observed that this species was less abundant during this study and its maximum incidence was in the fish baited traps.

Genus Gymnopleurus Illiger, 1803

Illiger, 1803, Mag. Ins., 11 : 199

Arrow, 1931, Fauna Brit. India. Lamell., 3 : 46

Balthasar, 1963, Monogr. Scarab. Aphod. Palaearkt. Orient., 1 : 177

The genus Gymnopleurus Illiger, is distributed over Oriental, Palaearctic and Ethiopian regions. A total number of 94 species were described from the world, of which 20 species were from India. The members of this genus are characterised by its body being broad, rather depressed and posteriorly narrowed. Head without transverse ridge or tubercle, hind margin with sharp rounded lobe closely fitting emargination of pronotum. Antennae 9-segmented. Labrum with front edge nearly straight and with median longitudinal tuff of stiff bristles. Mandibles long and

..85/-

narrow with closely fringed tips. Maxillae with a sharply angulate tip externally. Pronotum moderately convex, with front margin deeply excised, front angles sharp, hind angles generally blunt, sometimes produced or may be nearly obsolete; base feebly rounded or nearly straight. Scutellum not visible. Elytra rather flat, with sides deeply excised behind shoulders, exposing the sides of the body beneath. Front femora massive, with a tooth at front edge, front tibiae armed with three sharp teeth confirmed to the anterior half and serrate between and above them. Tarsi filiform, short and without fringes. Abdomen slightly reduced. Pygidium transverse.

The representatives of this genus are often found in the vicinity of forest. Biswas (1979), in his unpublished thesis, mentioned that some species are fairly common and abundantly occur in fungus in Meghalaya. In the present study only one species has been collected in fish baited and dung baited traps.

25. Gymnopleurus sinuatus var assamensis Waterhouse (PL.V/25)

Olivier, 1789, Entom., i, 3 : 160

Waterhouse, 1890, Ann. Mag. Nat. Hist., (6) 5 : 411

Arrow, 1931, Fauna Brit. India, Lamell., 3 : 63-64

Balthasar, 1963, Monogr. Scarab. Arbod. Palaearkt. Orient., 1 : 218

..06/-

Arrow (1931) dealt with 20 species of Gymnopleurus Illiger from Indian subregion, of which three species were recorded from hills of North East India. Among these, the species G. sinuatus var assamensis Waterhouse is most common in that part of the country. Arrow (1931) mentioned that this species was recorded from Dehra Dun and Almora : U.P., during June; Rangeet valley : Sikkim; Naga Hills : Nagaland; Patkai Hills : Arunachal Pradesh, during April, and Darjeeling district : West Bengal, during May, June and July. Biswas (1978) in his unpublished thesis, reported this species from Meghalaya. In the present study it has been observed that this species is fairly abundant in Dooars area of Jalpaiguri district : West Bengal.

DIAGNOSTIC CHARACTERS :

This species is large (length, 18-22 mm.; breadth, 9-14 mm.), broad and rather flat, dorsally deep coppery black, shining, and its antennal club bright yellow.

Head broad, its clypeus sharply notched at middle, and dorsal surface of head rugosely granular. Prothorax strongly transverse and convex, lateral margins angulate in the middle, narrowed in front and somewhat acute. Front margin distinctly concave. Pronotum finely and fairly closely punctured. Elytra slightly broader than length, finely striate and minutely punctured, intertices flat, lateral margins strongly excised near anterior one

..87/-

third of the length exposing metasternal epimera and base of abdomen. Sides of the abdomen sharply carinate. Pygidium sparsely punctured. Legs long and slender, front tibia with three distinct teeth closely placed with the terminal third of the tibia, rest of the part finely serrate, front femur with a small tooth, and with a sharp carina from the base of the tooth, the posterior half of external carina of the middle tibia loosely and of the hind tibia closely serrate.

ECOLOGY:

Gymnopleurus sinuatus var assamensis Waterhouse was one of the most abundant species (mean per fortnight : 20'54), amongst 29 species of Scarabaeidae caught during this study. A total number of 493 examples were trapped. Of the total Scarabaeidae caught, over 5% belonged to this species (Table 8). This species was found throughout the year except, for the cold dry winter months. It was fairly abundant from April to October in the forest floor and its maximum incidence was observed during monsoon and post-monsoon months when recorded average monthly rainfall were 625'5 and 237'5 cm. respectively.

The area of first choice of this species was the forest floor, where 459 examples (92.9% of the total catches) were trapped, whereas in the paddy field the seasonal incidence was only 34 examples (6.89%). This species was

..88/-

totally absent from the tea garden. (Tables 13 and 9).

The abundance of this species was observed as a single peak value in August in both of the forest floor and paddy field area in dung baited traps, whereas in the fish baited traps the abundance of this species was observed in two peaks in June and September in the forest floor. Besides these, minor peak was also observed in May in fish baited traps in forest floor (Fig.20).

This species was attracted more to dung baited traps than fish baited traps. In empty pitfall traps none of this species was caught. The dung baited traps constituted 54.56% of the total catches in three areas (Table 9). In the forest floor it was 48.27%, whereas in the paddy field it was 6.28% (Table 10). Fish baited traps attracted 45.43% of the total individuals catch during this study (Table 9). In the forest floor it was 44.62%, whereas in the paddy field it was only 0'81% (Table 10).

REMARKS:

This species was fairly common in forest floor of Dooars area of Jalpaiguri district, West Bengal. It was observed that this species was totally absent from tea garden but more common in forest floor than paddy field.

It has been observed that the abundance of this species in Dooars area was maximum during monsoon months.

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June to August (67.95%), whereas low incidence was observed during pre monsoon months, March to May (9.12%) and again during post monsoon months, September to November (22.92%) (Table 11). It appeared that the monsoon months were suitable for this insect emergence. During cold dry winter months, December to February there was a sudden fall of catch when recorded average daily maximum, minimum and monthly rainfall were 24'12'C, 10'9'C and 7'7 cm respectively. The earliest appearence was observed by April.

Genus Parachorius Harold, 1873

Harold, 1873, Col. Hefte, 11 : 103

Arrow, 1931, Fauna Brit. India Lamell., 3 : 357

Balthasar, 1963, Monogr. Scarab. Aphod. Palaearkt. Orient., 1 : 275

The genus Parachorius Harold is known to be distributed over Indo-malayan region and represented by a few species. Only 3 species are known from India. The members of this genus are characterised by body broadly oval and convex or almost hemispherical and devoid of any hairy clothing. Head flat, strongly dilated in front of the eyes, ocular lobes and clypeus not seperated from fore head, clypeus sharply notched and bidentate in front, with sides nearly stright and convergent. Antennae 9 segmented. Mentum sub-quadrate, hollowed beneath and strongly bilobed in front, the three joints of the palpi nearly equal in length, the two basal joints as broad as long. Prothorax strongly convex, sides

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rounded, not angulate, front and hind angles distinct, the latter very obtuse, front angles a little hollowed beneath, base nearly straight in the middle, not margined. Scutellum absent. Elytra with seven striae and a single suture straight or gently curved. Legs short but not stout, front tibiae armed with three external teeth and finely serrate above them. Middle and hind tibiae short and gradually dilating from bases to apice, but not greatly dilated at the extremity and without lateral ridges. Front tarsi slender, middle and hind tarsi scarcely tapering, a little flattened with the 1st joints about twice as long as the 2nd, the 2nd 3rd and 4th gradually becoming little smaller in size, claws minute.

Representatives of this genus are known to be rare but Biswas (1978), in his unpublished thesis, mentioned that some species are fairly common and abundantly occur in fungus in Meghalaya. In the present study only one species has been collected from fish baited traps.

26. Parachorius hookeri Arrow (PL.V/26)

Arrow, 1931, Fauna Brit. India, Lamell., 3 : 357

Balthasar, 1963, Monogr. Scarab. Palaearkt. Orient., 1 : 275

DIAGNOSTIC CHARACTERS :

This species is rather small (length, 5'5 - 7 mm. ; breadth, 3 - 3'5 mm.), body broadly oval, compact, convex, black and shining, and mouth-parts, antennae and legs reddish.

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Head broad, obtusely angulate laterally, puncturation deep and prominent, clypeus notched in front forming two small lobes. Prothorax convex, its lateral margins strongly rounded, base almost straight in the middle, front angles obtuse and hind angles almost obsolete, puncturation on pronotal disc fine and spares, on its lateral sides punctures are more prominent. Elytra shining, deeply striate and with double punctures, intertices finely punctured and striae 7 short. Pygidium strongly punctured.

REMARKS :

Since Balthasar (1963a) author has not seen any published record of this species. Recently, Biswas (1978) in his unpublished thesis recorded this species from Meghalaya. In the present study this species is being recorded here for the first time from Boxars are of Jalpaiguri district of West Bengal.

ECOLOGY :

Parachorius hookeri Arrow was fairly abundant species (mean per fortnight : 1'95) amongst the 29 species of Scarabaeidae trapped during this study. A total number of 47 examples were trapped. Of the total Scarabaeidae caught, 0'52% belonged to this species (Table 8). This species was trapped from April to October and fairly abundent during July to October, especially in the tea garden. Its maximum incidence was observed during July (monsoon month) and October (post-monsoon month) (Table 12).

The area of first choice of this species observed was

tea garden where 78.73% of the total individuals were caught, whereas the forest floor and paddy field represented 14.89% and 6.38% respectively (Table 9). The abundance of this species was observed in two peak values during July and October in the tea garden in fish baited traps (Fig. 19).

REMARKS :

It was observed that this species was most common in the tea garden. The abundance of this species was maximum during monsoon months, June to August when recorded average rainfall was 625'5 cm per month. It has been also observed that this species had gone hibernation during the cold dry winter months when recorded average daily maximum and minimum temperatures were 24'12'C and 10'9'C respectively. The first appearence was observed in the month of April.

Genus Hybosorus M'leay, 1819

M'leay, 1819, Horae Ent. 1 : 120
Westwood, 1845, Trans. Ent. Soc. London, 4 : 158
Lacordaira, 1856, Gen. Col., 3 : 133
Jacq. du val, 1859, Col. d'Eur., 3 : 33
Reitter, 1893, Verh. Nat. Ver. Brünn, 30 : 257
Pering., 1901, Trans. S. Afr. Phil. Soc., 12 : 492

Hybosorus M'leay is a small genus occurs in both the New and Old World, most of the species were recorded from Africa and Madagascar. Arrow(1912) in Junk's Coleopterorum Catologus listed two species H. illigeri Reiche from Punjab

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and Central India and H. orientalis Westwood from India. In the present study the species H.orientalis Westwood has been recorded from Dooars of Jalpaiguri district : West Bengal. The member of this genus are characterised by mandibles and labrum prominent: antennae 10 segmented, club 3 segmented, eight segment hollowed to receive the ninth: anterior coxae conical, prominent: middle coxae contiguous: six visible abdominal sternites, all but apical segment connate.

27. Hybosorus orientalis Westwood (PL.V/27).

Westwood, 1845, Trans. ent. Soc. Lond., 4 : 159

DIAGNOSTIC CHARACTERS :

This species is rather large (length, 9-10'5 mm.; breadth, 5-6 mm.), body elongate-oval, convex, very shining brownish-black; mouth-parts, scutellum, tarsi and antennae reddish-brown, and ventral surface shining.

Head sub-orbicular, convex, very closely and strongly punctured in front and finely so behind. Pronotum markedly convex, very finely, closely and minutely punctured, front angles acute, sides rounded in front and more or less straight behind, hind angles rather blunt, posterior margins sinuate anteriorly and gently rounded posteriorly. Elytra strongly convex, striate-punctate, interticos flat and impunctate.

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ECOLOGY:

A total number of 99 examples (mean per fortnight : 4'12) of this species were caught during this study. Of the total Scarabaeidae caught, over 1% belonged to this species (Table 8). This species was trapped in all of the three areas and the area of first choice observed was paddy field representing 37.37% of the total catches of this species, whereas tea garden and forest floor represented by 34.34% and 28.28% respectively (Table 9). The seasonal occurance of this species was observed from April to June during this study and its maximum abundance was observed in the month of June (Table 12).

This species was mostly caught in fish baited traps constituting 97.98% of the total catches in three areas (Table 9). In the paddy field it was 35.35%, whereas in the tea garden and forest floor it represented 34.34% and 28.28% respectively. Dung baited traps attracted none of this species during this study. In the empty pitfall traps this species was caught 2% in the paddy field (Table 10).

REMARKS:

The cumulative annual incidence of this species was observed in the following order in Dooars area during this study:

Paddy field > tea garden > forest floor.

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It has been observed that this species was mostly caught in the fish baited traps and the abundance was observed in the month of June during this study.

Genus Phaeochrous Castelnau, 1840

Castelnau, 1840, Hist. Nat. Ins., 2 : 103

Lacordaire, 1856, Gen. Col., 3 : 134

Pering., 1901, Trans. S. Afr. Phil. Soc., 12 : 496

Arrow (1912) in Junk's Coleopterorum Catalogus listed 24 species of the genus Phaeochrous Castelnau from the world, of which 2 are from India, P. Pallidus Arrow and P.emarginatus Castelnau. In the present study latter species has been recorded from Boora area of Jalpaiguri district, West Bengal.

28. Phaeochrous emarginatus Castelnau (PL.V/28).

Castelnau, 1840, Hist. nat. Ins., 2 : 109

Westwood, 1846, Trans. ent. Soc. Lond., 4 : 161

DIAGNOSTIC CHARACTERS :

This species is rather large (length, 9-10 mm.; breadth, 4'5-5'5 mm.), body elongate-oval, convex, shining reddish brown and ventral surface shining.

Head broader than long, closely and moderately strongly punctured, sides angulate and with long brownish hairs, eyes large, and clypeus lobed. Pronotum convex in the

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middle and reflexed in the sides, moderately strongly punctured in the middle and strongly, rugosely and closely punctured in the reflexed sides, front angles acute, sides rounded, posterior angles blunt, base sinuate in front and gently rounded behind. Elytra strongly convex, sides reflexed and anteriorly with long brownish hairs, striate-punctate, intertices convex and impunctate.

ECOLOGY :

Rhaeochrous emarginatus Castelnau was totally absent from tea garden and paddy field in Boora area during this study. A total number of 199 examples were trapped, which represented over 1% of the total Scarabaeidae trapped (Table 8). This species was found only in the pre-monsoon and monsoon months and fairly abundant in April and May (Table 12). This species was only trapped in fish baited traps, none of this species was trapped in dung baited and empty pitfall traps during this study (Table 9).

The emergence of this species was observed in the month of March in the forest floor and continued till August. Its abundance was observed in single peak value in the month of May (Fig. 21).

REMARKS:

It has been observed that this species was restricted to forest floor in Boora area during this study. The

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abundance of this species was observed maximum during pre-monsoon months, March to May when recorded average monthly rainfall was 190'3 cm and average daily maximum, minimum temperatures were 29'6'C, 18'4'C respectively. Attraction was observed in fish baited traps only.

Genus Oxynemus Castelnau

Castelnau, 1840, Hist. Nat. 2 : 98

Balthasar, 1964, Monogr. Scarab. Anhod. Palaearkt. Orient., 3 : 432.

The members of this genus can easily be recognised by small, elongate, convex usually black or blackish brown species. Head moderately convex without armature, punctured, antennae 9-segmented. Pronotum with longitudinal furrow, base sometimes straight with grooves, scutellum usually very small, tooth at shoulder, intertisces usually carinated or ribbed. Fore tibia normal with three external teeth, middle and hind tibiae with two distinct transverse ridges. The genus Oxynemus castelnau is related to the genus Reneudius Balthasar but can be separated by base of pronotum being finely and closely hairy, whole upper surface covered with short and fine microscopic hairs. Middle and hind tibiae hardly visible transverse ridge.

29. Oxynomus aciculatus Schmidt (PL.V/29)

Schmidt, 1909, Soc. Ent., 24 : 55

Balthasar, 1964, Monogr. Scarab. Aphod. Palaearkt. Orient., 3 : 486 - 487.

DIAGNOSTIC CHARACTERS :

This species is small (length, 3.5 mm. ; breadth, 1.5 mm.), dark reddish brown, anterior part of the head, sides of pronotum and legs pale brown, upper surface opaque, covered with short hairs, only the ribs on elytra are shining.

Head distinctly punctured, clypeus in front emerginate, sides rounded. Pronotum moderately strongly punctured, sides less strongly punctured. Scutellum small with longitudinal carina. Elytra striate. Middle and hind tibiae covered with long hairs at apex.

ECOLOGY :

This species Oxynomus aciculatus Schm. was trapped only in the forest floor. A total number of 4 examples were attracted to fish baited traps in the months of April.

REMARKS :

This species is the only representative of the sub-family Aphodiinae and was restricted to forest floor during this study.

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2. Family : Staphylinidae

This is one of the largest family of the order Coleoptera and commonly known as rove beetles, representatives of this family can be easily recognised by their short elytra, usually exposing more than three abdominal tergites. Rove beetles occur in almost every type of habitat, often found in carrion, also live in litter, under bark, under stones along shores of streams, many species live in fungi, eat pollen grains of flowers and certain species of Aleocharinae are parasitic on fly puparia, and some on mammals, some species of Oxytelinae are adapted for living in soil litter and decaying vegetable matter. The larvae though not well known, are usually predators and live in the same habitat as the adults, also feed on decaying vegetable and cow dung, human stool etc.

In the present study a total number of 5465 examples of staphylinidae were collected (Table 2). These examples represent 4 subfamilies, 15 genera and 19 species. Amongst the 4 subfamilies, Oxytelinae was the most predominant ones which comprises 7 species under 3 genera and accounted for 83'74% of the total Staphylinidae trapped during this study, whereas the other 3 subfamilies Aleocharinae, Paederinae and Staphylininae were accounted for 15.27% with 5 species under 5 genera, 0'73% with 2 species under 2 genera and 0'24% with 5 species under 3 genera respectively. The abundance of the subfamily, Oxytelinae was mainly supported by the two abundant species of this group viz. Anotylus

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laetus Cameron and A. nitidulus (Gravolly) which were accounted for more than 75% of the total Staphylinidae caught. Moreover, these two species were trapped in every month throughout the study (Table 18). This family mostly caught in fish baited traps constituting 82'79% of the total catches in three areas, whereas in the dung baited and empty pitfall traps it was 15'72% and 1'77% respectively (Table 4). The choice of area of this family was observed paddy field where 2275 examples (41'04%) were trapped followed by tea garden and forest floor where 2081 examples (39'07%) and 1109 examples (20'29%) weretrapped respectivoly (Table 4). The members of this family were fairly abundant from November to April and its maximum seasonal incidence was observed in cold dry winter months (December to February) (Table 7) when average daily maximum and minimum temperatures were recorded 24'12'C and 10'9'C respectively.

Genus Anotylus Thomson, 1861

Thomson, 1861, Skand. Col., 3 : 130

Cameron, 1930, Fauna. Brit. India, 1 : 212

This is one of the largest genus of the subfamily Oxytelinae and distributed throughout the India. The members of this genus are found in forest leaf litter, decaying plant matter and dung. This genus generally includes small to medium sized staphylinid beetles, species are broad to slender, depressed, subcylindrical, body

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moderately sculptured and sparsely pubescence, head constricted behind, antennae with scape constricted at base and parrallel-sided at apex, labrum with anterior margin broadly emarginate, maxillary palpi 4-jointed, prothorax transverse, prosternal process short and carinate, scuttellum concealed under pronotum, elytral epipiural ridge present, mesosternal process short, front tibia and middle tibia with longitidinal row of spines, tarsal formula 3-3-3.

30. Anotylus nitidulus (Gravelly)(PL.VI/30)

Gravelly, 1602, Col. Mic. Brunsv., : 102
Cameron, 1930, Fauna. Brit. India. 1 : 247-248.

Cameron (1930) mentioned that this species was recorded from Mussoorie, Saiya, Kanasar, Deoban, Chakrata : U.P. : Fagu, Naranda, Dauli Ganfa, Almora (Simla district) : Himachal Pradesh, and also from Federated Malaya states, Europe and North America. In the present study this species is being recorded for the first time from West Bengal.

DIAGNOSTIC CHARACTERS :

This species is rather small (length, 2'5-3 mm), body shining, antennae blackish, elytra pitchy, legs testaceous.

Head smaller than prothorax, clypeus depressed and with a few punctures, vertex with a little developed rather short sulcus, medianly finely punctured and sides coarsely and rugosely punctured, antennae with 4th to 10th segments transverse. Prothorax transverse, sides a little rounded

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anteriorly, more or less straight and more retracted behind the middle, and posterior angles rounded, median sulcus narrow, the lateral broader, less deep, slightly curved, surface with close elongate punctures. Elytra slightly broader and longer than the thorax, closely striate and punctured. Abdomen finely punctured and sculpture absent.

In males, posterior region rounded and more or less dilated, 7th abdominal sternite feebly emarginate in the middle. In females, head smaller than males. Post ocular region not dilated, 7th abdominal sternite produced in the middle and rounded.

ECOLOGY :

Anotylus nitidulus (Gravelly) was one of the most abundant species (mean per fortnight : 56'08) amongst the 19 species of Staphylinidae caught during this study. A total number of 1347 examples were trapped. Of the total Staphylinidae caught, over 24% belonged to this species (Table 14). This species was found throughout the year and it was fairly abundant from November to April (Table 18) when over 78% of this species were trapped in three areas. Its maximum incidence was observed during winter months (December to February) when recorded average daily maximum and minimum temperatures were 24'12'C and 10'9'C respectively. This species was mostly collected in fish baited traps, constituting 92.71% of the total catches in three areas (Table 15). In the paddy field it was 62.25%, whereas in the tea garden and forest floor it was 17.31% and

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13.15% respectively (Table 16). Dung baited traps attracted 2.37% in forest floor, '66% in tea garden and '44% in paddy field (Table 16). In empty pitfall trap this species was caught 3.26% in tea garden, '44% in paddy field and '07% in forest floor (Table 16).

The emergence of this species at Dooars area was observed in January and continued throughout the year and its maximum abundance was observed in three peak values in July, November and January in paddy field, whereas the abundance was observed in two peak values in February and March in tea garden and in single peak value in February in forest floor (Fig.22). Besides these minor peak values were also observed in July and December in tea garden.

The area of first choice of this species observed was the paddy field where 850 examples (over 63% of the total catches) were trapped, whereas in the tea garden and forest floor the seasonal incidence was 286 examples (21.24% of the total catches) and 211 examples (15.6% of the total catches) respectively (Table 19 and 19).

REMARKS :

It was observed that this species was one of the common and abundant species of Dooars area of Jalpaiguri district of West Bengal. The highest annual incidence was observed in the following order -

paddy field > tea garden > forest floor.

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It has been observed that the abundance of this species in Doors area was maximum during December to February (45.83%), whereas low incidence was observed during September to November (15.35%), June to August (18.4%) and again in March to May (20.1%) (Table 17). It appeared that the cold dry winter months (December to February) were suitable for this insect emergence when recorded average daily maximum and minimum temperatures were 24'12'C and 10'9'C respectively. The maximum attraction was observed to fish baited traps.

31. Anotylus laetus (Cameron) (PL.VI/31)

Cameron, 1930, Fauna Brit. India. 1 : 252

Cameron (1930) mentioned that this species was recorded from Dehra Dun Malhan range (Siwaliks), Dindihar (Almora) : U.P. Since then author has not seen any published record of this species from India. This species is being recorded here for the first time from Doors area, Jalpaiguri district of West Bengal.

DIAGNOSTIC CHARACTERS :

This species is rather small (length, 3'55 mm.), shining, head brownish except clypeus red, prothorax, elytra and abdomen reddish testaceous, antennae with the first four or five segments testaceous, the following

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reddish, legs testaceous.

Head small and transverse, covered with larger and smaller punctures except clypeus, antennal ridges elevated, clypeus depressed and its front margin rounded, vertex with a small sulcus, antennae with 4th segment about as long as broad, 5th to 10th segments transverse and the penultimate about twice as broad as long. Prothorax transverse, lateral margins parallel, retracted behind, anterior angles broadly rounded, posterior angles obtuse, median sulci deep and narrow, lateral sulci broad, punctures similar as on head. Elytra slightly longer than prothorax and finely striate-punctate. Abdomen impunctate.

In males, head large and slightly broader than prothorax, post ocular region slightly dilated and rounded and about twice as long as curve of the eye and front elevated. In females, head a little smaller than males, slightly narrower than prothorax, post ocular region rounded and scarcely dilated and about half longer than curve of the eye and front less deeply exavated.

ECOLOGY:

Anotylus laetus (Cameron) was the most prevalent species (mean per fortnight : 116.24) amongst the 19 species of Staphylinidae trapped during this study.

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A total number of 2791 examples were trapped. Of the total Staphylinidae caught, over 51% belonged to this species (Table 14). This species was found throughout the year in Dooars area during this study. It was fairly abundant from January to April and its maximum incidence was observed in the month of February (Table 18).

The area of first choice of this species observed was the tea garden where 1519 examples (over 54% of the total catches in three areas during this study) were trapped whereas, in the paddy field and forest floor the seasonal incidence was 1017 examples (36.13%) and 255 examples (9.27%) respectively (Tables 19 and 15).

The emergence of this species in Dooars area began by January and continued throughout the year. The abundance of this species in fish baited traps was observed in three peak values by February, March and April in tea garden whereas, in the paddy field the abundance was observed in three peak values by February, July and December and in the forest floor the abundance was observed in single peak value by February. Besides these, minor peak values in abundance in fish baited traps were also observed in December in tea garden and in March in forest floor. The abundance in dung baited traps was also observed in two peak values by January and March in each of the tea garden and forest floor whereas, in the paddy

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field it was observed in single peak value by February during this study (Fig. 23).

This species was mostly caught in fish baited traps constituting 83.58% of the total catches in three areas (Table 15). In the tea garden it was 41.77% whereas, in the paddy field and forest floor it was 34.78% and 7.02% respectively (Table 16). Dung baited traps attracted of the total catches in three areas (Table 15). In the tea garden it was 12.19% whereas, in the paddy field and forest floor it represented 1.31% and 1.67% respectively. In empty pitfall traps this species was caught 0'61% in tea garden, 0'59% in forest floor and 0'03% in paddy field (Table 16).

REMARKS:

It was observed that this beetle was most common and abundant species of Staphylinidae in Dooars area of Jalpaiguri district during this study. The highest annual incidence was observed in the following order:

tea garden > paddy field > forest floor.

It was observed that the abundance of this species was maximum during December to February (57.32%), whereas, low incidence was observed during September to November (1.52%), June to August (5.89%) and again March to May (31.03%) (Table 17). It appeared that the cold dry winter

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months (December to February) were suitable for this insect emergence when recorded average daily maximum and minimum temperatures were 24'12'C and 10'9'C respectively. Attraction was mainly observed to fish baited traps.

32. Anotylus latiusculus (Kraatz) (PL.VI/32)

Kraatz, 1859, Arch. Naturg., 25(1) : 176

Cameron, 1930, Fauna Brit. India, 1 : 250-251

Cameron (1930) mentioned that this species was recorded throughout the India and Ceylon, and Malayan Archipelago, Formosa, Australia, Aden, East West and South Africa, Egypt and Syria.

DIAGNOSTIC CHARACTERS :

This species is very small (length, 1'5 mm.), black, more or less opague, abdomen a little shining than other parts of the body, antennae blackish with segments 1-4 dark brown, elytra brownish yellow and legs testaceous.

Head flat, narrower than prothorax, post-ocular region not dilated, broadly rounded at base, situated on the same plane, anterior margin truncated, anterior and lateral border margined, vertex with a median short sulcus, on each side of the vertex longitudinally sulcate from base to apex finely punctured, eyes small, antennae

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short, 4 to 10 segments transverse. Prothorx strongly transverse, sides gently rounded from apex to base, posteriorly more retracted and posterior angles rounded, median sulcus deep and narrow, lateral sulcus broader, sides slightly impressed, puncturation similar as on head. Elytra broader and little longer than prothorax, striate, moderately closely and superficially punctured. Abdomen finely punctured.

ECOLOGY:

Anotylus latiusculus (Kraatz) was one of the abundant species (mean per fortnight : 15) amongst all of the 19 species of Staphylinidae trapped during this study. A total number of 360 examples were trapped. Of the total Staphylinidae caught, over 6% belonged to this species (Table 14). This species was found only January to March and December throughout the study and its maximum incidence was observed in the month of January (Table 18).

The area of first choice of this species observed was the paddy field where 328 examples (over 91% of the total catches in three areas) were trapped, whereas in the forest floor and tea garden the seasonal incidence was 18 examples (5%) and 14 examples (3.88%) respectively (Tables 19 and 15).

The abundance of this species was observed in two

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peak values in fish baited traps at paddy field in January and March (Fig. 24)., whereas in the forest floor and tea garden the highest seasonal incidence was observed in the month of December and February respectively.

This species was mostly trapped in fish baited traps constituting 92.77% of the total catches in three areas (Table 15). In the paddy field it was 89.44%, whereas in the forest floor and tea garden it was 2.7% and 0'5% respectively (Table 16). Dung baited traps attracted 5.3% in the tea garden, 2.2% in the forest floor and 1.6% in the paddy field. In empty pitfall trap this species was caught 0'0% in each of the three areas (Table 16).

REMARKS :

It was observed that Anotylus latiusculus (Kraatz) was one of the abundant species of staphylinidae trapped in Dooars area during this study. It was found that this specis was only present during the winter months (December to February) and early part of the hot dry months (March only). The recorded average daily maximum and minimum temperatures of cold dry winter months and hot dry months were 24'12'C and 10'9'C, and 29'6'C and 18'4'C respectively. It was observed that with the increase of temperature in the hot pre-monsoon months there was a gradual fall in catch and ultimately this species disappeared during monsoon and post monsoon months. It appeared that the cold dry winter months were favourable for this insect emergence. Maximum attraction was found in fish baited traps.

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33. Anotylus frater (Cameron) (PL.VI/33).

Cameron, 1930, Fauna Brit. India, 1 : 262

Cameron (1930) mentioned that this species was recorded from Dehra Dun, Mussorie, Chakrata : U.P. and Simla district, Himachal Pradesh. In the present study this species is being recorded for the first time from West Bengal.

DIAGNOSTIC CHARACTERS :

This species is small (length, 2'75 - 3 mm.), body more or less shining black, antennae with 1-4 segments brownish and legs reddish testaceous.

Head small and transverse, posterior angles broadly rounded, base emarginate, clypeus depressed and separated from front by a curve line, vertex with a small fovea, on either side of vertex with longitudinal sulcation surface impunctate but coarsely coraceous. Antennae with segment 4 slightly longer than broad, segments 5 to 10 more or less transverse. Prothorax not distinctly punctured, rather coarsely striate and rugose, sulci distinct, sides straight and retracted behind, posterior angles gently rounded. Elytra slightly longer and broader than prothorax, evenly and asperately punctured and indistinctly striate. Abdomen minutely and more or less closely punctured.

In males, head broad as prothorax, temples slightly dilated about as long as eye and vertex deeply sulcate. In females, head smaller than prothorax, temples parallel,

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slightly shorter than the length of eye, vertex more narrowly sulcate.

ECOLOGY:

Anotylus frater (Cameron) was totally absent from forest floor. Only a total number of 11 examples of this species were trapped (Table 14). In the tea garden, 9 examples were attracted to dung baited traps in the months of February and in the paddy field, 2 examples were attracted to fish baited traps in the month of December (Table 18).

REMARKS:

It was observed that this species was less abundant in Dooars area during this study. Only 11 examples were trapped of which highest incidence was observed in the cold dry winter season. Maximum attraction was observed to dung baited traps.

34. Anotylus sikkimi (Fauvel) (Pl. VI/34).

Fauvel, 1905, Rev. d'Ent., 24 : 115

Cameron, 1930, Fauna Brit. India, 1 : 242

Cameron (1930) mentioned that this species was recorded from Sikkim and Darjeeling. This species is being recorded for the first time from Dooars area of Jalpaiguri district of West Bengal.

DIAGNOSTIC CHARACTERS :

This species is rather small and broad (length,

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3'80 mm), black, shining, elytra reddish brown, antennae blackish and segments 1-4 yellowish, legs testaceous.

Head slightly broader than prothorax, post ocular region broadly rounded, clypeus slightly depressed and distinctly coriaceous, and front margin rounded, transversely slightly elevated between the antenal tubercles, vertex with a median and a pair of sulcus on each sides, vertex striate and its sides covered with distinct punctures, antennae rather short, 4th segment small, 5th to 10th segments transverse, the penultimate segment about three times as broad as long. Prothorax transverse, lateral margins rounded infront, posterior angles obtuse, sulci rather broad and deep, sides coarsely striate and punctured but sulci less striate, sides rather deeply impressed. Elytra slightly longer than prothorax and closely striate and punctured. Abdomen finely rather closely punctured.

ECOLOGY :

A total cumber of 52 examples of this species (mean per fortnight : 2'16) were trapped during this study. Of the total Staphylinidae caught, 0'95% belonged to this species (Table 14). This species was collected only during cold dry winter months (December to February). Its maximum incidence was observed in the month of December (Table 18).

This species attracted only to fish baited traps. None of this species was trapped dung baited as well as empty pitfall traps (Table 15). The area of first choice of

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this species observed was forest floor where 48 examples (92.3%) were caught, whereas in the tea garden and paddy field the seasonal incidence was 3 (5.7%) and 1 (1.92%) example respectively (Tables 15 and 19).

REMARKS :

It was observed that this species was common in forest floor than tea garden and paddy field of Doors area. Its seasonal incidence was observed only in cold dry winter months. It was also observed that this species was only attracted to fish baited traps (Table 15).

Genus Philonthus Curtis, 1825

Curtis, 1825, Brit. Ent., 13 : 610
Cameron, 1932, Fauna. Brit. India, 3 : 62-64

This is the largest genus of the subfamily Staphylininae and widely distributed throughout India and its habitat is dung, carrion, vegetable debris, in marshes, stream banks and under bark of decayed trees. So far, 120 species have been recorded from India. Members of this genus are generally more or less elongate, shining, head constricted behind, gular sutures united behind and diverging in front, labrum transverse and deeply bilobed, mandibles long and slender, usually with a tooth internally and outer border longitudinally sulcate. Thorax parallelsided, on each side of the disc with a row of two or more punctures. Elytra not

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extending much beyond the metasternum. Abdomen not keeled below at the base.

This genus is close to Hesperus Fauvel and can be easily separated from the latter by its superior lateral line of thorax slightly deflexed.

35. Philonthus eustilbus Kraatz (PL.VI/35)

Kraatz, 1859, Arch. Naturg., 25 (i) : 98

Cameron, 1932, Fauna Brit.India, 3 : 150-151

Cameron (1932) mentioned that this species was recorded from Derhadun (U.P.) and Belligam (Ceylon). Since then author has not seen any published record of this specis. This is the first time, this species is being recorded from Dooars area, West Bengal.

DIAGNOSTIC CHARACTERS :

This is rather large species (length, 8mm), black shining, antennae black, first segment slightly testaceous, thorax multipunctate laterally, legs reddish-yellow, abdomen strongly iridescent, and margin of the posterior ventral segments nearly reddish.

Head transverse, sub-orbicular, narrower than the thorax, eyes large, post ocular region smaller in length than diametre of the eyes, without median interocular punctures, with juncta-ocular punctures on either side and with three prominent punctured behind the eyes. Antennae with 3rd segment slight longer than 2nd,

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4th to 10th segments slightly longer than broad and the 11th as long as broad. Thorax as long as broad, sides parallel, posterior angles gently rounded, disc on either sides of the middle with a somewhat irregular row of ten or eleven punctures and sides finely punctured. Elytra scarcely longer but a little broader than thorax, distinctly pubescent and finely punctured. Abdomen strongly iridescent, narrowed posteriorly and strongly punctured. Pubescent rather long and sparing.

ECOLOGY :

Philonthus gustilbus Kraatz was only trapped in forest floor of Dooars area. During this study only a total number of 2 examples of this species were caught in fish baited trap in the month of February (Table 18).

REMARKS:

It was observed that this species was restricted to forest floor and attracted to fish baited trap only.

36. Philonthus assamensis Cameron (PL.VI/36)

Cameron, 1932, Fauna Brit.India, 3 : 100

Cameron (1932) reported its distribution from Manipur. Since then author has not seen any published record of this species. This is the first time that this species is being reported from Dooars area of Jalpaiguri district, West Bengal.

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DIAGNOSTIC CHARACTERS:

This species is rather small (length. 6 mm.), shining, black, antennae reddish brown, 1st segment testaceous, thorax red, legs reddish-yellow.

Head narrower than the thorax and sub-quardrate, eyes rather large, more or less as long as post-ocular region, near posterior angles densely and coarsely punctured. Antennae with 4th to 6th segments a little longer than broad. Thorax anteriorly narrower and longer than broad, disc with four dorsal row of punctures. Elytra slightly broader than thorax, closely, finely punctures and pubescent. Abdomen less shining, closely finely punctured and pubescent.

ECOLOGY:

Philonthus assamensis Cameron was only trapped in paddy field during this study. A total number of 6 examples were trapped in dung baited traps, of which 5 examples were in the month of July and 1 example was in the month of December (Table 18).

REMARKS:

It was observed that this species was restricted to paddy field and only attracted to dung baited traps.

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Genus Proteinus Latreille, 1796

Latreille, 1796, Prec. Car. Ins., : 9

Cameron, 1930, Fauna Brit. India, 1 : 123-124

This genus is small group of the sub-family Oxytelinae and distributed throughout the India under stones, in manure heaps and vegetable debris, some are associated with ants. 2 species are reported from India. Members of this genus are mostly small and slender, head transverse, narrower than thorax, antennae with first two segments stout, labrum strongly transverse, mandible stout and pointed, maxillaty palpi 4-jointed and labial palpi 3-jointed, tongue broad and membranous, prosternum broad and short, metasternal process narrow and pointed, tarsi 5-5-5.

37. Proteinus fuscotestaceus Cameron (PL.VI/37)

Cameron, 1924, Tr. Ent. Soc. Lond., : 162

Cameron, 1930, Fauna Brit. India, 1 : 125

DIAGNOSTIC CHARACTERS:

This species is small (length, 1.4 mm.), oval, shining, dark yellow, head black, antennae testaceous, the last four segments blackish, legs testaceous.

Head subtriangular, transverse, narrower than thorax, eyes prominent, vertex foveate on either side, impunctate.

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Antennae with first two segments stout and unequal. Thorax strongly transverse, widest about the middle, the sides slightly rounded infront and narrower behind, posterior angles rectangular, median with a fine line, sparsely punctured. Elytra broadered and more than twice as long as the thorax, coarsely and closely punctured. Abdomen narrowed, finely punctured.

ECOLOGY :

Proteinus fuscotestaceus Cameron was only trapped in forest floor during this study. Only a total number of 9 examples were trapped in fish baited traps in the month of January (Table 18).

REMARKS:

This species was restricted to forest floor during this study and attraction was observed only in fish baited traps.

Genus Leptacinus Erichson, 1839

Erichson, 1839, Kaf. Mark Brand., : 429

Cameron, 1932, Fauna Brit. India, 3 : 6-7

This genus belongs to the subfamily Staphylininae and distributed throughout the India. Generally they are found under stones, vegetables debris and some are asaociated with ants. Members of this genus are generally characterised by mostly small in size and slender, median

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frontal and lateral sulci well marked, labrum rather small and transverse, mandibles stout and pointed, maxillary palpi 4-jointed and labial palpi 3-jointed, tongue small and membranous, neck plate of prosternum rounded in front, prosternum short, truncate behind, tarsi 5-5-5, anterior tarsi simple.

38. Lentacinus notabilis Cameron (PL.VII/38).

Cameron, 1926, Trans. Ent. Soc. Lond. : 342

Cameron, 1932, Fauna Brit. India, 3 : 11

DIAGNOSTIC CHARACTERS :

This species is small (length, 3.4 mm.), narrow, elongate, pitchy-black, shining, posterior margin of 6th segment narrowly and 7th segment of abdomen yellowish, antennae and legs testaceous.

Head oblong, wider than the thorax, frontal furrows well marked, lateral very short, surface coarsely and not closely punctured. Antennae with segment 3 shorter than segment 2, segments 4-10 transverse. Thorax long and narrow, lateral sides emarginate behind the middle, disc on either side with ten punctures, at the sides with a curve row of seven and three behind the anterior angles. Elytra as long as but broader than thorax. Abdomen very finely punctured.

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ECOLOGY:

Leptacinus notabilis Cameron was trapped in paddy field during this study. None of this species was trapped in both of the forest floor and tea garden. Only a total number of 2 examples were trapped in fish baited traps in the month of July (Table 18).

REMARKS:

This species was restricted to paddy field during this study and attracted to fish baited traps only.

Genus Oxytelopsis Fauvel, 1895

Fauvel, 1895, Rev. d'Ent., 14 : 199

Cameron, 1930, Fauna Brit. India, 1 : 203-204.

Representatives of this genus of the subfamily Oxytelinae usually found in debris in damp places. Species are generally small with head transverse and small eyes, prominent, antennae short, temples constricted behind, neck broad, labrum transverse, maxillary palpi 4-jointed and labial palpi 3-jointed, mesosternum simple and its process short, metasternal process rather long, tibiae sulcate externally, tarsi 3-3-3.

This genus is closely related to Deloposis Fauvel but can be easily separated from the latter genus by its antennae being short and clavate.

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39. Oxytelopsis pseudopsina Fauvel (PL.VII/39)

Fauvel, 1895, Rev. d'Ent., 14 : 201

Cameron, 1930, Fauna Brit. India, 1 : 206-207

Cameron (1930) mentioned that this species was recorded from Dehra dun, Mussoorie (U.P.), Carin Asciuii Ghecu (Burma), Malay peninsula, Sumatra, Java and Borneo. Very recently, Biswas and Sengupta (1980) reported this species from Darjeeling : West Bengal and Meghalaya. This species is being reported here for the first time from Dooars area of West Bengal.

DIAGNOSTIC CHARACTERS :

This species is rather small (length 2'5 - 2'75 mm.), red, slightly shining, antennae, mouth-parts, legs reddish testaceous and abdomen obscure reddish testaceous.

Head narrowly transverse, sub-orbicular and narrower than thorax, eyes rather prominent, post ocular region gently rounded to neck, dorsal surface densely punctured, clypeus with a circular impression, the area within coarsely punctured. Prothorax transverse, anteriorly bisinute, sides rounded, posteriorly slightly narrowed and a little sinute near hind angles, lateral margins finely denticulate, disc with median sulcus wider in front and on the either with a broader obsolete one. Elytra longer than thorax, transverse and with asperate sculpture.

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Abdomen finely and closely punctured.

ECOLOGY:

Oxytelopsis pseudopaina Fauvel was collected from forest floor and paddy field. A total number of 9 examples were caught during this study (Table 14), 7 examples collected from paddy field, of which 5 were trapped in November and 1 example trapped each in September and October, whereas in the forest floor 2 examples were caught in January. This species was attracted maximum to fish baited traps (66%) than dung baited traps (11%) (Table 16).

REMARKS:

It has been observed that this species was less abundant and absent from tea garden in Dooars area during this study. The highest incidence was observed in the month of November in paddy field.

Genus Staphylinus Linnaeus, 1758

Linnaeus, 1758, Syst. Nat. ed., 10 : 421

Cameron, 1932, Fauna Brit. India, 3 : 179-181

This is one of the largest genus of the subfamily Staphylininae and widely distributed throughout India frequently on the ground, under stone, in dung, decaying fruit. So far, 34 species have been recorded from India.

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Members of this genus are generally elongate, more or less parallel, rather large species, head in variable shape, labrum transverse and bilobed, mandibles variable, with or without teeth. Thorax more or less trapezoidal, the superior lateral line strongly deflexed in front. Anterior tibiae with or without spines externally but middle and posterior strongly spinose, anterior tarsi with the first four joint strongly dilated.

This genus is closely related to Stevensia Cameron and can be easily separated from the latter by its mandibles sulcate externally.

40. Staphylinus maculicornis Kraatz

Kraatz, 1859, Arch. Naturg., 25(1) : 77

Cameron, 1932, Fauna Brit. India, 3 : 196

Cameron (1932) mentioned that this species was recorded from Mussoorie, Dehra dun (U.P.) and Pusha (Bihar). Since then author has not seen any published record of this species. This species is being recorded for the first time from Dooars area of Jalpaiguri district, West Bengal.

DIAGNOSTIC CHARACTERS :

This species is large (length, 12'5 mm.), more or less opaque and blackish, head, thorax and elytra variegated with more or less obscure purple, scutellum blackish,

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abdomen a little iridescent, sides with scattered yellowish hairs, antennae and femora deep brownish, tibiae and tarsi reddish.

Head slightly transverse, sub-quadrate, narrower than prothorax, eyes large than temples and deeply rugosely punctured and sparsely pubescent, antennae with 4th to 10th segments transverse and gradually broader than the precedings. Thorax broader than head, more or less transverse, sides nearly straight, hind angles rounded. Elytra more or less finely but roughly punctured, sparingly pubescent except behind. Abdomen rather finely closely punctured, pubescent.

ECOLOGY:

Stenhylinus maculipennis Kraatz was only trapped at forest floor. Only one example of this species was caught in dung baited trap in the month of January (Table 18).

REMARKS:

This species has been observed less abundant in Dooars area during this study.

41. Stenhylinus sp.

Stenhylinus sp. was totally absent from forest floor. A total number of 2 examples were trapped during this

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study. In the tea garden 1 example was trapped in dung baited trap in May and in the paddy field 1 example was trapped in empty pitfall trap in December (Table 16).

REMARKS:

This species was also less abundant like S. maculipennis Kraatz in Doaars area during this study.

Genus Scopaeus Erichson

Erichson, 1939-40, Gen. Spec. Staph., : 604

Cameron, 1931, Fauna Brit. India, 2 : 169-170

This is the largest genus of the subfamily Paederinae and widely distributed throughout India, usually found in damp places, leaf litter and haystack. So far, 24 species have been recorded from India. Members of this genus are generally slender and very small to medium size beetles, head quadrate or oblong, antennae slender, gular suture parallel, maxillary palpi 4-jointed and labial palpi 3-jointed, labrum quadridentate, posternum well developed, its process carinate, mesosternum narrowed infront forming a neck, its process very short, acute, free, abdomen keeled below the base, tarsi 5-jointed and 4th tarsal joint simple.

This genus is close to Stilicus Berthold and can be easily separated from the latter by its labrum having 4 denticulations.

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42. Scopaeus nitidulus Motschulsky (PL.VII/40).

Motschulsky, 1858, Bull. Mosc., 31(ii) : 643

Cameron, 1931, Fauna Brit. India, 2 : 174-175

Cameron (1931) mentioned that this species was recorded from Ceylon, Malay Peninsula, Sumatra and Philippines. This species is being recorded here for the first time from Dooars area of Jalpaiguri district, West Bengal.

DIAGNOSTIC CHARACTERS:

This species is small (length, 3 mm.), body shining, head and thorax reddish, elytra yellowish red, abdomen less shining, brownish, antennae and legs reddish yellow.

Head quadrate, broader than thorax, finely and sparsely punctured, antennae with 3rd to 7th segments a little transverse. Prothorax oval and longer then broad, sculptured and pubescent, basal part with a median keel and its sides depressed. Elytra slightly longer and broader than prothorax and with a few punctures. Abdomen very finely rather sparsely punctured and pubescent.

ECOLOGY:

Scopaeus nitidulus Motschulsky was found in paddy field and forest floor during this study. Only 2 examples were caught, one each in fish baited trap and dung baited trap. In the forest floor this species was trapped in the month of March, whereas in the paddy field it was trapped in the month of January (Table 18).

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REMARKS:

It was observed that this species was less abundant in Dooars area during this study and absent from tea garden.

Genus Thinocharis Kraatz, 1859

Kraatz, 1859, Arch. Naturg., 25(1) : 142

Cameron, 1931, Faune Brit. India, 2 : 117-118

The genus belongs to the subfamily Paederinae and found in decaying wood, fungus, leaf litter etc. The representatives of this genus are generally small and slender, first two segments of antennae thickened and rest very slender, gular sutures parallel, labrum transverse, the sides and anterior angles broadly rounded, maxillary palpi 4-jointed and labial palpi 3-jointed, mentum transverse and trapezoidal, lingula broad and membranous, prosternum rather short, mesosternum produced into a neck infront, tarsi 5-5-5 with joints 4 simple.

43. Thinocharis debilis Cameron (PL.VII/41).

Cameron, 1931, Faune Brit. India, 2 : 119

Cameron (1931) described this species and mentioned that this species was recorded from Siwaliks, Nahraunda (Himachal Pradesh). Since then author has not seen any published record of this species. This species is being recorded here for the first time from Dooars area of Jalpaiguri district of West Bengal.

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DIAGNOSTIC CHARACTERS :

This species is very small (length, 1'8 mm) body slightly shining, head blackish, thorax, elytra and abdomen reddish brown, antennae and legs yellowish.

Head small, sub-quadrate, very finely and rather distantly punctured, temples parallel, posterior angles broadly rounded, eyes small, antennae with segments 1 and 2 very stout and rest slender. Prothorax narrower than head, lateral margins parallel and slightly narrowed behind, finely punctured. Elytra slightly longer than prothorax and finely punctured. Abdomen very finely and closely punctured.

ECOLOGY :

Thinocharis debilis Cameron was totally absent from both of the tea garden and paddy field in Dooars area during this study. A total number of 38 individuals were caught (mean per fortnight : 1'58). Of the total Staphylinidae caught, 0'69% belonged to this species (Table 14). This species was collected during the post-monsoon (September to November) and winter months (December to February). Its maximum incidence was observed in the month of January when 68% of the total catches of this species were trapped.

Attraction was observed maximum to dung baited traps where 92.01% of the total catches of this species were trapped. None of this species was trapped in empty pitfall trap. Fish baited traps attracted 7.99% of the total catches (Table 15).

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REMARKS :

It was observed that this species was trapped only in the forest floor and its abundance was observed in cold dry winter months when average daily maximum and minimum temperatures were recorded 24'12'C and 10'9'C respectively.

Genus Cordalia Jacobs, 1924

Jacobs, 1924, Ent. Zeitschr. (Frankfurt), 38 : 82
Cameron, 1939, Fauna. Brit. India, 4(1) : 235-236.

This genus belongs to the sub-family Alaocharinae and found in vegetable debris rotten wood etc. So far, 3 species are recorded from India. The members of this genus are generally characterised by its shape parrallel, head exserted, temples not bordered, maxillary palpi 4-jointed and labial palpi 3-jointed, toungue short and broad, pronotal epiplura not visible from the sides, tarsi 4-5-5.

44. Cordalia vestita Bohemann (PL.VII/42)

Bohemann, 1858, Eugen. Resa. Ins. Col., : 25
Cameron, 1939, Fauna. Brit. India, 4(1) : 237-238

DIAGNOSTIC CHARACTERS :

This species is small (length, 2.2 mm), shining, reddish brown, the 4th and 5th visible abdominal segments blackish, antennae reddish brown, 1st, 2nd and 11th segments lighter, legs reddish yellow.

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Head strongly transverse, rounded, convex, a little narrower than thorax, finely punctured, antennae rather stout, segments 2 and 3 of equal length, segment 4 slightly longer than broad. Thorax cordiform, a little transverse, sides rounded, anterior portion dilated, retracted behind, disc with a rounded deep sulcus, finely punctured. Elytra convex, distinctly broader than thorax, at the base between the shoulder and scutellum vertically impressed, sides rounded, finely punctured. Abdomen with first three visible segments transversely impressed at the base. The whole insect closely covered with a long semi-erect, greyish pubescence.

ECOLOGY :

Cordalia vestita Bohemann was one of the predominent species (mean per forthight : 4'87) amongst the 19 species of Staphylinidae trapped throughout the study. A total number of 117 examples were trapped. Of the total Staphylinidae caught, over 2% belonged to this species (Table 14). This species was not found in the post-monsoon months (September to November) and its maximum incidence was observed during January to April (Table 18).

The area of first choice of this species observed was the tea garden where 90 examples (76.92%) were trapped, whereas in the paddy field and forest floor the seasonal incidence was 23 (19.65%) and 4 (3.41%) examples respectively (Tables 19 and 15). This species was attracted 94.01% to dung baited traps. In the tea garden it was 70.94%, whereas

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in the paddy field and forest floor it was 19.65% and 3.41% respectively (Table 16). None of this species was attracted to fish baited traps. In empty pitfall traps this species was caught 5.98% in the tea garden (Table 15).

The emergence of this species was observed by January and its abundance was observed in single peak value in March in tea garden in dung baited traps (Fig.25). Besides these minor peak values were observed in April, July, January, February in tea garden. In the paddy field the abundance was observed in the month of February and in forest floor 4 examples were caught in December (Table 18).

REMARKS :

This species was observed common in the tea garden and mostly attracted to dung baited traps. The annual incidence was observed in the following order -

tea garden > paddy field > forest floor.

It has been observed that the abundance of this species was maximum during March to May (hot dry pre-monsoon months) 59.82%, whereas during December to February (cold dry winter months) it was 33.34% and again low incidence was observed during June to August (monsoon months) 6'84% (Table 17). It appeared that hot dry pre-monsoon months were suitable for this insect emergence when recorded average daily maximum and minimum temperatures were 29'6'C and 18'4'C respectively.

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Genus Phymatura Sahlberg, 1876

Sahlberg, 1876, Enum. Col. Brach. Fenn., : 85

Cameron, 1939, Fauna Brit. India, 4(1) : 217-218

This genus belongs to the sub-family Aleocharinae and distributed throughout Jammu & Kashmir and West Bengal (Darjeeling district) in fungus. So far, 4 species are recorded from India. The members of this genus are characterised by its medium size, and rather convex, head narrowed behind, eyes large, temple bordered below, labrum transverse, mandibles rather slender and pointed, maxillary palpi 4-jointed, and labial palpi indistinctly 3-jointed, tongue narrow, thorax transverse, pronotal epipleura not visible from side, mesosternum finely keeled in the base, legs slender and tarsi 4-4-5.

This genus is closely related to Bolitochara Mannerh. but can be easily separated by its labial palpi indistinctly 3-jointed and toungue not bifid.

45. Phymatura intermedia Cameron (PL. VII/43)

Cameron, 1939, Fauna Brit. India, 4(1) : 221

Cameron (1939) mentioned that this species was recorded from Rongdong Valley, Choom, Lepchajagat, Darjeeling district, West Bengal. This species is being recorded here for the first time from Dooars area, Jalpaiguri district, West Bengal.

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DIAGNOSTIC CHARACTERS :

This species is closely related to P. jucunda Cameron but differs from the latter species by the following characters : species longer, shining, pale yellow, head black, pronotum bright ferreginous-red to dark brown, antennae pale but segment 11 bright reddish yellow.

In the males, the elytra devoid of tubercles, 7th and 8th tergites with a minute tubercle and with 6 median small denticulate processes, and on either side with a longer tooth.

ECOLOGY :

Phymatura intermedia Cameron was common in the tea garden during this study. A total number of 93 examples of this species (mean per fortnight : 3'45) were trapped during this study. Of the total Staphylinidae caught, over 1% belonged to above species (Table 14). This species was found only in the cold dry winter months and pre-monsoon months and its maximum incidence was observed during February and March (Table 18).

The area of first choice of this species observed was the tea garden where 72 examples (over 77% of the total catches) were trapped, whereas in the forest floor and paddy field the seasonal incidence was only 9 (19.35%) and 2 (3.21%) examples respectively (Tables 19 & 15). The abundance of this species was observed in two peak

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values by February and March in the tea garden in dung baited traps (Fig. 26). In the forest floor and paddy field maximum incidence was observed in December.

This species was mostly trapped in dung baited traps constituting 99.72% of the total catches in three areas (Table 15). In tea garden it was 75.27%, whereas in the forest floor and paddy field it was 19.35% and 1.07% respectively. Fish baited traps attracted only 2.14% in paddy field. In empty pitfall traps this species was caught 0'0% in each of the three areas. (Table 16).

REMARKS :

It was observed that this species was mostly trapped in dung baited traps and most common in the tea garden. The annual incidence was observed in the following order -

tea garden > forest > paddy field.

It has been observed that the abundance of this species in Dooars area was maximum during March to May (60.24%), whereas during December to February it was 39.75%. It has been observed that during June to November there was a sudden fall of catch and ultimately this species disappeared (Table 17).

Genus Microdotta Kraatz, 1862

Kraatz, 1862, Berl. Ent. Zeitschr., 6 : 300

Cameron, 1939, Fauna. Brit. India, 4(2) : 621-622

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Representatives of this genus under the subfamily Aleocharinae are generally found in ants and birds nests. So far, one species is recorded from India. Members of this genus are generally medium size, head concealed by the thorax, eyes large, temples bordered below, maxillary palpi 4-jointed and labial palpi 3-jointed, tongue narrow and simple. Thorax transverse, pronotal epipleura not visible from the side. Elytra a little longer than thorax. Abdomen rather parallel. Legs rather short, tarsi 5-5-5.

46. Microglotta sp. (PL.VII/44)

Microglotta sp. was one of the abundant species (mean per fortnight : 17'49) amongst all of the 19 species Staphylinidae trapped during this study (Table 14). A total number of 420 examples were trapped. Of the total Staphylinidae caught, over 7% belonged to above species (Table 14). This species was found only from January to April and again in December during this study and its maximum incidence was observed during December and again in January to February (Table 18).

This species was mostly trapped in fish baited traps constituting 86.42% of the total catches in three areas (Table 15). In the forest floor it was 79.28%, whereas in the tea garden and paddy field it was 6.42% and 0'7% respectively (Table 16). Dung baited traps attracted 6.19% in the garden, 5.25% in paddy field and 1.19% in forest

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floor. In empty pitfall traps this species was caught 0'95% in the tea garden, whereas none was trapped in forest floor and paddy field (Table 16).

The abundance of this species was observed in single peak value in February in the forest floor and also in single peak value in March in the tea garden. Besides these minor peak values were also observed in December in forest floor and in February in tea garden (Fig. 27). In paddy field this species was observed only in February, April and December throughout the year during this study and its maximum incidence was observed in the month of February.

The area of first choice observed was the forest floor where 339 examples (over 80% of the total catches) were trapped, whereas in the tea garden and paddy field the seasonal incidence was 57 (13.57%) and 25 (5.95%) respectively (Tables 19 and 15).

REMARKS :

It was observed that this species was one of the abundent species of Staphylinidae trapped in Doors area during this study. The highest annual incidence was observed in the following order -

forest floor > tea garden > paddy field.

It has been observed that the abundance of this species

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in Dooars area was maximum during December to February (95.24%), whereas low incidence was observed during March to May (4.76%) and nil during June to August and September to November (Table 17). It appeared that the cold dry winter months were suitable for this insect emergence when recorded average temperatures (maximum & Minimum) were 24'12'C & 10'7'C respectively. In the hot dry season (March to May) there was sudden fall of catch and ultimately it became nil during monsoon months (June to August) and post monsoon months (September to November) when average recorded monthly rainfall was 625'5 cm and 237'5 cm respectively. Maximum attraction was observed to fish baited traps.

Genus Aleochara Gravenhorst, 1802

Gravenhorst, 1802, Col. Micr. Brunsv., : 67

Cameron, 1939, Fauna. Brit. India, 4(2) : 623-625

This is one of the largest genus of the subfamily Aleocharinae and found in dung, decaying fungi and nests of burrowing mammals. Members of this genus are narrower in front, convex and robust, head small and concealed by thorax, labrum transverse, mandibles stout, maxillary palpi 5-jointed and labial palpi 4-jointed, toungue broad and short, pronotal epiplura not visible from the sides, tarsi 5-5-5.

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47. Aleochara castanea Motschulsky (PL.VII/45)

Motschulsky, 1858, Bull. Soc. Nat. Mosc., 31(3) : 239

Cameron, 1939, Fauna. Brit. India, 4(2) : 631-632

DIAGNOSTIC CHARACTERS :

This species is broad (length, 6'75 mm), shining, black, antennae with first four segments reddish yellow and rest reddish, legs reddish yellow.

Head small and transverse, surface finely punctured, eyes large. Pronotum distinctly broader than head and slightly transverse, convex, anterior margin narrowed, surface densely and finely punctured. Elytra as long as pronotum and distinctly transverse, puncturation similar to that of pronotum. Abdomen parallel and gradually narrowed behind, finely punctured. Species covered with dense pubescence.

ECOLOGY :

Aleochara castanea Motschulsky was one of the abundant species (mean per fortnight : 7'95) amongst all of the 19 species of Staphylinidae caught during this study. A total number of 191 examples were trapped. Of the total Staphylinidae caught, over 3% belonged to this species (Table 14). This species was found throughout the year except, post monsoon months (September to November) and its maximum incidence was observed during January to March (Table 18).

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This species was mostly trapped in fish baited traps constituting 96.89% of the total catches in three areas (Table 15). In the forest floor it was 82.19%, whereas in the tea garden and paddy field it was 13.61% and 1.04% respectively (Table 16). Dung baited traps attracted 3.14% in forest floor only. None of this species was caught in empty pitfall traps (Table 15).

The area of first choice of this species observed was the forest floor where 163 examples (over 85% of the total individuals catches) were trapped, whereas in the tea garden and paddy field the seasonal incidence were 26 (13.61%) and 2 (1.04%) respectively (Tables 19 and 15).

The abundance of this species was observed in single peak value in February in the forest floor and in the tea garden two peak values were observed in the month of February and March. Besides these minor peak values in abundance was observed in April in tea garden (Fig. 28). In the paddy field only 2 examples were trapped, one each in April and July.

REMARKS:

It was observed that the fortnightly incidence of this species was more abundant in cold dry winter months than pre-monsoon and monsoon months. In the post monsoon months none of this species was trapped amongst all of the

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three areas. In the cold dry winter months (December to February) the abundance of this species was 63.75%, whereas in the premonsoon months (March to May) and in the monsoon months (June to August) the abundance was 36.49% and 2.61% respectively (Table 17). It appeared that the cold dry winter months were suitable for this insect emergence. Attraction was observed maximum to fish baited traps and the species prefered forest floor than tea garden and paddy field.

Genus Dinusa Sauley, 1864

Sauley, 1864, Ann. Soc. Ent. Fr., (4), IV : 433

Cameron, 1939, Fauna Brit. India, 4 (2) : 530

This is one of the smallest genera of the subfamily Alecocharinae. So far, only 1 species has been recorded from India (Uttar Pradesh). Members of this genus are generally convex, broad in front, narrowed behind, head small much narrower than thorax, antenna 11-segmented and its segments variable in length, labrum transverse, mandible short and stout, right mandible with a distinct tooth at the middle and left angulate at the middle, maxillary palpi 4-jointed and labial palpi 3-jointed, thorax strongly transverse, prosternum short, mesosternum acute extending nearly whole length of the coxae, elytra shorter than thorax, abdomen short, legs slender, tibiae ciliate and tarsi 5-5-5.

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48. Dinusa heimi Wasmann (PL. VII/46)

Wasman, 1912, Zeitschr. Wiss. Zool. Ci. : 97

Cameron, 1939, Fauna Brit. India. 4(2) : 581

DIAGNOSTIC CHARACTERS :

This species is small (length, 2 mm.) convex and narrowed behind. Head small and narrower than thorax. Eyes moderate, temples not bordered below. Antennae 11-jointed, labrum transverse, angles rounded. Mandibles short and stout, pointed. Maxillary palpi 4-jointed, labial palpi 3-jointed, tongue rather narrow. Thorax strongly transverse, bordered behind, pronotal epipleura not visible from the side. Elytra not longer than thorax. Abdomen short. Lengs slender, rather long, tibiae ciliate, tarsi 5-5-5.

ECOLOGY :

Dinusa heimi wasmann was mostly trapped in fish baited traps. A total number of 12 examples were caught during this study. Of the total Staphylinidae caught, 0'21% belonged to this species (Table 14). This species was trapped in pre-monsoon months, monsoon months and post-monsoon months during this study.

The attraction to fish baited traps of this species constituted 75% of the total catches in three areas (Table 15). In the paddy field and tea garden it was 33.33% each, whereas in the forest floor it was 8.33%. Dung baited traps

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attracted 25% in the paddy field only (Table 16). In empty pitfall trap none of this species was caught. The area of first choice observed was paddy field (58.33%) followed by tea garden (33.33%) and forest floor (8.33%) (Table 19).

REMARKS:

It was observed that this species was mostly caught in the paddy field and attracted mainly to fish baited traps.

3. Family : Ptiliidae

These are the smallest of all beetles and commonly known as feather-wing beetles. Johnson (1972 a) mentioned that approximately 450 described species are known from the world. Cieki (1911) listed 6 species from Indian region, latter Johnson (1970 a, 1970 b, 1970 c and 1972 b) added 9 species, 3 from Nepal, 2 from Sikkim, 2 from Ceylon and 2 from Uttar Pradesh. They are rounded or oval, usually dark coloured and densely pubescent. Head with 11-segmented antennae, antennal insertions lateral, 2- or 3- segmented loose club; maxillae exposed at base. Prothorax with front prominent and contiguous, middle coxae separated. Tarsal formula 3-3-3, two basal segments very small. Elytra often truncate, wing feather-like because of a narrow body fringed with long hairs. The ptiliid live usually in rotton wood, dung,

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fungus covered log, or decomposed plant materials, where they are said to feed on the spores of fungi.

In the present study a total number of 671 examples of Ptiliidae were collected (Table 2). These examples represent only single species under the genus Acrotrichis Motschulsky.

Genus Acrotrichis Motschulsky, 1868

Motschulsky, 1868, Bull. Soc. Nat. Moscou., 41 : Part 2 : 177

This is the largest genus of the family Ptiliidae exibit a varied range of sizes and commonly occur in leaf-litter, decaying fungi, dung etc. The members of this genus can be recognised by head, pronotum & elytra usually punctate and finely pubescent. Pronotum broadest behind the middle and posterior angles produced backward. Elytra short exposing four abdominal tergites. Abdominal tergites 9 and 10 in both sexes fused together to form a pygidium.

REMARKS:

Recently, Johnson (1969) studied Ethiopian Acrotrichis Motschulsky. So far, no such work has been done from Indian region and the author is unable to identify the species of Acrotrichis Motschulsky, trapped in this experiment.

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49. Agrotrichia sp. (PL.VIII/47)

Agrotrichia sp. was the only species of the family Ptiliidae trapped during this study in Dooars area of Jalpaiguri district. A total number of 671 examples (mean per fortnight : 27'4) were trapped (Table 2). This species was found more or less throughout the year except in the month of September and October and its maximum seasonal incidence was observed in the monsoon months (June to August) during this study (Table 25).

The area of first choice of this species was paddy field where 330 examples (over 49% of the total catches in three areas) were trapped, whereas in the forest floor and tea garden the seasonal incidence was observed 32.67% and 18.69% respectively (Table 26).

This species was only attracted to dung baited traps constituting 99.55% of the total catches in three areas (Table 26). In the paddy field it was 48.91%, whereas in the forest floor and tea garden it was 32.68% and 18.41% respectively. Fish baited trap attracted 0'3% in the forest floor and 0'1% in the paddy field, whereas none was attracted in fish baited trap in the tea garden (Table 27). In empty pitfall trap none was caught during this study. (Table 26).

The abundance of this species in Dooars area was observed in two peak values in June and August in the paddy

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field, in January and May in the forest floor and in January and February in the tea garden (Fig. 32).

REMARKS:

It was observed that this species was most common in dung baited traps. The highest annual incidence was observed in the following order:

Paddy field > Forest floor > Tea garden.

It was observed that the abundance of this species was maximum during June to August (39.23%), whereas low incidence was observed during September to November (1.53%), December to February (29.01%) and again in March to May (30.23%). It appeared that the monsoon months (June to August) were suitable for this insect emergence when recorded average monthly rainfall was 625'5 cm. and daily average maximum and minimum temperatures were 30'95'C and 24'72'C respectively.

4. Family : Historidae

This is a distinct group of the super family Historoidea and commonly known as hister beetles. This is a large family and includes about 3470 species from the world, of which about 200 species are recorded from India. These are small to moderate sized (0'5 - 10 mm.), hard, compact, usually black and glabrous, shape oval, cylindrical

or depressed. Head usually deflexed, eyes small, antennae 11-segmented, geniculate, with 3-segmented compact club which hidden beneath the antennary grooves in thorax, mandibles large and strongly built, gular sutures confluent. Prothorax large, borders usually margined, prosternum usually with a long elevated caring, front coxae transverse. Legs usually short and retractile, femora somewhat swollen, tibiae compressed and variously spinose, tarsal formula 5-5-5 or 5-5-4 and tarsi often slender. Elytra apically truncate exposing last two abdominal segments and with distinct striae. The adults as well as the larvae are mostly carnivorous, some pray upon other insects and their larvae and other small animals. Many are found on carrion, excrement, decomposing plant materials and similar substances. The flat form histerids live under bark of dead or dying trees. In the Dooars area author has collected many of these flat form histerids especially under the fleshy, fungusy bark of Simul trees (Albizzia procera Benth.). The genera which are cylindrical in form are found in the galleries of the bark beetles and other wood boring insects. They are also found in decomposed litter of the Dooars forest and under the loose airy soil of tea garden.

In the present study a total number of 539 examples have been trapped which belong to 5 species under the genera, Hister Linnaeus, Saprinus Erichson, Eurylister Bickhardt

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and Chaetabraeus Portevin. All the 9 species, Hister luciscus Lewis, Saprinus chalcites Illiger, S. ontabilis Marseul, Eurylister sincerus Lewis and Chaetabraeus fabir Lewis have been kindly identified by Dr.Jean Therond, Nymes, France. In the present work author includes short description along with ecological observations of the two species (H. luciscus Lewis and S. chalcites Illiger) and only ecological observations of other three species (S. ontabilis Marseul, E. sincerus Lewis and C. fabir Lewis) due to unavailability of detail literature on the above Indian species and also incomplete representative collection of Zoological Survey of India.

Genus Hister Linnaeus, 1767

Linnaeus, 1767, Systema naturae, ed., 12 : 566

This is one of the largest genera of the family Histeridae. Mazur (1975) noted that this genus is distributed from India, Ceylon, Burma and Java. The members of this genus can be recognised by their transverse labrum neither grooved nor triangular in front. Mandibles equal, without fossae below the prothorax for the antennary clubed, anterior margin of pronotum bordered by only one stria, which is sometimes interupted, internal lateral striae generally straight along the sides, sometimes a little sinuate at the base. Internal subhumeral striae shortened in front and not similar to first dorsal striae. Anterior

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tibiae triangularly dilated and armed with 3-5 teeth. Mesosternum grooved and straight in front.

50. Hister luciscus Lewis (PL.VIII/48).

Lewis, 1885, Ann. Mag. Nat. Hist. (5) 15 : 463

DIAGNOSTIC CHARACTERS:

This is a rather large species (length, 10 mm. ; breadth, 6 mm.), body oval, slightly elongate, rather convex, shining.

Head transverse, eyes transverse, not projecting and finely faceted, with a well marked stria above eyes, only posterior side of head coarsely and densely punctate, antennal club 1 - segmented, large, scape apically thicked, labrum transverse and mandibles equal in size. Prothorax about two times wider than long and gradually narrowed anteriorly, pronotum impunctate, lateral margin with two striae, on ventral side antennal cavities present on front angles, prosternal process rounded in front. Elytra impunctate, striations as figured, epipleura well developed. Pygidium coarsely and sparsely punctured. Front tibiae broadly flattened and dilated apically and armed with 3 large and 1 small teeth, tarsal groove straight, middle and hind tibiae less compressed and with two marginal rows of spines.

ECOLOGY :

Hister luciscus Lewis was the most abundant species

(mean per fortnight : 18'7) amongst 5 species trapped during this study. A total number of 450 examples were trapped. Of the total Histeridae caught, over 83% belonged to above species. This species was found throughout the year, except in the December and its maximum abundance was observed from March to June (Table 25).

The area of first choice observed was tea garden where 251 examples (over 55% of the total catches in three areas) were trapped, whereas in the forest floor and paddy field it was 189 (42%) and 10 (2.22%) respectively (Table 26).

This species was mostly attracted to fish baited traps constituting 98.4% of the total catches during this study (Table 26). In the tea garden it was 55.77%, whereas in the forest floor and paddy field it was 38.4% and 2.22% respectively (Table 27). Dung baited traps attracted 1.3% of the total catches in the forest floor only. None of this species was trapped in dung baited traps in tea garden and paddy field. In empty pitfall traps this species was caught 0'3% in the forest floor and none was in the tea garden and paddy field (Table 27).

The abundance of this species was observed in two peak values by March and June in the tea garden, whereas in the forest floor the abundance was observed in single peak value by April (Fig.34). In the paddy field seasonal incidence was observed only in the month of April and June during this study.

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REMARKS:

It was observed that this species was most common in the tea garden of Doors area. The highest annual incidence was observed in the following order:

tea garden > forest floor > paddy field.

It was observed that this species was prevalent in the pre-monsoon months (March to May) when more than 74% of the total catches were trapped, whereas low incidence was observed in monsoon months (22.32%) and again in the post monsoon months (1.53%) and winter months (1.01%). It appeared that the pre-monsoon months were suitable for this insect emergence when recorded average monthly rainfall was 190'3 cm. and average daily maximum and minimum temperatures were 29'6'c and 18'4'c respectively. This species was mostly caught in fish baited traps in all of the three areas.

Genus Saprinus Erichson, 1834

Erichson, 1834, in Klug. Jahrb. Ins. 1:172

Ganglbauer, 1899, Die Kafer von Mitteleurona 3:380

Reitter, 1909, Fauna Germanica 2 : 291

Mazur, 1976, Bull. Ent. de Pologne, Wroclaw, 46 : 703.

The members of this genus are characterised by its body being oval, short, head enclosed by an interupted

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striae or excessively fine between frons and episternum. Pronotum with marginal striae entire, sometimes a little shortened at the base, covered with a puncturation at least at margins. Elytra with 4 dorsal oblique striae and the sutural one more or less long and humeral striae fine, puncturation present at least near posterior region. Pygidium short and transverse. Prosternum with internal striae at the top of carina and external striae boarding within the antennal fossae. Tibiae broad with strong row of denticles on external border and tarsal ridge ill defined.

51. Sepsinus chalcites Illiger (PL.VIII/49)
Illiger, 1807, Mag. Insk. = K., 6 : 40
Mazur, 1976, Bull. Ent. de Pologne, Wroclaw. 46 : 705.

Mazur (1976) noted that this species was recorded from mediterranean subregion, Africa, Arabia, India, Central Asia and Australia. Since then author has not seen any published record of this species from India. In the present study this species is being recorded for the first time from Doors area of Jalpaiguri district : West Bengal.

DIAGNOSTIC CHARACTERS :

This speciesis small (length, 3'3 mm.; breadth,

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2'5 mm.), body oval elongate, quite convex, blackish and shining.

Head elongate but retracted within front margin of prothorax, narrowed in front, vertex enclosed by a stria. Eyes elongate and not projecting and finely faceted. Antennal club 1-segmented, scape moderately large and apically thickend. Mandibles equal in size. Prothorax about two times wider than long, front and lateral margins bordered with a fine stria, puncturation coarse and moderately dense towards lateral margins and base, and finer towards middle. Elytra with 4 dorsal, fine oblique striae, coarsely punctured at apex and at sides. Pygidium transverse and punctate. Front tibia dilated apically and armed with a row of 7 strong teeth on external margin, middle and hind tibiae less dilated and with 2 marginal rows of denticles.

ECOLOGY :

Saprinus chalcites Illiger was common in the paddy field in Boxara area of Jalpaiguri district during this study. A total of 36 examples were trapped. Of the total Histeridae caught, over 6% belonged to above species. The abundance of this species was observed in the month of April (Table 25) when recorded rainfall and temperature (maximum and minimum) were 239 cm. and 28'45'C and 19'84'C respectively. The area of first choice of this species observed was paddy field (83'33%) followed by forest floor and tea garden (13.88% and 2'77% respectively) (Table 26). This species was

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mostly collected in fish baited trap constituting 94.41% of the total catches during this study (Table 26).. In paddy field it was 77.77%, whereas in the forest floor and tea garden it was 13.88% and 2.77% respectively. None of this species was attracted to dung baited trap. In empty pitfall traps this species caught 5.56% in the paddy field only (Table 27).

REMARKS :

It was observed that this species was common in the paddy field of Boosrs area during this study. The commulative annual incidence was observed in the following order -

paddy field > forest floor > tea garden.

Seasonal incudence was observed maximum during April and most of them were attracted to fish baited traps.

52. Saprinus ontabilis Marseul (PL.VIII/50)

Marseul,. 1855, Monogr. Hister.. : 438

Saprinus ontabilis Marseul was found common in the forest floor than tea garden and paddy field of Boosrs area during this study. A total number of 45 examples (mean per fortnight : 1'8) were trapped. Of the total Histeridae caught, over 8% belonged to this species. The seasonal incidence was observed maximum during post monsoon months

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and its abundance was observed in the month of April (Table 25).

In the forest floor this species was trapped 86°66%, whereas in the tea garden and paddy field it was 8.88% and 4.44% respectively (Table 26). This species was mostly attracted to fish baited traps constituting 97.47% of the total catches (Table 26). In the forest floor it was 84.4%, whereas in the tea garden and paddy field it was 8.8% and 4.4% respectively (Table 27). In the dung baited trap this species was caught 2.53% in the forest floor only (Table 27).

REMARKS :

It was observed that this species was common in the forest floor. The highest annual incidence was observed in the following order:

Forest floor > tea garden > paddy field.

The abundance of this species was observed in premonsoon months in the forest floor.

Genus Eurycliator Bickhardt

The members of this genus are known from South India (Bickhardt, 1916). In the present study 3 examples have been caught which represent single species, Eurycliator sincerus Lewis.

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53. Eurylister sincerus Lewis (PL.VIII/51)

Lewis, 1888, Biol. Centr. Amer., : 218

Only 3 examples of this species were trapped in fish baited traps in the forest floor during this study. Seasonal incidence was observed only in the month of April and May (Table 25).

Genus Chaetabraeus Portevin

This is widely distributed genus of the subfamily Abraeinae and found carrion, excrement, decomposing plant materials and similar substances. In the present study 5 examples have been caught which represent single species, Chaetabraeus fahir Lewis.

54. Chaetabraeus fahir Lewis

In the forest floor only 5 examples of this species were trapped during this study. The seasonal incidence of this species was observed only in the month of April and May (Table 25). This species was totally attracted to fish baited traps (Table 27).

5. Family : Carabidae

This is very large and one of the primitive families

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of Coleoptera, includes approximately 20000 species from the world, of which 2000 species recorded from India. The representatives of this family commonly known as ground beetles due to their terrestrial habit, live in lar large quantities under stones, logs, leaf-litter and also found in dead wood, meadows and agricultural field. They are noctural in habit and largely attracted to light. Both adults and larvae are predator in nature, adults are usually brightly coloured and swift runner. The family Carabidae is the largest and most important family of the suborder Adephaga. The chief adult characters of the family are as follows. Antennae usually filiform, tarsal formula 5-5-5 in both sexes, maxillae well developed, hind coxae immovably fused to metasternum completely dividing 1st visible abdomen sternite, notoplural suture usually present, body usually covered with distinct and prominent sensory hairs.

In the present study a total number of 276 examples of Carabidae were collected (Table 2). These examples represent 14 species under 13 genera belonging to two divisions viz. Carabida (genera, Agonum Bonelli, Tachys Stephens, Clivina Latreille, Lesticus Dejean, Galerita Fabricius, Chlaenius Bonelli, Perigona Castelnau, Dyschirius Panzer, Pentagonica Schmidt-Goebel, Tetragonoderous Dejean, Nephnidius Macleay and Caphora Schmidt-Goebel) and Branchinida (genus, Pheropsophus Solier) of a single subfamily Carabinae. Classification of Ball, 1968 has been followed. The are of first choice of this family

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was observed in paddy field where 123 examples (44.56% of the total Carabidae catches) were trapped, whereas in the forest floor and tea garden the abundance was observed 77 examples (27.89% of the total Carabidae catches) and 76 examples (27.89% of the total Carabidae catches) respectively (Table 4). This family mostly caught in empty pitfall traps constituting 80.07% of the total Carabidae catches in three areas. In the fish baited traps and dung baited traps this family was caught 11.99% and 8.33% of the total Carabidae catches respectively (Table 4). The members of this family were prevalent in the winter months (December to February) and also found in the hot dry months (March to May) but they were very scattered in the pre-monsoon (June to August) and post-monsoon months (September to November) (Table 17). The maximum abundance was observed in the month of February when 113 examples of this family were caught mostly in the empty pitfall traps.(Table 7).

Genus Agonum Bonelli, 1809

Bonelli, 1809, Obs. ent. I. Mem. Acad. Sci. Taurin, 18 : 21

Stephen, 1827, Ill. Brit. Ent., 1 : and 81

The genus is represented in all of the major zoogeographical regions of the world. 16 species have been recorded from India, mostly in Himalaya. The members of

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this genus are characterised by its claw not pectinate, prosternum with tip not margined, mentum with well-developed tooth, lateral margin of elytra sinuate near apex and or obliquely and feebly subtruncate, 4th tarsal segment simple not bilobed.

55. Agonum birmanicum (Bates) (PL.IX/52)

Bates, 1892, Ann. Mus. Civ. Stor. Nat. Genova, 22 : 369

DIAGNOSTIC CHARACTERS :

This species is rather large (length, 11'5 - 12 mm ; breadth, 4'5 - 5 mm.), body elongate oval, shining, deep brown, thorax medianly deep brown and laterally broadly margined with yellowish brown, mouth-parts, antennae and legs yellowish brown, ventral surface shining, deep brown.

Head as broad as long, slightly convex, surface smooth, frontal grooves short. Pronotum cordate, wider than long and wider than head, convex in the middle and refloxed in the sides, front angles blunt, sides strongly rounded in front and sinuate at some distance of hind angles, hind angles blunt, base bisinuate and narrower than apex, median line deep anteriorly and gradually fine behind, transverse impressions strongly marked, basal foveae deep, disk smooth, the impressioned sides and base strongly rugosely punctured. Elytra long as wide, shoulder square, base a half wider than prothorax, more than a half longer and wide, sides very gently rounded, narrowly bordered,

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striae-punctate, intervals smooth and convex.

ECOLOGY :

Agonum birmanicum (Bates) was one of the abundant species (mean per fortnight : 2'4) amongst the 14 species of Carabidae trapped during this study. A total number of 58 examples were trapped. Of the total Carabidae caught, over 21% belonged to above species (Table 20). This species was found from November to February and was fairly abundant in December and January. Its highest incidence was observed in tea garden where 34 examples (98'62%) were trapped, whereas in the paddy field 24 examples (41.37%) were caught. This species was totally absent from forest floor during this study (Tables 22 and 23).

This species was mostly caught in the empty pitfall traps constituting 86.21% of the total catches in two areas (Table 23). In the tea garden it was 44.82% whereas in the paddy field it was 41.37% (Table 21). In the fish baited traps this species attracted 12.06% in the tea garden, whereas in the paddy field none of this species was trapped in fish baited trap. Dung baited traps had 1.72% in the tea garden, whereas in the paddy field none was attracted in dung baited trap (Table 21).

The emergence of this species in Dboars are was observed in November and continued upto February. Its maximum abundance was observed in single peak value in January in the tea garden and in December in the paddy

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field (Fig. 29).

REMARKS :

It was observed that the abundance this species was maximum during cold dry winter months when recorded average monthly rainfall and daily maximum and minimum temperature were 7'7 mm, 24'12'C and 10'9'C respectively. The seasonal incidence of this species in the hot dry pre-monsoon months and in the monsoon months was absolutely nil, whereas in the post monsoon months only 2 examples were caught in the month of November in paddy field in empty pitfall trap.

Genus Pheropsophus Solier, 1833

Solier, 1833, Ann. Soc. ent. France. : 461

Generally they are called as bombardier beetles as they emit a volatile fluid when disturbed. They are widely distributed throughout the tropics. 30 species are distributed throughout India. Usually they are found under stones, under logs in the forest, in cultivated fields and generally they are attracted at light. The representatives of the genus Pheropsophus Solier are usually ferruginous with black markings, medium to large sized beetles, elytra costate and carinate which are sharp and well-defined. They are differentiated from the members of the genus Brachinus Weber. which are devoid of costa and carina and usually without dark markings.

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56. Thermosaphus satoirei (Dejean) (PL.IX/33)

Dejean, 1825, Spec.gen. Col., 1 : 301

Andrews, 1924, Miss I'Inde Babault, Carab., : 55

DIAGNOSTIC CHARACTERS :

This species is rather large (length, 17.5 - 18 mm.; breadth, 6 mm), body elongate oval, shining, head deep brownish, thorax reddish brown, elytra brownish with three yellowish brown spots on either sides, shoulder spots almost rounded extending from striae 4 to 6, middle spots transverse extending from 2nd interval to 9th interval, basal spots transverse extending entire basal region of the elytra, mouth-organs deep brownish, antennae brownish, legs yellowish brown. Ventral surface shining, brownish black.

Head convex, coarsely rugose on occiput otherwise smooth, frontal grooves short, shallow. Pronotum convex, cordate, as long as broad, broader than head, lateral sides gently curved in front and distinctly sinuate just before the posterior angels, posterior angles hardly obtuse, dorsal surface more-or-less smooth except a few irregular deep punctures, median line strong, lateral impression moderately distrinct. Elytra convex, slightly oval, lateral sides slightly curved, shoulder moderately curved.

REMARKS : (Vide consularis Chaudoir)

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ECOLOGY :

Pheropsophus catoirei (Dejean) was the most abundant species (mean per fortnight : 2'79) amongst all of the 14 species of Carabidae. A total of 67 examples were trapped. Of the total Carabidae caught, over 24% belonged to above species (Table 20). This species was found from December to March and its maximum seasonal incidence was observed in January and February.

This species was totally absent from tea garden during this study. The area of first choice of this species observed was paddy field where 42 examples (62.68%) were trapped, whereas in the forest floor the total seasonal incidence was 25 examples (37.31%) during this study (Tables 22 and 23).

This species was mostly caught in empty pitfall traps, constituting 95'52% of the total catches (Table 23). In the paddy field it was 98.2% and it was 37.31% in the forest floor (Table 21). In the dung baited traps this species attracted only 4.47% in the paddy field and none was in the forest floor (Table 21).

The abundance of this species in Doears are was observed in single peak value in February in both of the paddy field and forest floor (Fig. 30).

REMARKS :

It was observed that P. Catoirei (Dejean) was one of

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the common species of Carabidae trapped in Doons area during this study. This species was prevalent in the cold dry winter months (December to February) and was mostly trapped in empty pitfall traps.

57. Pheropsophus consularis (Schmidt - Goebel) (PL.IX/54)

Schmidt - Goebel, 1846, Faunula Coleopterum Birmenae.:75
Chaudoir, 1850, Bull. Soc. Nat. Mosc., 23(1) : 77
Andrewa, 1924, Miss. I'Inde Babault, Carab., : 55

DIAGNOSTIC CHARACTERS :

This is a large species (length, 17 mm. ; breadth, 6 mm.), body elongate oval, shining black, dorsal surface of head yellowish brown on lateral and anterior sides, brownish black along middle, middle black patches having a concavity on anterior side, pronotum brownish black with two yellowish brown elongate oval patches on either side of median line ; elytra brownish black with two yellowish brown spots on either sides. The shoulder spots almost rounded extending from striae 4 to 7, middle spots transverse extending from 2nd interval to 8th or 9th interval, generally the colour on the 4th, 6th and 8th interval extends forward and extends backward on intervals 5th and 7th ; mouthparts yellowish brown, antennae yellowish brown except 3rd and 4th segments darker and legs yellowish brown with

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the femur brownish black band on apex ; ventral side shining brownish black.

Head convex, coarsely rugose on occiput, otherwise smooth, frontal grooves deep elongate. Pronotum convex slightly cordate, as wide as long, slightly wider than head, lateral sides slightly curved anteriorly and distinctly sinuate near posterior angles, posterior angles hardly obtuse, dorsal surface smooth, median line fine, lateral impression moderately distinct. Elytra convex, slightly oval, widest below middle, lateral sides slightly curved, shoulder moderately curved.

REMARKS :

This species is widely distributed throughout the foothills of Himalaya and also recorded from Siliguri area of Darjeeling district, West Bengal.

This species varies from P. catoirei (Dejean) by its bicolour head and pronotum, and 2-spoted elytra.

ECOLOGY::

Pheropsophus consularis (Schmidt-Goebel) was one of the abundant species (mean per fortnight : 1'82) amongst all of the 14 species of Carabidae trapped during this study. A total number of 45 examples were trapped. Of the total Carabidae caught, over 16% belonged to above species (Table 20).

Amongst all of the three areas viz. forest floor, tea

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garden and paddy field, this species was totally absent from tea garden. In the paddy field this species had its highest annual incidence, over 53% of the total catches, whereas in the forest floor it was over 46% (Table 23).

This species was caught mostly in empty pitfall traps constituting 97.78% of the total catches in three areas (Table 23). In the paddy field it was 51.11% and in the forest floor it was 46.66% (Table 21). Fish baited traps attracted 2.22% of the total catches in the paddy field, whereas in the forest floor none was caught in fish baited trap. Dung baited traps had no yeild in both of the paddy field and forest floor during this study (Table 23).

The abundance of this species was observed in single peak value in February in both of the paddy field and forest floor (Fig.31).

REMARKS :

It has been observed that the fortnightly incidence of this species was prevalent in the cold dry winter months (December to February) when average daily temperatures (Maximum and Minimum) were recorded 24°12'C and 10°9'C respectively. This species was mostly caught in empty pitfall traps and its maximum incidence was observed in the month of February.

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Genus Tachys Stephens, 1828

Stephens, 1828, Ill. Brit. Ent. Mandib., 2 : 2 and 4

Kirby, 1837, Faun. Bor. Amer., 4 : 56

Motchulsky, 1839, Bull. Mosc., 1 : 73

Chaudoir, 1868, Rev. Mag. Zool., p. 213

Andrews, 1935, Fauna. Brit. India, 2 : 206

The representatives of this genus are world wide in distribution and very commonly found throughout India. So far, 80 species have been described from India. They frequently occur in the vecinity of water but some are found in moist places under refuse, dead leaves, a few live under bark and one or two members have found in fungi. Little is known about the biology of the species. These insects are charecterised by the variable colour, but usually either ferruginecus, with or without dark markings, or dark with or without pale spots on the elytra ; body glabrous, rarely pubescent, elytra usually with micro-sculpture ; outer margin of protibiae obliquely truncate and sometimes emarginate at apex ; number of elytral striae variable but no scutallary striole, a recurved striole nearly always present on its sides at the apex of elytra. It is differeitiated from the genera Bembidion Latreille and Lymnastis Motschulsk which are having scutallary striole and pubescent body surface respectively.

..168/-

58. Tachys truncatus (Nietner) (PL.IX/55)

Nietner, 1858, Ann.Mag.Nat.Hist., (3) 2 : 421

Andrews, 1925, Ann.Mus.Civ.Genova, 1 (1) : 374 & 375

Andrews, 1935, Fauna. Brit. India, 2 : 230

Andrews (1935) mentioned that this species was recorded from Calcutta, Eastern Dooars, Burma Malaya states, Cochin, Cambodia, Java, Sumatra, Borneo, Philippine islands, Ceylon and United Provinces.

DIAGNOSTIC CHARACTERS :

This is a small species rather minute with a length of 1'5 mm., colour testaceous brown, head and elytra generally darker than prothorax, legs pale testaceous.

Head large, frontal furrow short and fairly deep, mentum with two rounded depression rather than pores, eyes rather small and flat, antennae rather short and moniliform. Prothorax transverse, sides rounded anteriorly and slightly sinuate behind before the base, base with its sides oblique, hind lateral pore on the angle, median line fine, front transverse impression distinct. Elytra flat rather elongate, depressed in the middle, truncate at the apex, one dorsal striae, feebly impressed, not reaching base in front. Microsculpture evident but not so sharply defined.

..169/-

ECOLOGY :

Tachys truncatus (Mietner) was trapped in the paddy field and only one example was caught in fish baited trap (Table 22).

REMARKS :

This species was found less abundant in Dooars are and restricted to paddy field during this study.

Genus Clivina Latreille, 1802

Latreille, 1802, Hist. Nat. Crust. et Ins., 3 : 96

Schmidt - Goebel, 1846, Faunula Coleopterum Birmanae (Cover)

Putzeys, 1863, Postscr. ad Cliv. Mon., Mem. Liege, 18 : 68

Andrews, 1929, Fauna. Brit. India, 1 : 351

The representatives of this genus are distributed throughout the world and 23 species have been recorded from India. They live in moist places at the root of the trees, under bark, under dung, under vegitable debris, in marshes and under stones near water. They are also attracted at light. In this genus there is great variability of individuals in size, in colour and in form. They are usually black or piceous in colour and 4 to 11 mm. in length, form elongate and parallel. They are characterised

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by antennae without scape or groove, wings of clypeus not projecting far, elytra with marginal series of pores uninterupted at middle, head without carina, antennae with segments 1 and 2 normally attached, border of elytra not dented. This genus is differentiated from its nearest one Trilophus by its prothorax being bordered on lateral sides upto pedencle, labrum, 6-,7-, or 9- setose, black or piceous in colour rarely less than 5 mm. in length (vs. lateral borders of prothorax not reaching hind lateral pores, labrum 5-setose, testaceous in colour, not more than 3 mm. in length).

59. Clivina memnonia Dejean (PL.IX/56)

Dejean, 1831, Spec. Gen., 5 : 503

Putzeys, Mon. des Clivina et genres voisins, Mem. Liege, 2 : 585 (67)

Nietner, 1856, J. Asiat. Soc. Bengal, 25 : 390

Andrews, 1929, Fauna. Brit. India. 1 : 362

Andrews (1929) mentioned that this species was recorded from India, Ceylon, Burma, Malaya Peninsula and Indochina. Since then author has not seen any published record of this species. In the present study this species is being recorded here for the first time from Buxars area, Jalpaiguri district of West Bengal.

..171/-

DIAGNOSTIC CHARACTERS :

This species ranges from 6'5 mm. to 9 mm. in length, body elongate, black, palpi, base of the antennae, middle and hind legs red.

Head broad with prominent eyes, clypeus with its wings and median part fused, front edge slightly emerginate, angles slightly rounded, clypeal ridge strongly marked, suture obsolete, surface highly uneven, minutely punctured with some strong punctures in each side on under surface, mandibles short and stout. Prothorax convex, subquadrate, slightly narrowed anteriorly, median line passing through front sulcus, hind angles without tooth, surface irregularly striate. Elytra convex, parallel, rather pointed at apex, strongly striate, intervals convex.

ECOLOGY :

Clivina mamnonia Dejean had highest incidence in the paddy field (71.42%) amongst all of the three areas during this study. A total of 7 examples were caught. Of the total Carabidae caught, over 2% belonged to this species (Table 20). This species was mostly caught in fish baited traps (57.14%). Dung baited and empty pitfall traps resulted 28.56% and 14.28% respectively (Table 23).

Genus Lesticus Dejean, 1828

Dejean, 1828, Spec. gen. Col., 3 : 189

The 51 species of this genus are widely distributed

throughout the South East Asia and 11 species have been recorded from India. The members of the genus are easily recognised by basal segments of anterior tarsi dilated in male, apical segment of labial palpi securiform in male, mentum trilobed with prominent median tooth, pronotum cordate, elytra long oval or parallel.

60. Lesticus politocollis (Motschulsky)

Motschulsky, 1864, Bull. Soc. Nat. Mosc., 2 : 349
Chaudoir, 1868, Ann. Soc. ent. Belgique, 9 : 152
Andrews, 1928, Trans. ent. Soc. Lond., : 14

DIAGNOSTIC CHARACTERS :

This is a large species (length, 25 mm.), dorsal surface of head and prothorax shining, dark metalic green, elytra shining, blue-black, palpi, labrum, antennae (except apical 3 segments brownish) legs black, ventral surface shining, black, labrum more than twice wider than long, head convex, surface longitudinally rugose on lateral sides near eyes, otherwise smooth and impunctate, frontal grooves deep, long and parallel, eyes moderately large, occiput swollen. Pronotum convex cordate, widest at middle, more than one and half times wider than head and one and half wider than long, base wider than apex, lateral sides strongly rounded towards apex and slightly sinuate near basal angles, lateral margins widely bordered, apical

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angles hardly obtuse, rounded, basal angles distinctly obtuse and angulate, median line deep and lateral impressions distinct; basal grooves deep and wide, surface somewhat finely and densely punctate on basal grooves, otherwise smooth and impunctate. Elytra elongate, almost parallel sided, shoulder slightly rounded and apex distinctly sinuate; striae distinct, finely and closely punctate, intervals convex and smooth.

ECOLOGY:

Lesticus politocollis (Motschulsky) was totally absent from forest floor, amongst the three areas i.e. forest floor paddy field and tea garden. A total of 8 examples were trapped. Of the total Carabidae caught, over 2% belonged to above species (Table 20). Of the 8 examples caught, 7 were trapped in the paddy field and only one example was trapped in tea garden (Table 22). This species was trapped in premonsoon and monsoon months during this study (Table 24) and mostly caught in fish baited traps (75%) (Table 23).

Genus Galerita Fabricius, 1801.

Fabricius, 1801, Syst. Eleuth., 1 : 214

This genus comprises of 8 species distributed in India, Burma, Celebes, Tonkin, Annam and Honhong. Of the 8 species, 5 species have been recorded from India. This

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genus is characterised by its large size usually not less than 20 mm. Head abruptly curved behind the eyes forming a short distinct neck, antennae segment 1 scapiform, labrum wider than clypeus, apical segments of palpi securiform. Pronotum wider than head and wider as long. Elytra carinate.

This genus varies from the related genera Drypta Latreille and Dasera Hope which are smaller in size (not more than 10 mm in length) and with simple elytra.

61. Colerita orientalis Schmidt. - Goebel.
(PL.IX/57)

Schmidt - Goebel, 1846, Faunula Coleopterum Birmanae.: 8

Andrews, 1923, Trans. ent. Soc. London. : 8

DIAGNOSTIC CHARACTER :

This species is rather large (length, 20 mm. : breadth, 7'5 mm.), elongate oval, dorsal surface of head and pronotum, mouth-parts and antennae red; pronotum black ; legs yellowish with apex of femur black.

Head longer than wide, surface coarsely and densely rugose-punctate, labrum wider than long, apex gently sinuate, antennae long exceeding one third of elytra and eyes small. Pronotum cordate, little wider than head and little longer than wide or as long as wide, angles obtuse and rounded, sides moderately rounded anteriorly

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and distinctly sinuate posteriorly, median line fine and basal grooves shallow, surface coarsely and densely punctate and pubescent. Elytra elongate, almost parallel sided and its apex truncate.

ECOLOGY:

Galerita orientalis Schmidt - Goebel was only trapped in the forest floor during this study. A total number of 2 examples were caught in empty pitfall trap in the month of February (Table 24).

REMARKS:

This species was observed less abundent in Doosra area during this study and found in cold dry winter season in forest floor.

Genus Chlaenius Bonelli, 1910

Bonelli, 1910, Obs. Ent., 1. Tab. Synopt.

The diagnostic characters of this genus are mentum usually with well developed lateral lobes and median tooth, simple or bifid, rarely without lateral lobes and median tooth, lingula widened and truncate at apex and with two setae, paraglossae, narrow and pointed at apex, first three segments of front tarsi in male dilated, 4th segment bilobed or not bilobed, elytra pubescent with the 9the striae complete, palpi more or less truncate at apex.

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62. Chlaenius pictus Chaudoir (PL.X/58)

Chaudoir, 1856, Bull. Soc. Imp. Nat.Moscou, 29 : 208

Andrews, 1921, Trans. ent. Soc. London : 156

DIAGNOSTIC CHARACTERS :

This species is rather large (length, 12'5 mm ; breadth, 4'7 mm), elongate-oval; dorsal surface of head and pronotum dark metallic green, elytra black with a comma (,) shaped yellowish brown spot on either side near apex; palpi dark brown, labrum, antennae and legs reddish brown.

Head convex, wider than long, surface moderately rugose-punctate, eyes large, labrum wider than long, feebly emerginate at apex, antennae long reaching one third of elytra. Pronotum convex, oval, angles obtusely rounded, sides moderately and almost evenly curved towards base and apex, lateral margins finely bordered, median line fine, basal grooves moderately deep and wide, surface coarsely, rather shallowly and sparsely punctate. Elytra oval, sides gently curved, more curved near shoulder, humeri rounded, striae distinct, finely and closely punctate, intervals flat, rather coarsely and closely punctate and pubescent.

ECOLOGY :

Chlaenius pictus Chaudoir was absent from forest

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floor and trapped in tea garden and paddy field. A total number of 3 examples were trapped during this study (Table 20). In the tea garden 2 examples of this species were trapped in the month of March in fish baited traps and in the paddy field 1 example of this species was trapped in the month of May in dung baited trap (Table 22).

REMARKS:

It was observed that this species was less abundant in Dooars area during this study and totally absent from forest floor.

Genus Perigona Castelnau, 1835

Castelnau, 1835, Etud. Ent., : 151

Percheron, 1896, Trans. S. Afr. Phil. Soc., 7 : 586.

The Representatives of this genus are small size and elongate-ovale. Head triangular, impunctate, shiny but finely granulated, labrum truncate, nearly quardrate and setose, clypeus truncate, transverse and setose, fronto-clypeal suture prominent, antennae stout, submoniliform, pubescent 3rd segment onwards, eyes moderate and lateral, a pair of supraorbital setae present on each

..178/-

side. Pronotum somewhat cordate, transverse, shiny, glabrous, impunctate, a pair of setae present on lateral margins, apical margin wider than basal margin, posterior and anterior angles obstuse, median line present. Elytra elongate-ovale, humeral angle rounded, faintly striate, stria 8 deep and impunctate. Scutellum small and triangular. Legs slender and hairy.

63. Perigona nigriceps (Dejean) (PL.X/59)

Dejean, 1831, Spec. grn. Col., 5 : 44
Nietner, 1858, Ann. Mag. Nat. Hist.,(3) 2 : 429
Solane, 1903, Proc. Linn. Soc. NSW. : 635

This species is widely distributed throughout the world. In the present study this species is being recorded from Dooars area, Jalpaiguri district : West Bengal.

DIAGNOSTIC CHARACTERS :

This species is small (length, 3 mm; breadth, 1.25 mm.) and elongate oval. Head black; palpi, labrum, clypeus, antennae, pronotum, elytra and legs brown. Head triangular, impunctate, shiny and finely granulated, labrum truncate, nearly quadrate and setose; clypeus

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truncate, transverse and setose, fronto-clypeal suture prominent and a pair of supraorbital setae present on each side; antennae stout, submoniliform and pubescent from 3rd segment onwards, eyes moderately large and lateral. Pronotum somewhat cordate, transverse, shiny, glabrous, impunctate, a pair of lateral setae present on either side, front margin wider than basal margin, posterior and anterior angles obtuse and median line prominent. Elytra elongate oval, humeral angle rounded, faintly striate, stria 8 deep, impunctate and glabrous. Scutellum small and triangular.

ECOLOGY:

Perigona nigricens (Dejean) was fairly common in garden and totally absent from paddy field. A total number of 14 examples (mean per fortnight : 0'58) were trapped. Of the total Carabidae caught, over 5% belonged to this species (Table 20). This species was found from January to May and its maximum incidence was observed in April and May in the tea garden.

The area of first choice of this species observed

..180/-

was tea garden followed by forest floor. In the tea garden the cumulative annual incidence was 71.42%, whereas in the forest floor it was 28.56% (Table 23).

This species was mostly caught in empty pitfall traps constituting 85.71% of the total catches (Table 23). In the tea garden it was 64.28%, whereas in the forest floor it was 21.42%. Dung baited traps attracted 7.14% of the total catches both in the tea garden and forest floor (Table 21). None of this species was attracted to fish baited traps during this study (Table 23).

The abundance of this species was observed in the month of April in the tea garden and in the month of February in the forest floor.

REMARKS:

It was observed that the suitable period of this insect emergence was pre-monsoon months when 71% of the total catches was trapped. During these months average monthly rainfall and daily maximum & minimum temperatures were recorded 190'3 cm. and 29'6'C and 18'4'C respectively. Maximum incidence was observed

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in empty pitfall traps.

Genus Dyschirius Panzer, 1813

Panzer, 1813, Index Ent., : 67

Schmidt - Goebel, 1846, Fauna Col. Birm.,(Cover)

Andrews, 1929, Fauna Brit. India, 1 : 390

This genus is distributed throughout the world and 25 species have been recorded from India. The member of this genus are very convex, black or brassy insects, averaging about 3 mm. in length, antennae devoid of any groove, wings of clypeus not projecting far in front of median part, elytra with marginal series of pores widely interupted at middle, palpi dissimilar in two sexes, pronotum usually globose with border extending from apex to hind lateral pore or a little beyond it, labrum 6- setose. The habitat is generally in the visinity of water, and usually on sandy, or sometimes saline grounds. Nothing is known about the life history of the any Indian species.

This genus Dyschirius Panzer differes from Clivina Latreille by its lateral marginal pore interupted at middle, labrum always 6-setose, lateral border of pronotum not reaching pedancle.

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64. Dyschirius bengalensis Andrews (PL.X/60)

Andrews, 1929, Fauna Brit. India. I. : 397.

Andrews (1929) described this species from Sunderban and Calcutta : West Bengal. Since then author has not seen any published record of this species. This species is being recorded first time from Dooars area of Jalpaiguri district, West Bengal.

DIAGNOSTIC CHARACTERS :

This is a small species (length, 2'5 to 3 mm.; breadth, 0.7 to 0.8 mm.), body elongate, dorsal surface brassy, palpi, segments 1 to 3 of antennae and two hind pairs of legs dark reddish, apical segments of antennae dark brown, front legs deep brownish.

Head rather small, convex, clypeus slightly triangular, front margin truncate in middle, bordered, lateral teeth not so well marked, eyes moderately prominent. Prothorax globose, wider than head and a little wider than long, border extending to hind lateral pore, median line fairly deep, very deep near the base, surface shining. Elytra ovate, one third wider than prothorax and one and half longer than wide; entirely striate, striae fairly deep near the base and punctured and intervals slightly convex.

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ECOLOGY :

Dyschirius bengalensis Andrews was totally absent from tea garden. A total of 8 examples (0'33 mean per fortnight) were trapped. Of the total Caribidae caught, over 2% belonged to above species (Table 20). Of the 8 examples caught, 6 were trapped in forest floor in the month of November in the dung baited traps and 2 were trapped in the paddy field in fish baited trap in the month of August during this study. None was trapped in empty pitfall trap.

Genus Pentagonica Schmidt-Goebel, 1846

Schmidt - Goebel, 1846, Faunula Coleopterum Birmanae. : 47

The genus is widely distributed throughout the world, major faunal regions. 11 species are recorded from the Southeast Asia, of which only 4 species are recorded from India. The genus is characterised by its head being strongly constricted behind to form the neck, dorsal surface glabrous, penultimate segment of labial palpi bisetose, terminal segment fusiform, segments 1, 2, 3 of antennae glabrous, tarsal claws not pectinate and sides of pronotum angular.

65. Pentagonica tenebrosa Andrews (PL.X/61)

Andrews, 1932, Mem. Mus. Roy. Hist. Nat. Belg. 4 (4) Col. 1 : 19.

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DIAGNOSTIC CHARACTERS :

This species is rather large (length, 5'5 mm. ; breadth, 2'5 mm.), elongate oval, dorsal surface black except reflexed margins of pronotum and elytra yellowish, mouth-parts and antennae black, legs yellow.

Head small, wider than long, eyes, neck abruptely rounded contracted below the eyes, labrum wider than long and rounded at apex, antennae moderately long. Pronotum convex, hexagonal, little wider than head and almost twice wider than long, angulate at middle and obliquely curved anteriorly and posteriorly, median line fine, surface impunctate. Elytra elongate-oval, sides gently curved, strongly rounded near shoulder, apex truncate, striae district, finely and closely punctate, intervals convex and impunctate.

ECOLOGY :

Pentagonica tenebrosa Andrews was totally absent from forest floor and trapped in the tea garden and paddy field. A total of 7 examples were trapped. Of the total Carabidae caught over 2% belonged to this species (Table 20). In the tea garden 5 examples of this species were trapped, 1 each in the month of January and February, and 3 examples in the month of March. In the paddy field 2 examples were trapped, 1 each in the month of July and August. This species was mostly caught in empty pitfall traps. The emergence of this

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species was found in January and its maximum incidence was observed in March (Table 24).

Genus Tetragonoderous Dejean, 1829

Dejean, 1829, Snec. gen. Col., 4 : 485

The members of this genus are generally characterised by median tooth of mentum simple, lingula dilated and truncate at apex, apical segments of palpi elongate oval, and acuminate, labrum transverse and truncate at apex, first three segments of front tarsi in male dilated and triangular.

66. Tetragonoderous rombophorus Schmidt-Goebel.(PL.X/62)

Schmidt-Goebel, 1846, Faunula Colcopterum Birmanae.: 93

Andrews, 1923, Trans. ent. Soc. London. : 54

DIAGNOSTIC CHARACTERS :

This is rather small species (length, 4'5 - 5 mm; breadth, 1'8 - 2 mm.), wide oval, head and disc of pronotum, labrum and palpi reddish brown; sides of pronotum and legs yellowish brown; elytra reddish brown with yellowish brown patches oriented in a definite pattern.

Head convex, wider than long, surface impunctate, eyes large, antennae moderately long, neck short and contracted below the eyes. Pronotum convex subcordate, little more than one and half wider than head and more

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than one and wider than long, anterior angles obtusely rounded, posterior angles little obtuse and angulate, sides strongly curved towards apex and faintly sinuate near base; median line fine, basal groove short and near the base, surface with few punctures on basal grooves only. Elytra oval, sides gently curved, humeri rounded, striae distinct, intervals little convex and impunctate.

ECOLOGY :

Tetragonoderus rombophorus Schm.-Goebl. was only trapped in forest floor during this study. A total number of 2 examples were trapped in empty pitfall traps in the month of January.

Genus Aephnidius Macleay, 1825

Macleay, 1825, Ann. Jav., 1 : 23

The genus is characterised by mentum with well developed lateral lobes, median tooth absent, lingula truncate at apex and with two setae, paraglossae elongate, apical segments of palpi oval and narrowly truncate at apex, front tarsi truncate at apex.

67. Aephnidius adeliodes Macleay (Pl.X/63)

Macleay, 1825, Ann. Jav., 1 : 23

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DIAGNOSTIC CHARACTERS :

This species is small (length, 6'5 - 7 mm.; breadth, 2'5 - 3 mm.), body oval, shining, black, mouth-parts, antennae yellowish-brown, legs black, ventral surface shining, black.

Head entirely smooth, flat, broader than long, narrower than thorax, impunctate, frontal grooves short indistinct. Pronotum convex, broader than long, front angles blunt, sides gently curved, posterior angles blunt, dorsal surface smooth, median line deep, lateral impressions moderately distinct. Elytra convex, widest below middle, lateral sides slightly curved and strongly striate.

ECOLOGY:

Aenhnidius adelioden Maclesy was trapped in the tea garden and paddy field and none was found in the forest floor during this study. A total number of 15 examples were trapped. Of the total Carabidae caught, over 5% belonged to above species (Table 20). Seasonal incidence of this species was observed only from January to March and its maximum incidence (60%) was observed in the month of February. This species was caught mostly in empty pitfall traps constituting 93.33% of the total catches (Table 23). In dung baited traps this species was caught 6.66% of the total catches, whereas none of

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this species was trapped in fish baited trap (Table 23). The area of first choice observed was tea garden where 53.32% of the total catches were trapped (Table 23).

REMARKS:

It was observed that this species was absent from forest floor in Dooars area during this study. Its abundance was observed maximum in the month of February when recorded average daily maximum minimum temperatures were 25'5'C and 11'33'C respectively. This species was mostly caught in empty pitfall traps.

Genus Caphora Schmidt - Goebel, 1846.

Schmidt - Goebel, 1846, Faunula Coleopterum Birmanae. : 91.

This is a monotypic genus having the only representative Caphora humilis Schmidt - Goebel. This genus is characterised by the mentum with median tooth acute, lingula rounded at apex and with four setae, paraglossae wide and exceding lingula, apex rounded truncate, apical segments of palpi ovate and acuminate at apex, front tarsal segments 1-4 dilated in male, segments 2-4 bilobed. This genus is distributed in India : Bengal, Bihar, Purnea, U.P., Dehra Dun; Burma: Tenesserim : Thailand and Java.

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68. Caphora humilis Schmidt - Goebel (PL.X/64).

Schmidt - Goebel, 1846, Faunula Coleopterum Birmanae, : 91

Andrews, 1923, Trans. ent. Soc. London, : 53

DIAGNOSTIC CHARACTERS:

This species is small (length, 3'3 mm; breadth, 1'5 mm.), body oval, head and elytra dark brown, pronotum reddish brown, palpi, antennae and legs yellowish brown.

Head little convex, impunctate and glabrous, labrum rounded at apex, antennae short little exceeding the base of elytra, eyes rather small and flat, neck short. Pronotum convex, one and half wider than head and almost twice wider than long, anterior angles projecting, hardly obtuse and rounded, sides moderately curved and more contracted towards apex and less curved towards base, posterior angles obtuse and rounded, median line very fine, basal grooves indistinct, elytra convex, surface impunctate, less than one and half wider than pronotum and little longer than wide, sides little curved, apical sinuation absolete, humeri rounded, striae indistinct, surface impunctate.

ECOLOGY:

Caphora humilis Schm.-Goebl. was one of the abundant species of Carabidae (mean per fortnight: 1'54) trapped in Doors area during this study. A total number of 39

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examples were trapped. Of the total Carabidae caught, over 14% belonged to above species (Table 20). This species was equally abundant in the forest floor and tea garden where 40.54% of the total catches was trapped in each area, whereas in the paddy field this species was trapped 18.91% (Table 23).

This species was mostly caught in empty pitfall traps constituting 67.56% of the total catches (Table 23). In the tea garden it was 35.13%, whereas in the forest floor and paddy field it was 16.21% each (Table 21). Fish baited traps had 21.62% of the total catches (Table 23). In the forest floor it was 16.21% and in the tea garden and paddy field it was 2.7% each (Table 21). Dung baited traps had 10.81% of the total catches (Table 23). In the forest floor and tea garden it was 8.1% and 2.7% respectively, whereas in the paddy field it was 0'0% (Table 21).

The abundance of this species in Dooars area was observed from December to February and its maximum incidence was observed in the month of February (Table 24).

REMARKS :

It was observed that the forthnightly incidence of this species was prevalent in the cold dry winter months (December to February) when daily average maximum and minimum temperatures were recorded 24'12'C and 10'9'C respectively. It has been observed that this species was rather common in all of the three areas viz. forest floor,

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tea garden and paddy field during this study. The total incidence to empty pitfall traps was highest followed by fish and dung baited traps.

6. Family : Hydrophilidae

Hydrophilidae is a large family commonly known as water scavenger beetle, mostly aquatic ; some (subfamily : Sphaeridiinae) live in dung and moist decaying leaves and soil rich in humus. This family can be easily distinguishable by their strongly convexed broadly oval shape with ventral surface flattened, body glabrous and smooth. Antennae short and usually clavate and concealed; maxillary palpi markedly long. Legs with femur and tibia flatten, spinose or with heevy spurs, tarsal formula 5-5-5 or 5-5-4 and usually fringed with swimming hairs.

In the present study 3 species have been trapped which belong to the genera Cercyon Leach and Oosternum Sharp under the subfamily Sphaeridiinae. The representatives of Sphaeridiinae can be recognised by their first segment of mid and hind tarsi elongate and longer than the second, antennae longer than the maxillary palpi, base of pronotum as broad as anterior part of elytra, antennal insertion not concealed and visible from above, pronotum roof like, elytral epipluræ well developed in basal half. The genus Oosternum Sharp fairly closely related to the genus Cercyon Leach but can be separated by their shape of pronotum ; the

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former genus have middle of prosternum forming a plate like roof with fine medial longitudinal carina, whereas in Cercyon Leach middle of prosternum carinate and roof shaped plate absent.

Genus Oosternum Sharp, 1882.

Sharp, 1882, Biol. Centr. - Amer., 1(2) : 112

69. Oosternum horni d'orchym (PL. XI/65).

d'orchym, 1914, Ent. Mitteil., 3 : 326. F. 2p. 327

So far, this species was recorded from Ceylon, Honkong and Formosa. In the present study this species is being recorded for the first time from India.

DIAGNOSTIC CHARACTER :

This species is small (length, 1.6 mm.), shape oval and convex, and head reddish.

Head sparsely and coursely punctured, clypeus rounded in front and punctate, eyes moderately flat and moderately finely facetted; maxillary palpi long, but smaller than antennae. Pronotum transverse, convex and sparsely punctured, base and apex with black line, front and posterior angles rectangular. Scutellum with its apex acute and impunctate, elytra convex, reddish, striate punctate, striae with black punctures. Prosternum, mesosternum and metasternum punctured.

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ECOLOGY :

Oosternus horni d'orchym was one of the most abundant species (mean per fortnight : 7'9) amongst the 3 species of Hydrophilidae trapped during this study. A total number of 192 examples were trapped. Of the total Hydrophilidae caught, 76.8% belonged to this species. This species was found throughout the year, except January and June (Table 25). It was fairly abundant from May to November during this study.

The area of first choice was observed in paddy field where a total number of 80 examples(45.26% of the total catches in three areas) were trapped, whereas in the forest floor and tea garden the seasonal incidence was observed 33.68% and 21.05% respectively (Table 26).

This species was chiefly collected from dung baited traps constituting 67.6% of the total catches, whereas in the fish baited traps the seasonal incidence was 32.4%.(Table 26). In empty pitfall trap none of this species was collected during this study.

The abundance of this species was observed in single peak value in the month of November in dung baited trap in the paddy field (Fig. 37). In the tea garden maximum incidence was observed in the month of May in dung baited traps, whereas in the forest floor maximum incidence was observed in the month of July in fish baited traps during this study.

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REMARKS :

It was observed that this species was mostly attracted to dung baited traps. The highest annual incidence was observed in the following order-

paddy field > forest floor > tea garden

It was observed that this species was prevalent in hot dry pre-monsoon months in tea garden, monsoon months in forest floor and post-monsoon months in paddy field.

Genus : Cercyon Leach, 1817

Leach, 1817, Zool. Misc., 3 : 95

70. Cercyon sp. A (PL.XI/66)

This species is small (length, 2'4 mm.), shape elongate oval and black. Head black, sparse by punctured, clypeus rounddish in front eyes oval and coarsely facetted, maxillary palpi larger than attennae ; pronotum black convex and closely punctured ; elytra black and striate-punctate; scutellum elongate, its apex acute and impunctate.

ECOLOGY :

This species was totally absent from paddy field in Dooars area during this study. A total number of 57 examples (mean per fortnight : 2'3) were trapped, which constituted over 22% of total Hydrophilidae catches. This species was found more or less throughout the year, except

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September, October and December in Dooars area during this study (Table 25). It was fairly abundant from January to August in the forest floor and its maximum incidence was observed in cold dry winter months.

This species was mostly collected from dung baited traps constituting 78.94% of the total catches, whereas in the fish baited traps the seasonal incidence was observed 21.05% of the total catches in the forest floor only, and in empty pitfall traps there was no yeild during the study (Table 26). In the dung baited traps this species was attracted 47.3% in forest floor, whereas in the tea garden it was 31.57% (Table 27).

The area of first choice observed was forest floor where 68.42% of the total catches were represented, whereas in the tea garden this species was caught 31.57% (Table 26).

The abundance of this species was observed in January in the forest floor in dung baited traps, whereas in the tea garden the abundance was in the month of February in dung baited trap.

REMARKS :

It was observed that this species was fairly common in the forest floor of Dooars area during this study. The highest annual incidence was observed in the forest floor followed by tea garden. In the paddy field this species was totally absent. It was observed that this species was

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prevalent in cold dry winter months (54.38%), whereas low incidence was observed in pre-monsoon (24.56%), monsoon (19.29) and post-monsoon months (1.75%). It appeared that cold dry winter months were favourable for this insect emergence when recorded average daily temperatures (maximum and minimum) were 24'12'C and 10'9'C respectively. Attraction was maximum in dung baited traps.

71. Cercyon sp B. (PL.XI/67)

This species is small (length, 3.3 mm.), shape elongate oval and convex. Head black and sparsely punctured, clypeus rounded in front, a rounded brown patch on the middle of the head : pronotum red, transverse, punctate, front and posterior angles rectangular : elytra red, striate-punctate, punctures black, scutellum triangular, elongate and impunctate.

ECOLOGY :

This species was found only in forest floor in the month of February during this study (Table 25). Only 1 example was caught in dung baited trap.

REMARKS:

It was observed that this species was less abundant and restricted to forest floor during this study.

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7. Family : Tenebrionidae

This is not only one of the largest families of the order Coleoptera but also exibits many variations in its shape, size and bahitat. It includes approximately 18000 species from the world, of which so far, approximately 500 species have been recorded from India. The representatives of this family are commonly known as darkling beetles. It is very widely distributed in India and found almost in all habitats except, water. Some are severe pests of stored products, some inhabit termites and ants nest, human habitation, rotten wood, fungi, debris, under log and stone and several of them abundantly occur in desert areas. They are scavernger, feeding on decaying vegetables, animal waste products, chiefly dry seeds and sometimes living on plant roots. Beeson (1941) noted that some species of this family are coprophagus. The chief adult characters of the family are as follows : general appearance usually glabrous and strongly built, antennae 11 - segmented rarely 10-segmented, usually somehow clavate, labrum distinct, front coxae closed behind, trochanter heteromeroid type, tarsal formula 5-5-4 in both sexes, abdomen with 5 visible sternites, first three are connet.

In the present study a total number of 187 examples of this family have been trapped, which belong to 2 genera e.g. Gonocephalum Chevrolat and Uloma Castelnau and the species belong to these genera are Gonocephalum depressum

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Fabricius and Ulema sp.. Gonocephalum depressum Fabricius was found one of the most common species in Boosra area during this study, whereas the other species Ulema sp. was found restricted to tea garden and paddy field.

Genus Gonocephalum Chevrolat, 1849

Chevrolat, 1849, Dict. Univers. d'Hist. nat., 6 : 274
Kaszab, 1894, Naturg. Ins. Deutschl. 5 : 409, 418 & 435
Kaszab, 1934, Beitr. Best. Tab., 43 : 134, 140
Kaszab, 1952, Batom. Arbeiten aus dem Museum Gr. Frey, Bd. 3

This is a widely distributed genus of the family Tenebrionidae. So far, more than 100 species have been recorded from India. The members of this genus are usually oval or elongate oval and dorsal surface rough. Antennae 11-segmented segments moniliform, apical segments fairly broadened, and eyes usually small. Pronotum and elytra nearly equal in width, front coxal cavities close behind, elytra apically rounded, embracing the sides, striae usually present, intervens ridged, epipleural fold broad and epipleura narrow.

72. Gonocephalum depressum Fabricius (PL.XI/68)

Fabricius, 1798, Ent. Syst. Suppl., p : 41
Stev. 1929, Nouv. Mem. Mosc., 1 : 95
Gebien, 1906, Deutsche Ent. Zeitschr., p : 501

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DIAGNOSTIC CHARACTERS :

This species is rather large (length, 5'8 - 6 mm), mostly dull brown, oblong in shape, mandible short and robust, antennae moniliform and inserted beneath the front, eye emarginate on anterior margin, pronotum strongly depressed and its lateral margins thin, elytra fairly rugose, apically rounded and striate, front coxae short, globuse, separated by prosternum, metacoxae transverse and first segment of metatarsi longer than the second and claws simple.

ECOLOGY :

Gonocephalum depressum Fabricius was one of the common species (mean per fortnight : 7'5) of the family Tenebrionidae found in Cocoa are during this study. A total number of 183 examples were trapped. Of the total Tenebrionidae caught, over 96% belonged to this species. It was found more-or-less throughout the year except, June, October and November and most prevalent during pre-monsoon months (Table 25).

This species was chiefly caught in dung baited traps constituting 61.1% of the total catches in three area, whereas in the fish baited traps this species attracted 17.2% and in the empty pitfall traps represented 21.7% (Table 26). In the dung baited traps this species attracted 53.5% in forest floor, whereas in the paddy field and

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tea garden it was 6.1% and 1.6% respectively (Table 27). In the fish baited traps this species attracted 13.3% in the paddy field, whereas in the forest floor and tea garden none of this species was attracted in fish baited trap. In the empty pitfall traps this species was caught 13.4% in the tea garden, wherens in the forest floor and paddy field it was 7.7% and 0.6% respectively (Table 27).

The area of first choice of this species observed was forest floor where 119 examples (65% of the total catches) were trapped, whereas in the paddy field and tea garden the seasonal incidence was 37 examples (20%) and 27 examples (15%) respectively (Table 26).

The abundance of this species in the forest floor and paddy field was observed in single peak value by April in dung baited traps and fish baited traps respectively, whereas in the empty pitfall traps the abundance was observed in single peak value by March in tea garden (Fig.35).

REMARKS :

It was observed that Gonocephalum depressum Fabricius was the only abundant species of the family Tenebrionidae trapped during this study. The highest incidence was observed in the following order :

forest floor > paddy > tea garden.

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This species was observed abundant in dung baited traps and its maximum incidence during hot dry pre-monsoon months (March to May) when 91% of the total catches were trapped, whereas low incidence was observed during monsoon months, June to August (2%) and during post-monsoon months, September to November (1%) and again during cold dry winter months, December to February (5%). It appeared that the pre-monsoon months were suitable for this insect emergence when recorded average monthly rainfall and daily maximum and minimum temperature were 190'3 cm., 29'6'C and 18'4'C respectively. It was observed that this species was mostly attracted to dung baited traps during this study.

Genus Ulema Castelnau, 1840

Castelnau, 1840, Hist. Nat. 2 : 219

Redtenbacher, 1845, Gulf., : 127

The members of this genus are usually elongate and dorsal surface shiny, black or brown, small to moderately elongate, apical segments of antennae monoliform, labrum small and transverse, maxillary palipi well developed. Pronotum strongly transverse and moderately convex in the middle. Elytra elongate with longitudinal deep striae and having same width as pronotum, prosternal process elevated, intercoxal process between hind coxae broad, last abdominal segment broad, femur strong and robust, tibia fairly slender,

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front tibia boarder than the other tibiae and generally serrated, tarsi very slender.

73. Ulema sp.

This species was totally absent from forest floor during this study. Only 4 exemples were trapped. In the tea garden 2 examples of this species were caught in fish baited traps in March, whereas in the paddy field 2 examples were caught, 1 example each in the fish and dung baited trap during April.

8. Family : Trogidae

Trogidae is a small family largely composed of the genus Trox Fabricius, other two genera i.e. Glaresis Er. and Cryptogenius Westwood included under the family are small. Arrow (1912) in Junk's coleopterorum Catalogus listed 157 species, of which 4 species of the genus Trox Fabricius namely, T. indicus Harold, T. granulatus Hebrst. T. hangi Harold, and T. omaecanthus Harold, have been recorded from India. Crowson (1955) mentioned that the species of the genus Trox Fabricius are endemic in all main regions of the world except, New Zealand. The species are mainly feed on animal matter and unlike scarabaeids adopted dry habitats. In the present study only two species have been trapped especially, during winter season.

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Genus Trox Fabricius, 1775

Fabricius, 1775, Syst. Ent., p. 31

Fabricius, 1792, Ent. Syst., 1 : 86

Members of this genus Trox Fabricius are characterised by body being oblong, surface covered with irregular ridges and elevations. Antennae 9 or 10 segmented with 3-segmented club and second antennal segment arising from a point proximal of apex of first segment. Front coxae rounded, subconical and prominent, middle coxae nearly round and contiguous. Abdomen with 5 visible Sternites and Pygidium covered by elytra.

74. Trox Sp. A. (PL.XI/69)

The specimens differ from known indian species of Trox Fabricius by their smaller in size (length 6 mm) and shape of the scutellum, which is uniformly broadly rounded, whereas other species have scutellum with a distinct constriction at the base.

ECOLOGY :

Trox sp. A. was most common in the forest floor than tea garden, and totally absent from paddy field of Doors area during this study. A total number of 85 examples were trapped, which represented over 95% of the total catches of Trox sp. (A and B) during this study. This species was

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found more or less throughout the year except, July, August and December during this study (Table 25), and its maximum incidence was observed during January to March in the forest floor.

The area of first choice of this species observed was forest floor (91.76%) followed by tea garden (8.23%) (Table 26). This species was totally attracted to fish baited traps (Table 26).

The abundance of this species was observed in single peak value by February in the forest floor. Besides this, minor peak values were also observed in October and November in the forest floor (Fig.33).

REMARKS :

It was observed that this species was most common in the forest floor and totally absent from paddy field of Doors area during this study. The cumulative annual incidence was observed in the following order :

forest floor tea garden

This species was most abundant in the cold dry winter months (December to February). The attraction was observed totally to fish baited traps.

75. Irex sp. B. (PL.XI/70)

These specimens are close both to I. indicus Harold

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and T. comacanthus Harold in general shape and size including scutellum but nearer to T. comacanthus Harold especially in pronotal shape.

ECOLOGY :

Trox sp. B. was only caught in fish baited traps. None of this species was trapped in dung baited traps nor in the empty pitfall traps (Table 26). 4 examples were trapped during this study, of which 2 examples were caught in the paddy field and 1 example each in the forest floor and tea garden.

REMARKS :

It was observed that this species was less abundant in Doors area during this study and collected only in fish baited traps.

9. Family : Scydmaenidae

The representatives of this family are commonly known as the ant-like stone beetles. This is a moderately large family includes about 1194 species from the world, of which only about 30 species are known from India. These are oval, convex, often ant-like in appearence, usually reddish brown and shiny and covered with long hairs. Head small, oval with small eyes, antenna 11-segmented with 3- or 4- segmented loose club. Prothorax broader than head. Front

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coxae conical. Tarsal formula 5-5-5.

In the present study, only 21 examples of this family Scydmaenidae have been caught which comprise 2 species under the genus, Scydmaenus Latreille.

Genus Scydmaenus Latreille, 1802

Latreille, 1802, Hist. Nat. Crust. et Ins., 3 : 116

The members of this genus can be recognised by the presence of scutellum (though minute), first segment of hind tarsi moderately elongate, metapisternum distinct and partly enclosing hind coxae, posterior coxae oval, elytra abbriviated, antennae clavate and first antennal segment moderate or short, fourth palpal segment of labial palpi small, obtuse and rounded, pygidium vertical or greatly inclined.

A total number of 21 examples, comprise two species of this genus denoted Scydmaenus sp A and Scydmaenus sp B have been caught during this study.

76. Scydmaenus sp. A

Scydmaenus sp A was totally attracted to dung baited traps. A total number of 6 examples, 2 in each of the three areas, paddy field, tea garden and forest floor were trapped. This species was only found in cold dry winter months (December to February).

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REMARKS :

It was observed that this species was similar to Scydmaenus sp B in seasonal incidence and trap preference but it was less abundant than the later species during this study.

77. Scydmaenus sp. B

Scydmaenus sp B was totally attracted to dung baited traps in Doors area during this study. A total number of 15 examples (mean per fortnight : 0'5) were trapped. This species was only found in cold dry winter months (December to February). The highest seasonal occurance was observed in the month of February when recorded average daily maximum and minimum temperatures were 25'77'C and 11'33'C respectively.

This species was common in tea garden than forest floor and paddy field. In the tea garden the cumulative annual incidence was 50.09%, whereas in the paddy field and forest floor it was 42% and 7.9% respectively.

REMARKS :

It was observed that this species was more common in tea garden than paddy field and forest floor. Attraction was observed only to dung baited traps in all of the three areas during this study. It was observed that the cold dry winter months were favourable for this insect emergence.

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10. Family : Peclophidae

The representatives of this family are known as short-winged mold beetles and generally found in the various types of mold which may occur in the logs, leaf litter and vegetable garbage and also in dung. These small beetles are compact, robust and heavily chitinised in appearence. They are closely resemble to the family Staphylinidae in appearence. The broad abdomen, narrower prothorax and still more narrow head as contrasted to the nearly parallel sided Staphylinidae. This is a very diverse and little studied group from Indian region.

In the present study only 17 examples of this family were trapped which comprise a single species under the genus Cyathiger King.

Genus Cyathiger King, 1865

King, 1865, Trans. Ent. Soc. N.S.Wales, 1 : 174

78. Cyathiger sp.

ECOLOGY :

Cyathiger sp. was caught only in tea garden during this study. A total number of 12 examples (mean per fortnight : 0'7) were trapped. The seasonal incidence of this species was found only in January and February during this study. Its maximum incidence was observed in the month of February when maximum and minimum temperatures

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were recorded 25'77'C and 11'33'C respectively. This species was totally caught in dung baited traps.

REMARKS :

It was observed that Cyathiger sp. was the only species of the family Pselaphidae trapped in Doors are during this study. This species was similar in trap preference with Atomaria sp. of the family Cryptophagidae. Both the species were attracted to dung baited traps and trapped in tea garden only.

11. Family : Chrysomelidae

Chrysomelidae is one of the largest families of Coleoptera. Jacoby (1908), Maulik (1919, 1926, 1936) recorded 1900 species from India. Both adults and larvae are phytophagus, usually feed on roots, stem and leaves of herbaecous plants. It comprises small to medium sized, ranging to 20 mm. long, usually elongated cylindrical to flat and oval and generally brightly coloured. Some species are pests of agricultural crops and some act as defoliator to forest plants.

In the present study, only 16 examples of this family have been caught which comprise 4 species under 3 genera, Lema Fabricius, Chaetocnema Stephens and Longitursus Latreille.

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Genus Lema Fabricius, 1798

Fabricius, 1798, Ent. Syst. Suppl., : 90

This is the largest genus of the subfamily Criocerinae and widely distributed throughout the world,except, New Zealand. So far, 86 species have been recorded from India. The members of this genus are generally small to medium sized, head constricted posteriorly, antennae filiform, elytra punctate-striate, legs elongate, femora moderately thickended, claws simple and united at base. This genus is close to Crioceris Geoffroy and can be easily separated from the latter genus by its claws being joined at the base. In the present study only one example of this genus has been caught.

79. Lema sp.

Only 1 example of Lema sp. was caught in fish baited trap in the month of May during this study (Table 25). This species was found only in the forest floor.

Genus Chaetocnema Stephens, 1831

Stephens, 1831, Ill. Brit. IV. Ent., : 325

This is a very small sized beetles distributed almost all parts of India. So far, 17 species have been recorded from India. Usually live on vegetable and other crop plants. Some species are pests of paddy and millet. In the present

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study, a total number 8 examples have been caught which belong to two species and its specific indentification could not be possible. The members of this genus are generally small and ovate, head usually broad and without any front elevations, prothorax broader than long, elytra striate punctate, front coxal cavities closed behind, middle and hind tibiae with an excavation on its outer apical end with a marginal row of stiff bristles. This genus is close to Craspicnema Scherer but can be easily separated from the latter genus by the middle and hind tibiae with an excavation on its outer apical end with a marginal row of stiff bristles. In Craspicnema Scherer only hind tibiae posses those characters.

30. Chaetocnema sp. A.

A total number of 3 examples were trapped in the paddy field, 1 example was in the month of May in empty pitfall trap and 2 examples were in the month of July in fish baited traps (Table 25).

REMARKS :

It was observed that this species was totally absent from tea garden and forest floor during this study.

31. Chaetocnema sp. B.

Chaetocnema sp. B. was totally absent from tea garden

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during this study. A total number of 4 examples were trapped, of which 3 examples were trapped in the forest floor in the month of July, whereas 1 example was trapped in the paddy field in the month of June during this study.

REMARKS:

It was observed that this species was totally absent from tea garden during this study.

Genus Longitursus Latreille, 1829

Latreille, 1829, Cuvier's Regn. Anim. Red., 5 : 155

This is the largest Indian genus of the subfamily Alticinae and widely distributed throughout India. So far, 27 species have been recorded from India. In the present study, only 8 examples have been caught, which belong to single species but could not be identified the species. The members of this genus are usually small and ovate, antennae long and slender, prothorax broader than long, elytra striate punctate, front coxal cavities open behind, posterior tibiae long and flat above towards the apex with a distinct and sharp spine, first segment of posterior tarsi equal to or larger than half of corresponding tibiae. The genus is nearer to Lupromorpha Weise but can be easily separated from the latter species by its first segment of hind tarsi is not less than half of the corresponding tibiae and posterior edge of elytra without any hairs.

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82. Longitursus sp.

A total number of 8 examples of Longitursus sp. were trapped in Dooars area during this study. In the forest floor 1 example was caught in fish baited trap, 2 examples were caught in empty pitfall trap and 1 example was caught in dung baited trap in the month of May. In the paddy field 3 examples were trapped in the month of August, of which 2 examples were in empty pitfall trap and 1 example was in dung baited trap. In the tea garden only 1 example was caught in dung baited trap in the month of April (Table 25).

REMARKS :

During this study it was observed that this species was found in all the three areas unlike other species of Chrysomelidae trapped in Dooars area of Jalpaiguri district.

12. Family : Elateridae

Elateridae is one of the largest families of the order Coleoptera. The members of this family are commonly known as click beetles as they produce a sound click by freely articulating prothorax with the produced prosternum fitted into a mesosternal fossa. Representatives of this family are elongate, somewhat depressed in shape, found on foliage, bushes, under bark and leaf litter. The larvae feed on plant

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materials, also known to feed on animal materials, rotten trees trunk and found in sandy soils where they devour roots, tubers or sometimes moss. Some are very injurious to agricultural products.

In the present study, a total number of 15 examples of this family have been caught which comprise 4 species under 3 genera, namely Heteroderes Latreille, Drasterius Eschtz. and Cardiophorus Eschtz. The 4 species are as follows-

83. Heteroderes lenis Candeze

84. H. spinosus Candeze

85. Drasterius collaris Candeze

86. Cardiophorus sp.

Of the 4 species, 3 examples of H. lenis Candeze, 2 examples in the paddy field and 1 example in the forest floor, were caught mostly in the empty pitfall traps in the monsoon months. Similarly, 5 examples of H. spinosus Candeze, 3 examples in the paddy field and 2 examples in the forest floor were caught mostly in empty pitfall traps in monsoon months (June and July). The other two species, D. collaris Candeze and Cardiophorus sp. were also common in the paddy field and mostly caught in dung and empty pitfall traps. A total number of 6 examples of D. collaris Candeze were trapped, of which 5 examples were trapped in the month of June in the paddy field and 1 example was trapped in the month of July in the forest floor, whereas the species (Cardiophorus sp.) was trapped in the paddy field in June during this study.

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13. Family : Cryptophagidae

The representatives of this family are commonly known as silken fungus beetles and generally feed on mold, fleshy, fungi, decayed leaves and similar materials. They are small in size, pubescent, with open front coxal cavities, antennae with 3-jointed club, tarsal formula 5-5-5 or 5-5-4 in ♂ and 5-5-5 in ♀.

In the present study 12 examples of this family were caught which belong to the genus Atomaria Stephens.

Genus Atomaria Stephens, 1830

Stephens, 1830, Ill. Brit. Ent. Mand. III, : 46

These are small well marked group can be easily recognised by their eliptical or oval shape and antennal insertion on top of the head with markedly large scape and segments 3-8 alternately long and short and club 3-segmented. Phothorax devoid of callosities at its front angle, front coxal cavities open behind, mesocoxal cavities close outwardly by sterna. Abdomen with 5 strenites. Tarsal formula is 5-5-5 in both sexes. Adeagus without parameres. Species diverse and widely distributed all along the foot hills of Himalaya, majority of them still remain undescribed.

87. Atomaria sp.

Atomaria sp. was only trapped in the tea garden of

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Doors area during this study. This species was found from January to March and a total number of 12 examples were caught in dung baited traps. Its highest seasonal incidence was observed in the month of January when recorded maximum and minimum temperatures were 22'65'C and 9'29'C respectively.

REMARKS :

It was observed that this species was found only in the tea garden and attracted to dung baited traps.

14. Family : Curculionidae

The representatives of this family are commonly known as snout beetles or weevils. Curculionidae is one of the largest and diverse family of the order Coleoptera. Almost all the members of this family are phytophagus, some leaf miners, some burrow in the stem of plants, some are stored grain pests, larvae often live in the soil and feed on roots of plants. Others cause galls on the roots and stems. The majority of weevils larvae live within the tissues of the host plant. Pupation takes place within the host plant or in the soil.. The adult weevils feed on the green tissues of plants, on pollen, flower tissues or developing fruits. The chief distinguishing characters of this family are : head with distinct, usually long and slender snout, geniculate antennae inserted on the snout, antennal club usually

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compact gular suture confluent and tarsi pseudotetramerous.

87. Genus Tanymecus Schonherr, 1826

Schonherr, 1826, Disp. Meth., : 127

The genus Tanymecus Schonherr is very common in India and known to be distributed over North America, Europe, Africa, Central Asia and far East countries. So far, more than 43 species have been recorded from India. The representatives of this genus can be recognised by the variable shape of the head with lateral eyes, rostrum varing in length, its base slightly broader from forehead or not and sides straight. Antennae inserted at the middle or before middle of the rostrum, the scape gradually thickned or rather abruptly calvate. Prothorax truncate or slightly rounded at base, the gular margin usually with a shallow sinuation. Scutellum triangular and distinct. Elytra variable in shape, truncate or sinuate at base, shoulder generally well developed. Legs elongate and slender, the femora moderately calvate, tibiae almost straight externally and sometimes denticulate internally.

88. Tanymecus indicus Faust

Faust, 1894, Ann. Mus. Civ. Genova, 34 : 177

Marshall (1916) mentioned that this species was recorded from Calcutta, Asansol : West Bengal : Assam : Bihar : Utter Pradesh : Cacca : Bangladesh : and Punjab.

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Since then, author has not seen any published record of this species. In this study, this species is being recorded from Boosara area of Jalpaiguri district, West Bengal.

DIAGNOSTIC CHARACTERS :

This species is rather small (length of 4'5 mm. to 7 mm.), blackish and covered with brown scales. Eyes large, oval, slightly prominent, rostrum as long as broad with distinct central carina, mandible not prominent. Prothorax a little longer than broad, sides rounded, apex of the prothorax a little narrower than the base. Elytra striate, striae not so deep towards the apex, broad near shoulder and gradually narrowed posteriorly. Legs blackish, tibiae not denticulate.

REMARKS :

This species is a well known agricultural pest, causes damage to Wheat and Bhutta by the adult which lives on the ground, hiding among the loose clods in the paddy field and nibbling off the young germinating plants during pre-monsoon months (March - April).

ECOLOGY :

Tanymecus indicus Faust was trapped in the paddy field during this study. A total of 3 examples were

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trapped of which 2 were caught in empty pitfall traps in March and 1 example was caught in dung baited trap in April (Table 25).

REMARKS :

This species was found restricted in the paddy field of Deoare area and trapped in the hot dry pre-monsoon months.

15. Family : Nitidulidae

The members of this family are commonly known as the sap beetles. This is a moderately large family of Clavicornia includes about 2200 species from the world, of which about 180 species are recorded from India. These beetles are (1'5 to 12 mm.) usually elongated, oval depressed, pale brown or yellowish red. Head with large rounded eyes, 11-segmented antennae with 3 segmented compact club, antennae received in an antennary groove on ventral side, mandibles moderately large. Prothorax usually transverse with transeverse front coxal cavities. Tarsal formule 5-5-5 in both sexes. Elytra shortened exposing part of abdomen. The habits of these beetles are variable. They live in the seed capsules, leaf litters, flowers, decaying fruits, fermenting fruit juice, fungi, under bark and some are known to breed in the nests of bumble bees.

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Genus Hantoncus Murray, 1964

Murray, 1964, Trans. Linn. Soc., London 24 : 401

The members of this genus can be easily recognised by body small, slightly convex, head large with antennae moderately long and distinct compact pubescent club. Pronotum slightly convex, marginod and transverse. Elytra truncate obliquely at apex exposing 2 apical abdominal segments. Tarsi dilated, more so in front tarsi and claws simple. In the present study only two examples of this genus have been caught.

89. Hantoncus sp.

ECOLOGY :

This species was the only representative of the family Nitidulidae trapped during this study. Only 2 examples trapped in the month of April and December (Table 25), in fish baited trap in forest floor of Doosra area.

REMARKS :

During this study it was observed that this species was restricted to forest floor and attraction was observed to fish baited trap.

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16. Family : Silphidae

These are commonly known as the carrion beetles. This is a moderately large family includes 702 species from the world, of which 29 are represented in Indian subregion. The common members of this family are moderately large and are known to be some of the largest beetles found on carrion. These are moderately elongated, subparallel or oval, black, testaceous, or black with organge or yellow markings. Head bulging at the ocular region, broad basally and deflexed, surface smooth or rugose, antennae 10 or 11 segmented and clubbed. Prothorax much larger than head and about as broad as elytra, oval, cordate or quadrate, sides margined, front coxae prominent with exposed trochantins. Legs with spinose tibiae, tarsal formula 5-5-5 in both sexes. Elytra often truncate exposing part of abdomen.

The silphids are known to found on carrion and also on decaying vegetables. The species of Nicrophorus Fabricius burry carrion, such as dead mice, reptiles, fish and small animals.

Genus Nicrophorus Fabricius, 1775

Fabricius, 1775, Syst. Ent., : 71

The genus Nicrophorus Fabricius is commonly known as burying beetle. So far, 57 species have been described

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from the world, of which 2 have been recorded from India. The member of this genus are black, with varible orange colouration on the elytra, antennae with 4-segmented club, and front tibia with a strong tooth towards apex.

90. Nicrophorus nepallensis Hope

Hope, 1831, Zool. Misc., 1 : 21

DIAGNOSTIC CHARACTERS :

This species is rather large (length, 19 mm. : breadth, 8 mm.), head well developed with distinct neck constriction, vertex of head with a rounded reddish spot, eyes markedly large and slightly yellowish, antennae with scape markedly large, club yellowish. Pronotum slightly transverse and broadly rounded, black, a lateral and basal margin slightly inflated, anterior half of pronotum with a suture like impression. Scutellum large and triangular. Elytra elongate, truncated at apex and slightly narrowed in front, black with two transverse reddish patches in front and behind. Abdomen with a few segments exposed.

ECOLOGY :

Nicrophorus nepalensis Hope was trapped only in the forest floor during this study. A total number of 2

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examples were trapped in fish baited trap in the month of January (Table 25).

REMARKS :

This species was less abundant during this study and only attracted to fish baited traps.

17. Family : Lagriidae

The representatives of this family are commonly known as lagriid beetles and are moderately large (10 mm. - 15 mm.), elongated, subcylindrical, metallic blue, green or reddish. Head projected and prominent, usually constricted behind the eyes, antennae 11-segmented and filiform with apical segment often markedly long. Prothorax usually elongated and punctate, front coxal cavities closed behind, and middle coxae conical. Elytra entire and completely covering the abdomen. Tarsal formula 5-5-4 with penultimate segment lobed below.

In the present study only one example of this family was caught which belong to the genus Lagria Fabricius.

91. Lagria sp.

This species is large, elongated, metallic blue with small head constricted behind the eyes, antennae

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slender 11-segmented. Prothorax much narrower than abdomen, punctate. Elytra punctate and completely covering the abdomen.

ECOLOGY :

Lagria sp. was found in the month of February during this study. Only one example was caught in empty pitfall trap in the paddy field.

REMARKS :

This occasional species was trapped only in the paddy field during this study.

18. Family : Lathrididae

The representatives of this family are known commonly as the minute scanvanger beetles, ranging from 1 mm. - 3 mm. long (Johnson, 1977), reddish brown in colour, usually feed on mould and commonly found on decomposed plant materials. Author has collected a large number of Lathrididae from Jalpaiguri district in hay stack, bushes, flowers and grass. But in the present experiment only one example of Corticarina sp. has been trapped. The chief adult characters of this family are body glabrous or pubescent, sometimes pronotum and elytra carinate or costate, antennae slender

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with 3-segmented loose club, tarsal formula 3-3-3 in both sexes, ventral surface often with waxy exudate.

Genus Corticarina Reitter, 1880

Reitter, 1880, Vrh. Nat. Ver. Brunn (Best. Tab. 3) : 28

92. Corticarina sp.

This species is small, brown, with long slender legs, antennae slender with 3-segmented loose club, head much narrower than pronotum. Prothorax somewhat broad strongly curved at the side. Basal segment of hind tarsi produced ventrally.

ECOLOGY :

Corticarina sp. was found in the month of January in dung baited trap. Only one example was trapped in the paddy field.

REMARKS :

This occasional species was trapped only in the paddy field during this study.

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R E S U L T S

The correlation between the total catches and certain climatological factors in each season during this study showed that the coleopterous insects had their incidence more or less throughout the year depending on the emergence of different families in different seasons.

A total number of 16602 representatives of 18 families and 92 species of the order Coleoptera were caught in the pitfall traps during this study. The family Scarabaeidae represented maximum number of species (29) followed by Staphylinidae (19), Carabidae (14), Histeridae (5), Elateridae (4), Chrysomelidae (4), Hydrophilidae (3), Tenebrionidae (2), Trogidae (2), Scydmaenidae (2), Ptiliidae (1), Pselaphidae (1), Cryptophagidae (1), Silphidae (1), Curculionidae (1), Nitidulidae (1), Lagriidae (1) and Lathridiidae (1) (Table 2).

Of the 18 families caught, the Scarabaeidae was the most abundant family which accounted for 54.42% of the more than 9000 beetles trapped, and Staphylinidae accounted for 32.91 of the more than 5000 beetles trapped, whereas with the representatives of 14 species, the Carabidae accounted for 1.66% of the total 276 beetles trapped. However, with the representative of a single species the Ptiliidae accounted for 4.04% of the more

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than 600 beetles trapped. The Histeridae, with 5 species, accounted for 3.24% of the more than 500 beetles trapped and Hydrophilidae and Tenebrionidae, with 3 species each, accounted for 1.51% and 1.12% of the total 250 and 167 beetles trapped respectively (Table 2).

Beetles were more abundant in fish baited traps constituted 83% of the total beetles catches, whereas in the dung baited traps it was 13% and in the empty pitfall traps it was 3% of the total catches during this study. The Scarabaeidae, Staphylinidae, Histeridae, Trogidae, Silphidae and Nitidulidae were mostly caught in fish baited traps, whereas the Ptiliidae, Hydrophilidae, Scydmaenidae, Cryptophagidae, Tenebrionidae, Pselaphidae and Lathridiidae occured mostly in dung baited traps. The Carabidae were mostly caught in empty pitfall traps, whereas the Elateridae and Chrysomelidae showed more or less an uniform distribution accross all the traps including empty pitfall traps.

All the families exibited a distinct habitat preference (Table 4). The Scarabaeidae, Tenebrionidae, Hydrophilidae and Trogidae were most abundant in forest floor, whereas Staphylinidae, Histeridae were most common in tea garden, and Carabidae, Ptiliidae were found abundant in paddy field (Fig.4). The other 10 families, though they were lessly trapped (sometimes represented

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by one or two examples) during this study, were found restricted only in a single area except, Scydmaenidae, Elateridae and Chrysomelidae. The Scydmaenidae and Chrysomelidae were trapped in all of the three areas but Elateridae were found totally absent from tea garden common in paddy field than forest floor. The Scydmaenidae showed the choice of first preference to tea garden and followed to paddy field and forest floor, whereas Chrysomelidae showed least preference to tea garden and were more common in paddy field than forest floor. The Silphidae and Nitidulidae were found only in the forest floor, whereas the Cryptophagidae, Pselaphidae and Lagriidae found in the tea garden, and Curculionidae and Lathridiidae were in the paddy field only (Table 6).

Amongst the three trapping plots it was found during this study that the beetles were less abundant in tea garden than forest floor and paddy field. During the study total beetles trapped in the tea garden were 4953 examples, whereas 5642 examples were trapped in paddy field and 6007 examples were trapped in the forest floor (Table 3). The highest catch of beetle fauna in the forest floor was mainly supported by Scarabaeidae (67.18%) and also this was area of choice by Tenebrionidae (1.98%), Hydrophilidae (1.72%) and Trogidae (1.36%). Other four abundant families in forest floor were Staphylinidae,

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Carabidae, Histeridae and Ptiliidae, which were represented by by 18.48%, 1.28%, 4%, and 3.67% respectively (Table 3). Miscellaneous family like Slateridae was also caught 0'54% in this forest floor area. The area of first choice of the representatives of Ptiliidae and Carabidae was paddy field where they were caught 5.76% and 2.18% respectively. Other than these two families in the paddy field Scarabaeidae, Staphylinidae, Histeridae, Hydrophilidae, Tenebrionidae, Trogidae and Miscellaneous families like Chrysomelidae, Curculionidae etc. were represented by 48'32%, 40'35%, 0'74%, 1.52%, 0'65%, 0'03% and 0'46% respectively. The total catches of the beetle fauna (4953 examples) in tea garden was mainly supported by Staphylinidae (42.44%) and also this was area first choiced by Histeridae (5.47%). Other than these two abundant families in tea garden, Scarabaeidae, Carabidae, Hydrophilidae, Ptiliidae, Tenebrionidae, Trogidae, and Miscellaneous families like Scydmaenidae, Pselaphidae etc. were represented as 44'92%, 1'53%, 1'21%, 2'69%, 0'58%, 0'16% and 0'88% respectively (Table 3).

In the present study, 9035 examples of Scarabaeidae were trapped which belong to single tribe Coprinii, under 7 genera and 29 species. Number of species of Scarabaeidae caught varied during the year, they increased with the increase of rainfall during pre-monsoon and monsoon months. Most of the species (about 71% of the total species of

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Scarabaeidae caught during this study) were emerged by April and reached their peak period of abundance during post-monsoon months (Table 7) when the highest seasonal occurence of the Scarabaeidae was observed. During the months, September to November, a total number of 3617 examples (over 40% of the total Scarabaeidae caught) were trapped, of which a total number of 1977 examples (over 21% of the total Scarabaeidae caught) were caught in the month of October and also during this month 809 examples of lone species Onthophagus exquisitus Arrow were trapped, which covered 8% of the total Scarabaeidae caught during this study. Of the total 29 species of Scarabaeidae caught during this study, 14 species were common in each of the three areas, 5 species were found in two areas (2 species in forest floor and paddy field, and 3 species in tea garden and paddy field) and 10 species were found in single area (7 species in forest floor and 3 species in paddy field). Although 14 species were found in each of the three areas but most of the species were abundant in forest floor excepting, Onthophagus exquisitus Arrow and O. orientalis Harold which were more abundant in paddy field then tea garden and forest floor.

During this study a total number of 5465 examples of the family Staphylinidae were caught which belong to four subfamilies, Oxytelinae, Staphylininae, Paederinae and Aleocharinae and identified as 19 species

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under 13 genera. The species of Staphylinidae caught varied during the year and number of species were increased with the decrease of rainfall and temperatures during the cold dry winter months. Most of the species (about 59% of the total species of Staphylinidae caught during this study) were emerged by December and reached their peak period of abundance during February (Table 7) when the highest seasonal incidence of Staphylinidae was observed. During the month of February a total number of 1831 examples (over 33% of the total Staphylinidae caught during this study) were trapped. This concentration of beetle community in the month of February was mainly due to the fact that during this month the species Anotylus laetus Cameron was most abundant. A total number of 1008 examples of this species were trapped in this month which covered more than 18% of the total Staphylinidae caught during this study. Of the total species of Staphylinidae caught during this study, 9 species were common in all of the three areas, forest floor, tea garden and paddy field, 6 species were found in two areas (3 species in forest floor and paddy field, and 3 species in tea garden and paddy field) and 7 species were found in single area (5 species in forest floor and 2 species in paddy field).

The family Carabidae represented by 14 species belong to 13 genera and a total number of 276 examples were

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caught during this study. Number of species were increased with the decrease of rainfall and temperatures. Most of the species (about 97% of the total species of Carabidae caught during this study) were abundant during cold dry winter months when the highest seasonal occurence (76%) were observed. During these months (December to February) a total number of 211 examples were trapped, of which a total number of 113 examples (over 44% of the total catches) were collected in the month of February. Of the 14 species of Carabidae caught, 2 species were common in all of the three areas (tea garden, paddy field and forest floor), 9 species were found in two areas (3 species in forest floor and paddy field, 5 species in tea garden and paddy field, and 1 species in forest floor and tea garden) and 3 species were found in single area (2 species in forest floor and 1 species in paddy field).

The family Histeridae represented by 5 species which belong to 4 genera and a total number of 539 examples were caught during this study. The species of Histeridae were most common in the hot dry months when the temperatures were high with a few showers of rain. During these months, March to May a total of 389 examples (over 72% of the total Histeridae caught during this study) were trapped, of which a total of 152 examples

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(28% of the total catches) were collected in the month of April. Of the 5 species of Histeridae caught during this study 3 species were common in each of the three areas (forest floor, tea garden and paddy field) and 2 species were obtained only from forest floor.

The families Chrysomelidae and Elateridae were represented by 4 species which were found during pre-monsoon and monsoon months. One species of Chrysomelidae was found in each of the three areas, forest floor, tea garden and paddy field, whereas no representative of Elateridae was found in each of the three areas. 3 species of Elateridae and 1 species of Chrysomelidae were found in two areas (forest floor and paddy field) and 1 species of Elateridae and 2 species of Chrysomelidae were found only in single area, paddy field and paddy field, forest floor respectively.

The Hydrophilidae was represented by total number of 250 examples pertaining to 3 species under 2 genera. The species of Hydrophilidae were fairly abundant in monsoon and post monsoon months when total number of 150 examples (60% of the total catches) were trapped. Of the total 3 species caught during this study, 1 species was common in all of the three areas, forest floor, paddy field and tea garden, 1 species was found in two areas, forest floor and tea garden, and 1 species was found only in single area, forest floor.

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The family Scydmaenidae was represented by two species under single genus during this study. Both of the species reached their peak in abundance in February and both the species were common in each of the three areas, forest floor, tea garden and paddy field.

In the present study Tenebrionidae was represented by 2 species which were trapped in hot dry pre-monsoon months, mostly in the month of April. Of the two species Tenebrionidae caught, one species was common in all of the three areas and one species was only found in paddy field.

The families Pselaphidae, Cryptophagidae, Silphidae, Lathridiidae, Lagriidae, Curculionidae, Nitidulidae and Ptiliidae were represented by single species which were mostly trapped in the cold dry winter months, except the families Ptiliidae and Curculionidae which were common in the warmer months. The representatives of all these families, except Ptiliidae, were found in single area as follows : Silphidae and Nitidulidae (forest floor), Lagriidae, Cryptophagidae and Pselaphidae (tea garden), and Lathriddidae and Curculionidae (paddy field). The representative of the family Ptiliidae was found most common and abundant in each of the three areas, forest floor, tea garden and paddy field.

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D I S C U S S I O N

Thomas and Sleeper (1977) mentioned that several problems associated with the pitfall traps method can be overcome if the proper precautions are taken; Turner (1962) mentioned that pitfall traps efficiency is directly related to its circumference. It is unfortunate that there is no standered size of can trap but it is necessary that uniformity of the traps should be maintained throughout the study to ensure the equal catch. However, several authors have achieved satisfactory results in studing density estimation with this method. A review of previous works has led to a conclusion that for quantitative works pitfall traps might have some draw backs of its own, especially if it embraces groups more diverse than a single family of Coleoptera, but in comparision between two or more habitats probably it gives more accurate indication of faunal activity. Fichter (1941) while discussing pitfall traps, stated that this method may be used to compare the composition of soil surface arthropod population in two or more habitats. Boyd (1960) used pitfall traps to compare the surface dwelling fauna of grazed and ungrazed grassland and concluded that fairly accurate surface activity of soil fauna can be understood by pitfall catches. Williams (1959 a) used these pitfall traps in a different habitats to measure the activity of

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ground dwelling invertebrates and interpreted the catches of the traps as measures of the level of activity in their respective vegetation types. In a population study of Carabidae, Greenslade (1964 a) mentioned that pitfall traps can be used also in comparing the fauna of different habitats in conjunction with marking and recapture or quadrate counts, and for investigating the distribution of one species in a single vegetation type.

In the present study a total number of 16602 beetle examples were caught during March'77 to February '78, of which 88'75% represented by the Scarabaeidae and Staphylinidae, and 11% represented by the Histeridae, Tenebrionidae, Carabidae, Ptiliidae, Hydrophilidae, Trogidae, lastly 0.25% was the miscellaneous families represented by Scydmaenidae, Pselaphidae, Cryptophagidae, Chrysomelidae, Lathridiidae, Lagriidae, Silphidae, Elateridae, Curculionidae and Nitidulidae (Table 2). Poole (1974) mentioned that usually the communities are made by a few abundant species and many less abundant or some rare species. In the present study it was observed that amongst the eight abundant families, a few species made up the majority of beetles which includes 8 species of the Scarabaeidae accounted for 46'18% of the total beetles trapped, 7 species of the Staphylinidae accounted for 31'71% of the

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total beetles, 3 species of the Carabidae and 1 species of each family Ptiliidae, Tenebrionidae, Hydrophilidae, Histeridae and Trogidae accounted for respectively 1'02%, 3.96%, 1'08%, 1'14%, 2'7% and 0'5% of the total beetles trapped.

One of the main aims in the present study was to observe the difference in habitat preference of the species and also the species compositions between the three different adjoining vegetation types, forest floor, tea garden and paddy field in Dooars area of Jalpaiguri district which situated at the foot hills of North East Himalaya of the state, West Bengal. In a study of Phenology of some surface-active arthropods of Moreland Country in North Wales, Pearson and White (1964) stated that pitfall traps measure activity as well as abundance of a species, the actual number caught being a product of both activity and abundance and the data collected can be most validly used to investigate the phenology of a species in different habitats. It has been observed that a total number of 16602 beetles individuals pertaining to 18 families and 92 species under 57 genera were caught during this study. Out of 92 species were trapped, about 50% of these species were represented by a few examples, even sometimes only one or two individuals. The decreasing population size and area preference of 23 abundant and common species of

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Coleoptera of Boosra area during this study are shown in histogram (Figs. 6 and 7) and the list of 92 species mentioned are arranged according to the total number of individuals trapped as follows:

Onthophagus exquisitus Arrow

Anotylus laetus (Cameron)

Anotylus nitidulus (Gravelly)

Onthophagus deflexicollis Lansberge

Onthophagus vaulogeri Boucomont

Onthophagus singhi Biswas (manuscript name)

Acrotrichis sp.

Gymnopleurus sinuatus var assamensis Waterhouse

Hister luciscus Lewis

Catharsius sagax (Quenstedt)

Microglotta sp.

Anotylus latiusculus Kraatz

Onthophagus luridopennis Bohemann

Onthophagus orientalis Harold

Aleochara castanea Motschulsky

Costernum horni d'orchym

Gonocephalum depressum Fabricius

Cordalia vestita Bohemann

Trox sp.A

Phymatura intermedia Cameron

Pheronosphus consularis (Schmidt - Goebel)

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Onthophagus rudis Sharp

Phaeochrous emarginatus Castelnau

Hybosorus orientalis Westwood

Onthophagus gangeticus Gillet

Onthophagus bifasciatus (Fabricius)

Onthophagus furcicollis Arrow

Onthophagus hastifer Lansberge

Onthophagus phanaeiformis Boucomont

Cercyon sp. A

Anotylus sikkimi (Fauvel)

Parachorius hookeri Arrow

Saprinus optabilis Marseul

Carphoca humilis Schmidt - Goebel

Thinocharis debilis Cameron

Saprinus chalcites (Illiger)

Onthophagus chamrupus sp. nov.

Onthophagus centricornis (Fabricius)

Cyathiger sp.

Onthophagus tricornis (Wiedemann)

Aephnidius adelioides (Macleay)

Perigona nigriceps (Dejean)

Scydmaenus sp. B

Onthophagus krishnai Biswas (manuscript name)

Atomaria sp.

Dinusa heimi Wasmann

Anotylus frater (Cameron)

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Onthophagus rynthi Biswas (manuscript name)

Proteinus fuscotestaceus Cameron

Oxytelopsis pseudopsina Fauvel

Onthophagus unifasciatus (Schaller)

Dyschirius bengalensis Andrews

Lesticus politocollis (Motschulsky)

Longitursus sp.

Pentagonica tenebrosa Andrews

Clivina memnonia Dejean

Catharsius pithecius (Fabricius)

Philonthus assamensis Cameron

Drasterius collaris Candeze

Scydmaenus sp. A.

Chaetabraeus fahir Lewis

Heterocerus spinosus Candeze

Trox sp. B.

Onthophagus vigilans Boucomont

Chaetocnema sp. B.

Tenymecus indicus Faust

Ulona sp.

Oxynomus aciculatus Schmidt

Chlaenius pictus Chaudoir

Eurylister sincerus Schmidt

Philonthus austilbus Kraatz

Onthophagus atropolitus d'orbigny

Leptacinus notabilis Cameron

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Staphylinus sp.

Scopaeus nitidulus Motschulsky

Galerita orientalis Schmidt - Goebel

Tetragonoderus rombophorus Schmidt - Goebel

Haptoncus sp.

Microphorus nepalensis Hope

Heteroderes lenis Candeze

* Onthophagus pactolus Fabricius

* Largia sp.

* Tachys truncatus Nietner

* Staphylinus maculipennis Kraatz

* Corcyon sp.B.

* Corticarina sp.

* Cardiophorus sp.

* Lema sp. (Those species are marked with an asterisk are represented by single specimen).

Fortnightly catch review of the beetles of 18 families during this study resulted that the seasonal occurance of the families were more during the winter months when average 9-10 families were caught per fortnight, next highest seasonal occurence was found during hot dry pre-monsoon months when average 8-9 families were caught per fortnight. The lowest seasonal incidence was observed in the post-monsoon months when average 5 families were caught per fortnight, and also in the monsoon months when average catches were 7-8 families

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per fortnight (Table 7). In a review of total catches of beetles in number irrespective to the families per fortnight resulted that beetles were more abundant in the hot dry pre-monsoon months (Fig.3) when total beetles were caught 26.97% whereas in the cold dry winter months when number of families were more, the lowest incidence of the total beetles (23'11%) were trapped. The next highest catches were in the monsoon months when total number of beetles were caught 25'31% and in the post-monsoon months the total catches were 24'91% (Table 7). In the winter months though more families were trapped but the total catches were less, this well might due to the fact that incidence of miscellaneous families like Scydmaenidae, Pselaphidae, Cryptophagidae, Silphidae etc. were more during these months but not totally surface dwelling in habit and less active in monsoon months (Table 7).

It is stated earlier that there is a co-relation between the total catches of the beetles and certain environmental factos which also suggested by Ahearn (1971) that prevailing weather conditions are environmental factors of major significance in determining the relative abundance of arthropods. Temperature, relative humidity and rainfall affect the arthropod population through modification in their daily and seasonal surface activities,

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as well as through adjustment their densities. Williams (1940), in a four-year study on the effect of weather on insect density ' concluded that rainfall and temperature were the two main climatic factors having greatest influence on total catches of insect in England. In the present study it has been observed that certain families or groups or species directly respond with the change of temperature, humidity and rainfall. Abundance of beetles depend on the three major phenomena viz. i) increase in abundance with increase in temperature, ii) increase in abundance with increase in temperature and rainfall, and iii) increase in abundance with decrease of temperature and rainfall. Increase in abundance with increase in temperature was observed in Histeridae and Tenebrionidae during hot dry pre-monsoon months when recorded average daily maximum and minimum temperatures and monthly rainfall were 29'6'C and 18'4'C and 190'3 cm respectively but they were gradually decreased with the increase of rainfall during the monsoon months when average monthly rainfall was recorded 625'5 cm, whereas increase in abundance with increase in temperature and rainfall occured in the Scarabaeidae, Ptiliidae and Hydrophilidae during the monsoon months when recorded average daily maximum and minimum temperatures and monthly rainfall were 30'95'C and 24'72'C and 625'5 cm respectively.

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Thirdly increase in abundance with decrease in temperature and rainfall was observed in the Staphylinidae, Carabidae and Trogidae during cold dry winter months when recorded average daily maximum and minimum temperatures and monthly rainfall were 24'12'C and 10'9'C and 7'7 cm.. respectively. The incidence of beetles with decrease of temperature and rainfall was also observed in Scydmaenidae, Pselaphidae, Cryptophagidae, Lathridiidae, Lagriidae and Silphidae during this study. These families were trapped less in number, sometimes represented by only one or two examples during this study. The other two families Curculionidae and Chrysomelidae were occasionally (accidentally) trapped both in the baited and empty pitfall traps.

In this study the Scarabaeidae (Coprinae & Hybosorinae) were accounted for 29'16% of the total species and 54'12% of the total beetles trapped, whereas Aphodiinae had a negligible catch (1'06% of the total species and 0.02% of the total catches). Rainio (1966) observed that in the forest and Pastures of Finland, Aphodiinae : Scarabaeidae were abundant (92%) of the total beetle species and 99% of the total beetles trapped, and Scarabaeidae made up 6% of the total species and 1% of the total individuals trapped ; Hanski and Koskela (1977) also mentioned that there were no species of

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Scarabaeidae but 18 species of Aphodiinae : Scarbaeidae were trapped in Finland.

Halfter and Mathews (1966) mentioned that the food preference of the species may vary from locality to locality and depend upon the source of food availability. In the present study the low incidence of Scarabaeidae in cow dung baited traps well might be explained by the fact that the pungent smell of the fish bait was more attractive to Scarabaeidae than the mild smell of cow dung bait. Oppenheimer (1977) discussed in study of ecology of dung beetles that cattle dung though abundant was rarely available to dung beetles as it was collected by the villagers to use as fuel after being dried, whereas Upadhyaya and Tripathi (1973) observed that Catharsius molossus (Linnaeus) collected from cattle dung in Utter Pradesh went to human dung when the beetles were exposed to human dung, cattle dung and horse dung in a test chamber. In the present study the most abundant species of Scarabaeidae were Onthophagus exquisitus Arrow, O. deflexicollis Lansberge, O. Vaulogeri Boucomont, O. singhi Biswas (manuscript name), O. luridipennis Bohemann, O. orientalis Harold, Gymnopleurus sinuatus var assamensis Waterhouse and Catharsius sagax (Quenstedt). Of these, three species O. vaulogeri Boucomont, O.singhi Biswas (manuscript name) and O. deflexicollis Lansberge are more or less similar in size and had similar

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seasonal incidence during this study. These species were most abundant in fish baited traps and less so in cow dung baited traps. These three species were also common in forest floor followed by paddy field and tea garden (Table 11). The most common and abundant species O. exquisitus Arrow is small in size (5-6 mm. in length) but it showed similar behaviour in relation to bait and area preference as O. orientalis Harold which is a rather large species (7'5 - 13 mm. in length). But the later species was less abundant, again both these two species were predominantly trapped in paddy field mostly in the fish baited traps. O. luridipennis Bohemann was only attracted to fish baited traps and prefered forest floor area followed by tea garden and paddy field, whereas species O. rudis Sharp and Pheochrous emarginatus Castelnau were also attracted to fish baited traps but only in the forest floor area. Catharsius sagax (Quenstedt) and Gymnoplaurus sinuatus var assamensis Waterhouse were only large sized Scarabaeidae trapped during this study. These two species were most common in forest floor and G. sinuatus var assamensis Waterhouse was totally absent from tea garden and attracted more than 50% to the dung baited traps, whereas C. sagax (Quenstedt) showed more than 35% of the total incidence in the tea garden and mainly attracted to fish baited traps (92%).

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In Staphylinidae 7 species mainly, Anotylus laetus Cameron, A. nitidulus (Gravelly), Microglotta sp., A. latiusculus Kraatz, Aleochara castanea Motschulsky, Phymatura intermedia Cameron and Cordalia vestita Bohemann were most abundant. Of which the two species A. laetus Cameron and A. nitidulus (Gravelly) were predominant than others and they are more or less similar in size and trapped chiefly in fish baited traps but they differed each other by their area of preference, A. laetus Cameron was most common in the tea garden, whereas A. nitidulus (Gravelly) prefered the paddy field of its first choice. These two species had similar annual fluctuation in total abundance. Likewise A. laetus Cameron and Phymatura intermedia Cameron prefered tea garden but Phymatura intermedia Cameron differed from the former species by choicing the dung baited traps. A. latiusculus Kraatz is a smaller sized Staphylinidae and was 3'7 times less abundant than A. nitidulus (Gravelly) but these two species had similarities in their area preference (Paddy field) and also in bait preference (Fish bait). Another two species, Microglotta sp. and Aleochara castanea Motschulsky showed similar area preference and also bait preference though there was such difference between their body size, Aleochara castanea Motschulsky is a larger species (3'75 mm.), whereas Microglotta sp. is a smaller species (1.8 mm.) but both

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of them were abundant in forest floor and prefered fish baited traps.

Three abundant species of Carabidae were, Pheropsophus catoirei (Dejean), Agonum birmanicum (Bates), and P. consularis (Schmidt-Goebel). The species, P. catoirei (Dejean) and P. consularis (Schimdt-Goebel) comparatively larger and equal in their size, whereas A. birmanicum (Bates) is much smaller in size, former two species showed a similar behaviour throughout the study, both the species were abundant in the paddy field, totally absent from tea garden (Fig. 7) and showed highest seasonal incidence in the month of February, whereas A. birmanicum (Bates) differed from these two former species by total absence from forest floor and abundant in the tea garden (Fig. 7) and showed highest seasonal incidence in the month of January. The only similarity was that these species were mostly caught in empty pitfall traps. Walsh (1931, 1933) Kaufmann (1937) made experiments to determine whether baited traps resulted in a marked increase in catch of Carabidae, in addition the effect on catch of the density of traps in a plot investigated. Both authors found that there was no variation of catches of Carabidae, and no trap-density effect were recorded.

The minute feathered-wing beetle Acrotrichis sp. was the only representative of the family Ptiliidae in

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this study. This species showed a distinct habitat and bait preference, and mostly attracted to dung baited traps throughout the study and most common in paddy field. Gonocephalum depressum Fabricius, the only abundant species of the large family Tenebrionidae during this study, exibited an uniform distribution in all the traps including empty pitfall traps.

The most common species of Histeridae was Hister luciscus Lewis which was 10 times more abundant than another species of Histeridae Saprinus ontabilis Marseul but both the species were chiefly attracted to fish baited traps, whereas they differed from their choice of areas, Hister luciscus Lewis was abundant in loose airy soil of tea garden where they burried themselves upto 10 cm. depth of this soil, and Saprinus ontabilis Marseul was abundant in the forest floor where they kept themselves hidden under the decomposed litter layer on the soil surface. Another species, Saprinus chalcites (Illiger) which is smaller in size then the former two species, had similar trap preference but differed from the choice of area. S. chalcites (Illiger) was abundant in the paddy field, and found resting underneath the manure and haystack damping besides the paddy field.

Majority species of Hydrophilidae are known to be aquatic and commonly known as water scavenger beetles, but

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few species of the sub-family Sphaeridiinae live in dung and moist earth, soil rich in humus or in moist decaying leaves. During this study three species of Hydrophilidae trapped belong to the sub-family Sphaeridiinae and mostly trapped in dung baited traps. The species Oosternum horni d'orchym and Cercyon sp. A. are more abundant but they were dissimilar in size, in area preference and also in seasonal incidence. O. horni d'orchym is larger in size and over three times more abundant than Cercyon sp. A. The former species was most common in paddy field, whereas the later species was totally absent from paddy field and common in forest floor. Other species, Cercyon sp. B. was only represented by a single individual during this study and trapped in forest floor in dung baited trap.

The family Trogidae represented by 2 species which belong to the genus Trox Fabricius. Trox sp. A. was abundant, constituted 95% of the total catches. Trox sp.A. is smaller than Trox sp.B. and former species was totally absent from paddy field, whereas later was more in paddy field than teagarden and forest floor.

Scherney (1960) studied carabid beetles of cultivated land by pitfall traps, where he showed area of preference of these beetles as follows : Wheat field> barley > potatoes > clover > grass meadow > densely covered waste ground, and concluded that most of the

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insects were associated with the cultivation. Greenslade (1964 b, 1964 c), in his Wood-land and grassland study, emphasised largely on the difference between the woodland edge, where the floor had a little litter, and huge litter covered area deep inside woods. In the present study tea garden was very clean and had a little litter cover, whereas forest floor had huge litter covered area, and paddy field was open yard area and consisted of small plots with slightly elevated crop rows from the original cultivated plot. In a review of total number of species of Coleoptera trapped during this study resulted that the paddy field habitat had the highest number of Coleopterus species (66), whereas in the forest floor and tea garden habitat the total number of species were trapped 65 and 52 respectively (Table 1). Though number of species trapped in these three adjoining areas, forest floor, tea garden and paddy field, were different, yet it is observed that the most abundant species of this area were common in all of the three areas, except the abundant species Gymnopleurus sinuatus var assamensis Waterhouse, Pheropsophus catoirei (Dejean) and P. consularis (Schmidt-Goebel) which were totally absent from tea garden, and again Agonum birmanicum (Bates) and Trox sp.A. were totally absent from forest floor and paddy field respectively (Fig. 7). It well might be the fact that they had restricted movement and live on that particular

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areas only. One of the interesting observations has been made that was the complete absence of Aphodiinae : Scarabaeidae species in paddy field and forest floor, though only species, Oxynomus aciculatus Schmidt occured only in the forest floor and was not a common species.

It was observed that most of the species had a peak period of abundance during the year of study. Such peak period may vary with the variation of locomotor activity of each species of beetles (Evans, 1969). Species showed that maximum activity differed from species to species and in order to decreasing population size these species could be ranked in a series showing later or lesser activity. Greenslade (1969) also mentioned that this activity differed in Carabidae from species to species. Kasule (1968) used pitfall traps to study Staphylinidae and obtained similar results. These activity peaks in both Carabidae and Staphylinidae usually represented breeding activity and during this period the females are building up food reserves for future egg laying (Evans, 1969). During this study these activities were also observed in the Scarabaeidae which were most abundant during late monsoon months and post-monsoon months.

Instead of comparing all the factors of surface dwelling beetles if only factor like bait is considered then it can be seen that within the families the different

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activity peaks were observed in different species in different seasons for avoiding overlapping. In the present study the two families, Scarabaeidae and Staphylinidae showed a distinct different activity peaks throughout the year though both the families were chiefly attracted to fish baited traps. The Scarabaeidae were observed abundant during late monsoon and early post monsoon months, whereas Staphylinidae showed these activity peaks during the cold dry winter months (Table 5). The Carabidae had also activity peaks during this cold dry winter months and almost all the species were trapped in empty pitfall traps, whereas Staphylinidae were mostly trapped in fish baited traps and some in dung baited traps. The Histeridae and Trogidae were also attracted to fish baited traps but their activity peaks were in the hot dry pre-monsoon months and late winter months respectively. Though the Staphylinidae and Trogidae had their activity peaks in the winter months but the areas were different. Trogidae were abundant in forest floor, whereas Staphylinidae were more abundant in paddy field and tea garden.

In this study only one roller species of Scarabaeidae, Gymnopleurus sinuatus var assamensis Waterhouse was trapped which found to make dung roles inside the dung baited traps in the forest floor and paddy field during monsoon months.

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Ovarov (1931) and Landin (1961) stressed the ultimate need for a more detailed classification of animal habitat in the same way as the climate is being graded according to its scale into macro-, micro- and ecoclimate. Similarly, in the present study 92 species were trapped which showed differences in time of occurance, bait preference, breeding time & life cycle and hibernation, and as a matter of fact that these emphasize their microhabitat within the vegetation type must differ, both from one another and also in time.

It is mentioned earlier in the introductory part of this work that the beetle fauna of Dooars area of Jalpaiguri district, foot hills of North East Himalaya, West Bengal are still poorly known. It is mentioned that several new records to Dooars area and a few new records even from India have been noted in present study, moreover practically no other biological informations are known about 92 species dealt in the present study. For the constructive and meaningful conclusion for such ecological studies more details especially life history, habitats, breeding time and behaviour of each species are very much essential. This is a preliminary study and first attempt to make a basic knowledge of surface dwelling beetles of Dooars area, therefore several conclusions are remained unsolved or incomplete. Besides representatives of 18

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families of the order Coleoptera studied in the present investigation, following orders and families were also caught in pitfall traps during March 1977 to February 1978, which are not taken into account in the present study.

Class	: Insecta	
Order	: Hymenoptera	: Ichneumonidae and Formicidae
Order	: Diptera	: Muscidae and Calliphoridae
Order	: Hemiptera	: Aphididae
Order	: Orthoptera	: Tettigoniidae
Order	: Collembola	: Isotomidae
Class	: Arachnoidea	: Spiders, Harvestmen and mites.

From the results achieved in the present study it can be concluded that pitfall traps are useful devices to study the activity, abundance of surface dwelling beetles in single or different vegetation types. In addition to ground beetles the collection of other insects proves that this trap device well might be successfully incorporated in sampling and collection, and also in studing particularly the ecology of nocturnal insects.

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S U M M A R Y

Very little was known about the surface dwelling beetle fauna of Dooars area of Jalpaiguri district, foot hills of North East Himalaya, West Bengal. The present project an attempt has been made to study the surface dwelling beetle fauna, especially their population, seasonal variation, diversities of beetle fauna, standarisation of traps, bait and habitat preference etc. Experiment has been designed by making pitfall traps in three adjoining ecological areas viz. forest floor, tea garden and paddy field. Traps used in this study were baited (fish bait and dung bait) and without bait (empty pitfall trap). Fish and dung were collected locally from the market and an Indian pet cow respectively. During this study a total number of 92 species (including a species new to science) were trapped. All the species were identified and descriptions of species were given along with illustration where necessary. The published information about the distributional record of these species and other taxonomical informations were also mentioned. A total number of 16002 beetle examples belong to 13 families were collected by using 27 pitfall traps, of which 9 were baited with fish, 9 were baited with dung and 9 were empty pitfall traps in three rows in each of the three vegetation types viz. forest floor, tea garden

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and paddy field. Of the 18 families caught, Scarabaeidae and Staphylinidae were the most abundant families represented by 54.42% of the more than 9000 beetles trapped and 32.91% of the more than 5000 beetles trapped respectively. Other than these two abundant families, Carabidae, Trogidae, Histeridae, Ptiliidae, Hydrophylidae, Tenebrionidae, Scydmaenidae, Elateridae, Cryptophagidae, Chrysomelidae, Legriidae, Lathridiidae, Nitidulidae, Silphidae, Curculionidae, Pselaphidae were also caught during this study. The seasonal occurance of the families was found different to avoid overlapping. Discussion is made on the relationship between the total catches with the number of families trapped in different seasons. Rainfall and temperatures had an effect on the seasonal abundance on these families which are as follows : i) Increase in abundance with increase in temperature was observed in Historidae and Tenebrionidae during hot dry pre-monsoon months when average daily maximum and minimum temperatures, and monthly rainfall were recorded 29'6'C and 18'4'C and 190'3 cm. respectively, whereas they gradually decreased with the increase of rainfall during the monsoon months when average monthly rainfall recorded 625'5 cm.
ii) Increase in abundance with increase in temperatures and rainfall is observed in Scarabaeidae, Ptiliidae and Hydrophilidae, during monsoon months when recorded average

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daily maximum and minimum temperatures and monthly rainfall were 30'95'C and 24'72'C, and 625'5 cm. respectively. iii) Increase in abundance with decrease in temperatures and rainfall was observed in Staphylinidae, Carabidae and Trogidae during cold dry winter months when recorded average daily maximum and minimum temperatures and monthly rainfall were 24'12'C and 10'9'C, and 7'7 cm. respectively. Fortnightly catch review of these 18 beetle families during this study resulted that the seasonal occurance of the families were abundant during cold dry winter months. But both the number of species and individuals were abundant in the hot dry pre-monsoon months. Most of the species of different families trapped in the cold dry winter months were small in number. A few species of the families Scarabaeidae and Staphylinidae were trapped throughout the year. The density of beetles was higher in the forest floor followed by paddy field and tea garden. Most of the beetles were found abundant in fish baited traps constituting 83% of the total beetles catches. The representatives of the families Trogidae, Silphidae and Nitidulidae were totally attracted to fish baited traps only, whereas, Scydmaenidae, Pselaphidae and cryptophagidae were totally attracted to dung baited traps only and Ptiliidae, Hydrophilidae, and Tenebrionidae were found abundant on the dung baited traps. Most of the

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families (57% of the total families caught) were totally absent from empty pitfall traps, whereas the only family Carabidae was found most abundant in empty pitfall traps, and Elateridae and Chrysomelidae showed more or less an uniform distribution accross all the traps including empty pitfall traps. The most common species observed during this study were Onthophagus exquisitus Arrow (Scarabaeidae) and Anotylus laetus Cameron (Staphylinidae) amongst all of the three studied sites. Few species were found restricted for particular vegetation type. Many new distributional records to Dooars area, some even from India have been noted in the present study, a new species of Scarabaeidae is described. Data from this fortnightly samples of surface living beetles have been analysed and discussion made especially on seasonal variation amongst the families and species. Abundance and peak period are shown by graphs, histograms and charts. Bait and area preference are also discussed.

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Table 1.

CHARACTERISTICS OF STUDIED AREAS, FOREST FLOOR, TEA GARDEN and PADDY FIELD

	Characteristics / Areas	FOREST FLOOR	TEA GARDEN	PADDY FIELD
1.	Description	Deciduous, unreserved area, covered with dense canopy	Reserved area with wire fence throughout its boundary, with sparse canopy	Unreserved open yard area consisted of small plots with crop rows, and without any canopy
2.	Soil type	Clay loam	Sandy loam	Clay loam
3.	pH of soil (gm ions/l, 1:2.5)	5.55	6.15	6.05
4.	Physical composition of soil			
	i) % of sand	35.32	45.61	38.11
	ii) % of silt	14.21	8.16	15.81
	iii) % of clay	51.47	46.24	46.11
5.	Chemical composition of soil			
	i) Organic carbon%	2.2584	0.958	0.513
	ii) Total Nitrogen %	0.203	0.085	0.043
	iii) Specific conductance (millim./cm) 1.5	0.647	0.0598	0.0523
6.	Soil temperature	Lower than both of the paddy field and tea garden	Slightly higher than forest floor but lower than paddy field	Higher than both of the forest floor and tea garden
7.	Plant species	The most common and important timber species - Shorea robusta, Schima wallichi, Castanopsis tribuloides, Dillenia pentagyna, Terminalia balerica, T. tomentosa, Amoora wallichi, Sterculia villosa, Gmelina arborea Macranga denticulata, Litsea polyantha, Premna intermifolia, Careya arborea, Callicarpa arborea, Albizzia procera, Albizzia sp. Salmalia malabarica, Syzygium sp., Zyzyphus jaeratiana Under-growth with herbs and shurbs mainly of compositae and pteridophyte	Tea bushes(Thea sinensis) Shade trees (Albizzia procera) Undergrowth clean, without grassy plot.	Seasonal crops - Paddy (Oriza sativa) Wheat (Triticum aestivum) Bhutta (Zea mays) Crop row with grassy plot

Contd.....

Table 1 (Contd....)

Areas / Characteristics	FOREST FLOOR	TEA GARDEN	PADDY FIELD
8. Application of pesticides	NIL	At regular intervals of 15-20 days	Irregular
9. Total catches of coleoptera	6007	4953	5642
10. Total catches of coleopterus species per area	65	53	66
11. Species found in single area	Onthophagus rynthi, O.rudis, O.atropolitus, O.vigilans, Onthophagus sp., Oxynomus aciculatus, Phaechorous emarginatus, Staphylinus maculipennis, Philonthus eustilbus, Proteinus fuscotestaceus, Rhinocharis debilis, Calerita orientalis, Tetragonoderus romboophorus, Chaetobrocus fahir, Eurylister sinceras, Cereyon Sp.A., Loma sp., Haptoncus sp., Nicrophorus nepalensis	Atomaria sp., Cyathiger sp.	Onthophagus pactolus, O.shamrupus sp. nov., O.centricornis, Philonthus assamensis, Leptacinus notabilis, Tachys truncatus, Tanymecus indicus, Chaetocnema sp. A., Corticarina sp, Lagria sp.
12. Most common species	Onthophagus exquisitus (Scarabaeidae)	Anotylus nitidulus (Staphylinidae)	Onthophagus exquisitus (Scarabaeidae)

TABLE 2

NUMBER OF SPECIES AND TOTAL BEETLE EXAMPLES OF 18 FAMILIES OF THE ORDER COLEOPTERA COLLECTED FROM PIT FALL TRAP EXPERIMENT IN THE THREE ADJOINING AREAS, FOREST FLOOR, TEA GARDEN AND PADDY FIELD DURING MARCH 1977 to FEBRUARY 1978

CATEGORY	FAMILIES	SPECIES	NUMBER	PER CENT
MAJOR FAMILIES	Scarabaeidae	29	9035	54.42
	Staphylinidae	19	5465	32.91
	Ptiliidae	1	671	4.04
	Histeridae	5	539	3.24
MINOR FAMILIES	Carabidae	14	276	1.66
	Hydrophilidae	3	250	1.51
	Tenebrionidae	2	187	1.12
	Trogidae	2	89	0.53
	Scydmaenidae	2	21	0.12
	Pselaphidae	1	17	0.09
	Chrysomelidae	4	16	0.09
	Elateridae	4	15	0.08
MISCELLANEOUS FAMILIES	Cryptophagidae	1	12	0.07
	Curculionidae	1	3	0.01
	Nitidulidae	1	2	0.01
	Silphidae	1	2	0.01
	Lagriidae	1	1	0.006
	Lathridiidae	1	1	0.006
TOTAL	18 FAMILIES	92	16602	100

TABLE 3

ABUNDANCE OF THE FAMILIES OF COLEOPTERA CAUGHT DURING MARCH 1977 TO FEBRUARY 1978 IN FOREST FLOOR, TEA GARDEN AND PADDY FIELD

BEETLE FAMILIES	FOREST		TEA GARDEN		PADDY FIELD		TOTAL CATCH	
	TOTAL	%	TOTAL	%	TOTAL	%		
Scarabaeidae	4038	67.18	2273	44.92	2724	48.32	9035	54.42
Staphylinidae	1109	18.18	2081	42.44	2275	40.35	5465	[illegible]
Ptiliidae	220	3.67	126	2.69	325	5.76	671	[illegible]
Histeridae	241	4	256	5.47	42	0.74	539	3.24
[illegible]ebiidae	77	1.28	76	1.53	123	2.18	276	1.66
[illegible]lophilidae	104	1.72	60	1.21	86	1.52	250	1.54
[illegible]ebrionidae	119	1.98	29	0.68	39	0.65	187	1.12
Trogidae	79	1.36	8	0.16	2	0.03	89	0.53
Miscellaneous families	20	0.33	44	0.88	26	0.46	90	0.54
TOTAL	6007	100	4953	100	5642	100	16602	100

TABLE 4 : Area and trap preferences of families of Coleoptera caught fortnightly during March '77 to February '78 in the forest floor, tea garden and paddy field.

BEETLE FAMILIES	AREAS						CHOICE OF AREA	TRAPS						CHOICE OF TRAP
	FOREST		TEA GARDEN		PADDY FIELD			FISH BAIT		DUNG BAIT		EMPTY PITFALL		
	TOTAL	%	TOTAL	%	TOTAL	%		TOTAL	%	TOTAL	%	TOTAL	%	
Scarabaeidae	4038	44.69	2273	25.1	2724	30.74	Forest Floor	8556	94.69	341	3.77	138	1.52	Fish bait
Staphylinidae	1109	20.29	2081	38.07	2275	41.04	Paddy field	4525	82.79	843	15.72	97	1.77	Fish bait
Ptiliidae	220	32.67	126	18.69	325	48.63	Paddy field	3	0.45	668	99.55	-	-	Dung bait
Histeridae	241	44.71	256	47.48	42	7.79	Tea garden	529	98.14	7	1.29	3	0.55	Fish bait
Carabidae	77	27.89	76	27.53	123	44.56	Paddy field	32	11.59	23	8.33	221	80.07	Empty pitfall
Hydrophilidae	104	41.6	60	24	86	34.4	Forest Floor	73	29.2	177	70.8	-	-	Dung bait
Tenebrionidae	119	63.63	29	15.5	39	20.85	Forest Floor	34	18.18	144	60.95	39	20.85	Dung bait
Trogidae	79	88.76	8	10.02	2	2.24	Forest Floor	89	0.64	-	-	-	-	Fish bait
Miscellaneous Families	20	22.03	44	48.71	26	28.24	Tea garden	12	13.35	63	70.03	15	16.47	Dung bait

TABLE 5 : Total catches and number of species of Scarabaeidae and Staphylinidae caught per trap and month during March '77 to February '78 in forest floor, tea garden and paddy field .

Months	Fish bait		Total number of species/month		Dung bait		Total number of species/month		Empty Pit fall		Total number of species/month	
	Scarab.	Staph.	Scarab.	Staph.	Scarab.	Staph.	Scarab.	Staph.	Scarab.	Staph.	Scarab.	Staph.
March	25	724	8	6	2	281	1	5	11	16	2	1
April	894	341	19	3	4	27	1	4	22	72	7	4
May	1105	24	17	2	14	11	4	2	8	2	3	1
June	1046	15	20	3	21	7	5	3	25	4	3	1
July	586	366	17	5	63	11	7	3	8	-	2	-
August	1319	13	17	4	175	15	6	2	33	1	2	1
September	1384	43	16	4	34	2	3	2	23	-	3	-
October	1981	63	15	3	5	-	4	-	1	-	1	-
November	198	182	7	3	-	5	-	1	1	-	1	-
December	27	375	6	9	-	36	-	6	-	2	-	1
January	7	793	1	8	2	257	1	8	-	-	-	-
February	6	1623	1	8	1	195	1	10	-	-	-	-

Scarab: Scarabaeidae; Staph: Staphylinidae

[illegible] Quantitative [illegible] of [illegible] families of Coleoptera [illegible] under [illegible] field during [illegible] to [illegible]

	Family	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible] ation	[illegible] field
[illegible]	[illegible]	[illegible]				[illegible]	[illegible]	1[illegible]	[illegible]	1	[illegible]	[illegible]75	-	-	[illegible]	27	41
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4[illegible]	237	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	17	72	8
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.5	[illegible]	[illegible]	-	2	-	1	2[illegible]8	[illegible]	324	-	-	-
[illegible]	[illegible]	[illegible]	241	[illegible]	[illegible]2	529	7	5	233	[illegible]	[illegible]	7	-	-	1	-	2
[illegible]	[illegible]	[illegible]	77	[illegible]	[illegible]	34	[illegible]	121	[illegible]	10	15	11	[illegible]	6	59	60	102
[illegible]	[illegible]	250	106	[illegible]	[illegible]	[illegible]	175	-	106	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	-	-
[illegible]	[illegible]	[illegible]	114	[illegible]	[illegible]	36	[illegible]	39	6	2	26	97	3	12	14	24	1
	[illegible]	[illegible]	[illegible]	[illegible]	2	[illegible]	-	-	[illegible]	6	2	-	-	-	-	-	-
[illegible]	[illegible]ridae	21	3	10	[illegible]	-	[illegible]	-	-	-	-	[illegible]	10	8	-	-	-
	[illegible]hidae	17	-	17	-	-	17	-	-	17	[illegible]	-	17	-	-	-	-
11	[illegible]elidae	16	8	1	7	5	5	5	3	-	2	2	1	2	2	-	3
12	[illegible]teridae	15	4	-	11	2	4	9	1	-	1	1	-	3	2	-	7
1[illegible]	Cryptophagidae	12	-	12	-	-	12	-	-	12	-	-	12	-	-	-	-
14	[illegible]lionidae	3	-	-	3	-	1	2	-	-	-	-	-	1	-	-	2
[illegible]	[illegible]idulidae	2	2	-	-	2	-	-	2	-	-	-	-	-	-	-	-
16	Silphidae	2	-	2	-	2	-	-	-	2	-	-	-	-	-	-	-
[illegible]	[illegible]athridiidae	1	-	-	1	-	1	-	-	-	-	-	-	1	-	-	-
[illegible]	[illegible]rridae	1	-	-	1	1	-	-	-	-	1	-	-	-	-	-	-

TABLE _7_

FORTNIGHTLY CATCH OF FAMILIES OF COLEOPTERA
[illegible] FROM MARCH 1977 TO FEBRUARY 1978
[illegible] TRAPS IN THREE ADJOINING AREAS,
[illegible], TEA GARDEN AND PADDY FIELD

Families of coleoptera	1977 MAR		APL		MAY		JUNE			JULY		AUG		SEPT		OCT		NOV		DEC		1978 JAN		FEB	
1. [illegible]	7	31	202	629	100	447	645	432	215	442	643	887	658	733	1013	771	147	52	24	3	1	8	6	2	
2. [illegible]idae	253	749	175	246	29	6	16	10	374	3	11	18	36	9	3	60	59	128	140	264	538	670	612	1156	
3. [illegible]idae	20	17	11	40	99	25	139	8	2	–	30	90	–	–	–	–	–	10	11	23	61	27	34	37	
4. Histeridae	25	172	42	102	24	15	51	20	4	8	16	8	–	2		10	5	1	–	–	6	11	2		
5. [illegible]idae	11	4	2	12	5	1	–	–	5	1	1	6	–	–	–	2	–	13	14	18	20	47	62	51	
6. [illegible]sphilidae	4	7	3	9	28	–	–	2	1	43	20	8	4	1	10	15	44	4	9	–	–	13	4	2	
7. [illegible]idae	18	12	34	96	9	1	–	–	2	1	1	2	2	–	–	–	–	–	–	1	1	3	1	3	
8. [illegible]a	12	6	3	2	–	2	5	1	–	–	–	–	1	–	6	6	–	5	–	–	5	6	4	25	
9. Scydmaenidae	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	2	6	–	2	
10. [illegible]	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	2	1	4	
11. [illegible]	–	–	–	1	5	–	–	1	6	–	3	–	–	–	–	–	–	–	–	–	–	–	–		
12. [illegible]	–	–	–	–	–	–	10	–	8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
13. [illegible]idae	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5	–	7	–	
14. Curculionidae	–	2	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
15. [illegible]idae	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	
16. Silphidae	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	
17. Lathridiidae	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	
18. Lagriidae	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	
No. of families/ fortnight	9	9	10	14	8	7	6	7	9	6	8	7	5	4	4	6	4	7	6	7	10	13	11	10	
Average of families/ season			8-9					7-8						5							9-10				
Percent of total catches/season			26.97					25.31						24.91							23.11				

TABLE 8

SPECIES OF SCARABAEIDAE: ABUNDANCE AND TOTAL NUMBER TRAPPED DURING MARCH 1977 TO FEBRUARY 1978 IN THREE ADJOINING AREAS, FOREST, TEA GARDEN AND PADDY FIELD

Sl. No.	Species of Scarabaeidae	Abundance			Total No. Trapped
		Mean per fortnight	Rank	Per cent	
1	Onthophagus deflexicollis	53.12	2	14.11	1275
2	O. vaulogeri	42.2	3	11.21	1013
3	O. orientalis	11.37	8	3.02	273
4	O. zynthi	.37	22	.09	9
5	O. luridopennis	11.62	7	3.08	279
6	O. gangeticus	3.2	12	.85	77
7	O. Phanaeiformis	2.5	16	.66	60
8	O. exquisitus	146.2	1	38.83	3508
9	O. singhi	34.41	4	9.14	826
10	O. hastifer	2.62	15	.69	63
11	O. furcicollis	2.66	14	.70	64
12	O. bifasciatus	2.75	13	.73	66
13	O. tricornis	.62	20	.16	15
14	O. unifasciatus	.33	23	.08	8
15	O. krishnai	.5	21	.13	12
16	O. pactolus	.04	29	.01	1
17	O. rudis	7.83	9	2.08	188
18	O. vigilans	.16	25	.04	4
19	O. centricornis	.87	19	.23	21
20	O. sp.	.04	28	.01	1
21	O. shamrupus sp. nov.	1.04	18	.27	25
22	O. atropolitus	.08	27	.02	2
23	Catharsius sagax	18.29	6	4.85	439
24	C. pithecius	.29	24	.07	7
25	Gymnopleurus sinuatus var assamensis	20.54	5	5.45	493
26	Parachorius hookeri	1.95	17	.52	47
27	Hyboserus orientalis	4.12	11	1.09	99
28	Phaeochrous emarginatus	6.62	10	1.75	159
29	Oxynomus reticulatus	.16	26	.04	4

TABLE 9

PER CENT OF TOTAL CATCHES PER AREA AND PER TRAP OF SCARABAEIDAE TRAPPED DURING MARCH 77 TO FEBRUARY 78

Sl. No.		AREAS				TRAPS	
		Forest floor (%)	Tea garden (%)	Paddy field (%)	Fish (%)	Dung (%)	Empty pitfall (%
1	Onthophagus deflexicollis	49.18	22.98	27.84	97.17	.07	2.74
2	O. vaulogeri	51.92	19.94	28.14	96.05	.09	3.84
3	O. orientalis	20.88	35.54	43.58	97.05	2.93	-
4	O. synthi	100	-	-	100	-	-
5	O. luridopennis	60.57	32.25	7.18	100	-	-
6	O. gangeticus	20.77	2.59	76.64	94.8	3.89	1.29
7	O. phanaeiformis	78.33	20.01	1.66	100	-	-
8	O. exquisitus	28.38	30.17	41.45	98.17	.22	1.59
9	O. singhi	50.14	24.93	24.93	98.54	1.08	.36
10	O. hastifer	9.52	69.85	20.63	100	-	-
11	O. furcicollis	-	57.82	42.18	98.44	1.56	-
12	O. bifasciatus	6.06	56.07	37.87	95.45	3.03	1.51
13	O. tricornis	66.68	26.66	6.66	100	-	-
14	O. unifasciatus	-	12.5	87.5	100	-	-
15	O. krishnai	90.66	-	8.34	100	-	-
16	O. pactolus	-	-	100	100	-	-
17	O. rudis	100	-	-	100	-	-
18	O. vigilans	100	-	-	100	-	-
19	O. centricornis	-	-	100	100	-	-
20	O. sp.	100	-	-	100	-	-
21	O. shamrupus sp. nov.	-	-	100	100	-	-
22	O. atropolitus	100	-	-	-	100	-
23	Catharsius sagax	68.12	25.96	5.92	92.25	7.74	
24	C. pithecius	-	42.86	57.14	57.14	28.57	14.28
25	Gymnopleurus sinuatus var assamensis	92.9		6.89	45.43	54.56	-
26	Parachorius hookeri	14.89	78.73	6.38	100	-	-
27	Hyboserus orientalis	28.28	34.34	37.38	97.98	-	2.02
28	Phaeochrous emarginatus	100	-	-	100	-	-
29	Oxynomus aciculatus	-	100	-	100	-	-

TABLE 13

CUMULATIVE ANNUAL INCIDENCE OF SCARABAEIDAE PER AREA AND PER TRAP DURING MARCH 1977 to FEBRUARY 1978

Sl. No.	Species of Scarabaeidae	Cumulative annual incidence	Cumulative annual incidence per area			Cumulative annual incidence per trap			Cumulative annual incidences per trap/per area								
									Fish-bait			Dung-bait			Empty pitfall		
			Forest	Tea Garden	Paddy field	Fish bait	Dung bait	Empty pitfall	Forest	Tea Garden	Paddy field	Forest	Tea Garden	Paddy field	Forest	Tea Garden	Paddy field
1	Onthophagus deflexicollis	1275	627	293	355	1239	1	35	618	290	331	-	-	1	9	13	13
2	O. vaulogeri	1013	526	202	285	973	1	39	490	200	283	-	-	1	36	2	1
3	O. orientalis	273	57	97	119	265	8	-	51	96	118	6	1	1	-	-	-
4	O. rynthi	9	9	-	-	9	-	-	9	-	-	-	-	-	-	-	-
5	O. luridopennis	279	169	90	20	279	0	-	169	90	20	-	-	-	-	-	-
6	O. gangeticus	77	16	2	59	73	3	1	16	1	56	-	-	3	-	1	-
7	O. phanaeiformis	60	47	12	1	60	0	-	47	12	1	-	-	-	-	-	-
8	O. exquisitus	3505	996	1059	1454	3445	8	56	973	1052	1420	1	-	7	22	7	27
9	O. singhi	826	414	206	206	814	9	3	404	204	206	9	-	-	1	2	-
10	O. hastifer	63	6	44	13	63	0	-	6	44	13	-	-	-	-	-	-
11	O. furcicollis	64	-	37	27	63	1	-	-	37	26	-	-	1	-	-	-
12	O. bifasciatus	66	4	37	25	60	2	1	4	34	25	-	2	-	-	1	-
13	O. tricornis	15	10	4	1	15	-	-	10	4	1	-	-	-	-	-	-
14	O. unifasciatus	8	-	1	7	8	-	-	-	1	7	-	-	-	-	-	-
15	O. krishnai	12	11	-	1	12	-	-	11	-	1	-	-	-	-	-	-
16	O. pactolus	1	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-
17	O. rudis	188	188	-	-	188	-	-	188	-	-	-	-	-	-	-	-
18	O. vigilans	4	4	-	-	4	-	-	4	-	-	-	-	-	-	-	-
19	O. centricornis	21	-	-	21	21	-	-	-	-	21	-	-	-	-	-	-
20	O. sp.	1	1	-	-	1	-	-	1	-	-	-	-	-	-	-	-
21	O. shamrupus sp. nov.	25	-	-	25	25	-	-	-	-	25	-	-	-	-	-	-
22	O. atropolitus	2	2	-	-	-	2	-	-	-	-	2	-	-	-	-	-
23	Catharsius sagax	439	299	114	26	405	34	-	280	114	11	19	-	15	-	-	-
24	C. pithecius	7	-	3	4	4	2	1	-	1	3	-	1	1	-	1	-
25	Gymnopleurus sinuatus var assamensis	493	458	-	34	224	269	-	220	-	4	238	31	-	-	-	-
26	Parachorius hookeri	47	7	37	3	47	-	-	7	37	3	-	-	-	-	-	-
27	Hybosorus orientalis	99	28	34	37	99	-	-	28	34	37	-	-	-	-	-	-
28	Phaeochrous emarginatus	159	159	-	-	159	-	-	159	-	-	-	-	-	-	-	-
29	Oxyomus aciculatus	4	-	4	-	4	-	-	-	4	-	-	-	-	-	-	-

TABLE 14

SPECIES OF STAPHYLINIDAE : ABUNDANCE FOR THE YEAR MARCH 1977 TO FEBRUARY 1978, TOTAL NUMBER TRAPPED DURING THE STUDY IN THREE ADJOINING AREAS, FOREST FLOOR, TEA GARDEN AND PADDY FIELD

Sl. No.	Species	ABUNDANCE			Total number trapped
		Mean/ fortnight	Rank	Per cent	
1	Anotylus nitidulus	56.08	2	24.63	1347
2	A. latiusculus	15.01	4	6.58	360
3	A. frater	0.45	11	0.2	11
4	A. laetus	116.24	1	51.06	2791
5	A. sikkimi	2.16	8	0.95	52
6	Philonthus assamensis	0.25	14	0.10	6
7	P. eustilbus	0.08	15	0.03	2
8	Proteinus fuscotestaceus	0.37	12	0.16	9
9	Leptacinus notabilis	0.08	16	0.03	2
10	Oxytelopsis pseudopsina	0.37	13	0.16	9
11	Staphylinus maculipennis	0.04	19	0.01	1
12	Staphylinus sp.	0.04	17	0.03	2
13	Scopaeus nitidulus	0.08	18	0.03	2
14	Thinocharis debilis	1.58	9	0.69	38
15	Aleochara castanea	7.95	5	3.49	191
16	Cordalia vestita	4.87	6	2.14	117
17	Dinusa heimi	0.51	10	0.21	12
18	Phymatura intermedia	3.86	7	1.69	93
19	Microglotta sp.	17.49	3	7.68	420

TABLE 15

PER CENT OF TOTAL CATCHES PER AREA (FOREST FLOOR, TEA GARDEN, PADDY FIELD) AND PER TRAP (FISH BAIT, DUNG BAIT, EMPTY PITFALL) OF STAPHYLINIDAE CAUGHT DURING MARCH '77 TO FEBRUARY 1978

SPECIES OF STAPHYLINIDAE	AREAS			TRAPS		
	Forest floor %	Tea garden %	Paddy field %	Fish bait %	Dung bait %	Empty pitfall %
Anotylus nitidulus	15.6	21.24	63.15	92.71	3.49	3.78
A. latiusculus	5	3.88	91.11	92.77	7.77	-
A. frater	-	81.81	18.18	18.18	81.81	-
A. laetus	9.27	54.58	36.13	83.58	15.17	-
A. sikkimi	92.3	5.7	1.92	100	-	-
Philonthus assamensis	-	-	100	-	100	-
P. eustilbus	100	-	-	100	-	-
Proteinus fuscotestaceus	100	-	-	100	-	-
Leptacinus notabilis	-	-	100	100	-	-
Oxytelopsis pseudopsina	22.22	-	77.77	88.88	11.11	-
Staphylinus maculipennis	100	-	-	-	100	-
Staphylinus sp.	-	50	50	-	50	50
Scopaeus nitidulus	50	-	50	50	50	-
Thinocharis debilis	100	-	-	7.99	92.01	-
Aleochara castanea	85.34	13.61	1.04	96.85	3.15	-
Cordalia vestita	3.41	76.92	19.65	-	94.01	5.98
Dinusa heimi	8.33	33.33	58.33	75	25	-
Phymatura intermedia	19.35	77.41	3.21	4.28	95.72	-
Microglotta sp.	80.47	13.57	5.95	86.42	12.61	0.95

TABLE 16

TRAP PREFERENCE OF THE SPECIES OF STAPHYLINIDAE CAUGHT DURING MARCH 1977 TO FEBRUARY 1978 IN FOREST FLOOR, TEA GARDEN AND PADDY FIELD

Species of staphylinidae	AREA -->	FOREST FLOOR			TEA GARDEN			PADDY FIELD		
	TRAP -->	Fish bait %	Dung bait %	Empty pitfall %	Fish bait%	Dung bait %	Empty pitfall %	Fish bait %	Dung bait %	Empty pitfall %
Anotylus nitidulus		13.15	2.37	0.07	17.31	0.66	3.26	62.25	0.44	0.44
A. latiusculus		2.7	2.2	-	0.5	5.3	-	89.44	1.6	-
A. frater		-	-	-	-	81.81	-	18.18	-	-
A. laetus		7.02	1.67	0.58	41.77	12.19	0.61	34.78	1.31	0.03
A. sikkimi		92.3	-	-	5.7	-	-	1.92	-	-
Philonthus assamensis		-	-	-	-	-	-	-	100	-
P. eustilbus		100	-	-	-	-	-	-	-	-
Proteinus fuscotestaceus		100	-	-	-	-	-	-	-	-
Leptacinus notabilis		-	-	-	-	-	-	100	-	-
Oxytelopsis pseudopsina		22.22	-	-	-	-	-	66.66	11.11	-
Staphylinus maculipennis		-	100	-	-	-	-	-	-	-
Staphylinus sp.		-	-	-	-	50	-	-	-	50
Scopaeus nitidulus		50	-	-	-	-	-	-	50	-
Thinocharis debilis		7.99	92.01	-	-	-	-	-	-	-
Aleochara castanea		82.19	3.14	-	13.61	-	-	1.04	-	-
Cordalia vestita		-	3.41	-	-	70.94	5.98	-	19.65	-
Dinusa heimi		8.33	-	-	33.33	-	-	33.33	25	-
Phymatura intermedia		-	19.35	-	2.14	75.27	-	2.14	1.07	-
Microglotia sp.		79.28	1.19	-	6.42	6.19	0.95	0.71	5.23	-

TABLE 17

SEASONAL VARIATION AND AREA PREFERENCE OF PREDOMINANT SPECIES OF STAPHYLINIDAE IN THE FOREST FLOOR, TEA GARDEN AND PADDY FIELD DURING MARCH 1977 TO FEBRUARY 1978

Sl. No.	SPECIES	SEASONAL ABUNDANCE (%)																Area of first choice
		MAR-MAY			Total	JUN-AUG			Total	SEPT-NOV			Total	DEC-FEB			Total	
		Fish	Dung	Empty		Fish	Dung	Empty		Fish	Dung	Empty		Fish	Dung	Empty		
1.	Anotylus lactus	25.93	4.99	0.11	31.03	5.33	0.56	-	5.89	1.49	0.03	-	1.52	47.82	9.5	-	57.32	Tea garden
2.	Anotylus nitidulus	13.96	2.88	3.26	20.1	18.04	-	0.36	18.4	14.99	0.36	-	15.35	45.53	0.14	0.16	45.83	Paddy field
3.	Microglotta sp.	0.24	3.57	0.95	4.76	-	-	-	-	-	-	-	-	86.2	9.04	-	95.24	Forest floor
4.	Anotylus latiusculus	20.83	-	-	20.83	-	-	-	-	-	-	-	-	71.93	7.21	-	79.14	Paddy field
5.	Aleochara castanea	36.49	-	-	36.49	2.61	-	-	2.61	-	-	-	-	60.61	3.14	-	63.75	Forest floor
6.	Cordalia vestita	-	53.84	5.98	59.82	-	6.84	-	6.84	-	-	-	-	-	33.34	-	33.34	Tea garden
7.	Phymatura intermedia	-	60.24	-	60.24	-	-	-	-	-	-	-	-	3.61	36.14	-	39.75	Tea garden

TABLE 18

SEASONAL OCCURANCE OF STAPHYLINIDAE IN TERMS OF TOTAL NUMBER CAUGHT PER MONTH DURING MARCH 1977 TO FEBRUARY 1978

Sl. No.	SPECIES	MAR	APL	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	JAN	FEB
1	Anotylus nitidulus	152	117	4	5	238	5	13	29	167	167	211	239
2	A. latiusculus	75	-	-	-	-	-	-	-	-	27	177	81
3	A. frater	-	-	-	-	-	-	-	-	-	2	-	9
4	A. laetus	584	280	24	16	127	20	24	33	15	73	552	1043
5	A. sikkimi	-	-	-	-	-	-	-	-	-	48	2	2
6	Philonthus assamensis	-	-	-	-	5	-	-	-	-	1	-	-
7	P. eustilbus	-	-	-	-	-	-	-	-	-	-	-	2
8	Proteinus fuscotestaceus	-	-	-	-	-	-	-	-	-	-	-	9
9.	Leptacinus notabilis	-	-	-	-	2	-	-	-	-	-	-	-
10	Oxytelopsis pseudopsina	-	-	-	-	-	-	1	1	5	-	2	-
11	Staphylinus maculipennis	-	-	-	-	-	-	-	-	-	-	1	-
12	Staphylinus sp.	-	-	1	-	-	-	-	-	-	1	-	-
13	Scopaeus nitidulus	1	-	-	-	-	-	-	-	-	-	1	-
14	Thinocharis debilis	-	-	-	-	-	-	-	3	-	-	26	9
15	Aleochara castanea	56	8	-	-	2	3	-	-	-	5	16	101
16	Cordalia vestita	53	17	-	1	7	-	-	-	-	4	26	9
17	Dinusa heimi	5	-	-	-	2	1	4	-	-	-	-	-
18	Phymatura intermedia	46	5	-	-	-	-	-	-	-	9	12	21
19	Microglotta sp.	15	5	-	-	-	-	-	-	-	71	36	293
	Total number of species/month	9	6	3	3	7	4	4	4	3	11	12	12
	Species with maximum number	7	6	2	3	4	3	2	2	2	7	7	7

TABLE 19

CUMULATIVE ANNUAL INCIDENCE OF STAPHYLINIDAE PER AREA PER TRAP DURING MARCH 1977 TO FEBRUARY 1978

Species	Cumulative annual incidence	Cumulative annual incidence per area			Cumulative annual incidence per trap			Cumulative annual incidence per trap per area								
								FISH BAIT			DUNG BAIT			EMPTY PITFALL		
		Forest Floor	Tea garden	Paddy field	Fish bait	Dung bait	Empty pitfall	Forest floor	Tea garden	Paddy field	Forest floor	Tea garden	Paddy field	Forest floor	Tea garden	Paddy field
1. Anotylus nitidulus	1347	211	286	850	1249	47	51	178	233	838	32	9	6	1	44	6
2. A. latiusculus	360	18	14	328	334	26	-	10	2	322	8	12	6	-	-	-
3. A. frater	11	-	9	2	2	9	-	-	-	2	-	9	-	-	-	-
4. A. laetus	2791	255	1519	1017	2298	459	34	193	1148	957	46	354	59	16	17	1
5. A. sikkimi	52	48	3	1	52	-	-	48	3	1	-	-	-	-	-	-
6. Philonthus assamensis	6	-	-	6	-	6	-	-	-	-	-	-	6	-	-	-
7. P. pustilbus	2	2	-	-	2	-	-	2	-	-	-	-	-	-	-	-
8. Proteinus fuscotestaceus	9	9	-	-	9	-	-	9	-	-	-	-	-	-	-	-
9. Leptacinus notabilis	2	-	-	2	2	-	-	-	-	2	-	-	-	-	-	-
10. Oxytelopsis pseudopsina	9	2	-	7	8	1	-	2	-	6	-	-	1	-	-	-
11. Staphylinus maculipennis	1	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-
12. Staphylinus sp.	2	-	1	1	-	1	1	-	-	-	-	1	-	-	-	1
13. Scopaeus nitidulus	2	1	-	1	1	1	-	1	-	-	-	-	1	-	-	-
14. Thinocharis debilis	38	38	-	-	3	35	-	3	-	-	35	-	-	-	-	-
15. Aleochara castanea	191	163	26	2	185	6	-	157	26	2	6	-	-	-	-	-
16. Cordalia vestita	117	4	90	23	-	110	7	-	-	-	4	83	23	-	7	-
17. Dinusa heimi	12	1	4	7	9	3	-	1	4	4	-	-	3	-	-	-
18. Phymatura intermedia	83	9	72	2	3	80	-	-	2	1	9	70	1	-	-	-
19. Microglotta sp.	420	338	57	25	363	53	4	333	27	3	5	26	22	-	4	-

TABLE 20: Species of carabidae : abundance and total number trapped during March '77 to February '78 in three adjoining areas, Forest floor, Tea garden and Paddy field.

Sr. No.	Species of the Carabidae	ABUNDANCE			Total no. trapped
		Mean Fortnight	Rank	Percent	
1	Pheropsophus consularis	1.82	3	16.3	45
2	P. catoirei	2.79	1	24.27	67
3	Caphora humilis	1.54	4	14.3	39
4	Dyschirius bengalensis	0.33	7	2.89	8
5	Chlaenius pictus	0.12	11	1.08	3
6	Clivina memnonia	0.28	9	2.53	7
7	Tachys truncatus	0.04	14	0.36	1
8	Galerita orientalis	0.08	12	0.72	2
9	Lesticus politocollis	0.33	8	2.89	8
10	Pentagonica tenebrosa	0.28	10	2.53	7
11	Aephnidius adeliodes	0.62	5	5.43	15
12	Perigona nigriceps	0.58	6	5.07	14
13	Agonum birmanicum	2.41	2	21.08	58
14	Tetragonoderus rambophorus	0.08	13	0.72	2

TABLE 21: Trap preference of the species of Carabidae caught during March '77 to February '78 in forest floor, tea garden and paddy field areas.

Sr. No.	Carabidae Species / AREAS / TRAPS	Forest floor			Tea garden			Paddy field		
		Fish bait%	Dung bait%	Empty Pitfall%	Fish bait%	Dung bait%	Empty Pitfall%	Fish bait%	Dung bait%	Empty Pitfall%
1	Pheropsophus consularis	-	-	46.66	-	-	-	2.22	-	51.11
2	P. catoirei	-	-	37.31	-	-	-	-	4.47	58.2
3	Caphora humilis	16.21	8.1	16.21	2.7	2.7	35.13	2.7	-	16.21
4	Dyschirius bengalensis	-	75	-	-	-	-	25	-	-
5	Chlaenius pictus	-	-	-	66.66	-	-	-	33.33	-
6	Clivina memnonia	-	14.28	-	-	-	14.28	57.14	14.28	-
7	Tachys truncatus	-	-	-	-	-	-	100	-	-
8	Galerita orientalis	-	-	100	-	-	-	-	-	-
9	Lesticus politocollis	-	-	-	-	12.5	-	75	12.5	-
10	Pentagonica tenebrosa	-	-	-	-	14.28	57.14	-	-	28.56
11	Aephnidius adeliodes	-	-	-	-	6.66	46.66	-	-	46.66
12	Perigona nigriceps	-	7.14	21.42	-	7.14	64.28	-	-	-
13	Agonum biramanicum	-	-	-	12.06	1.72	44.82	-	-	41.37
14	Tetragonoderus rambophorus	-	-	100	-	-	-	-	-	-

TABLE 22 : Area and trap preferences of the family carabidae during March '77 to February '78.

Sr. No.	Species	AREAS			TRAPS		
		Forest	Tea Garden	Paddy field	Fish baited	Dung baited	Empty Pitfall
1	Pheropsophus consularis	21	-	24	1	-	44
2	P. catoirei	25	-	42	-	3	64
3	Caphora humilis	16	15	8	9	4	26
4	Dyschirius bengalensis	6	-	2	2	6	-
5	Chlaenius pictus	-	2	1	2	1	-
6	Clivina memnonia	1	1	5	4	2	1
7	Tachys truncatus	-	-	1	1	-	-
8	Galerita orientalis	2	-	-	-	-	2
9	Lesticus politocollis	-	1	7	6	2	-
10	Pentagonica tenebrosa	-	5	2	-	1	6
11	Aephnidius adeliodes	-	8	7	-	1	14
12	Perigona nigriceps	4	10	-	-	2	12
13	Agonum biramanicum	-	34	24	7	1	50
14	Tetragonoderus rambophorus	2	-	-	-	-	2

TABLE 23 : Percent of total collection per area and per trap in three areas (forest floor, tea garden & paddy field) of Carabidae trapped during March '77 to February '78.

Sr. No.	Carabidae Species	AREAS			TRAPS		
		Forest floor %	Tea garden %	Paddy field %	Fish bait %	Dung bait %	Empty Pitfall %
1	Pheropsophus consularis	46.66	-	53.33	2.22	-	97.78
2	P. catoirei	37.31	-	62.68	-	4.47	95.52
3	Caphora humilis	40.54	40.54	18.91	21.62	10.81	67.56
4	Dyschirius bengalensis	75	-	25	25	75	-
5	Chlaenius pictus	-	66.66	33.33	66.66	33.33	-
6	Clivina memnonia	14.28	14.28	71.42	57.14	28.56	14.28
7	Tachys truncatus	-	-	100	100	-	-
8	Galerita orientalis	100	-	-	-	-	100
9	Lesticus politocollis	-	12.5	77.5	75	25	-
10	Pentagonica tenebrosa	-	71.42	28.56	-	14.28	85.71
11	Aephnidius adeliodes	-	53.32	46.66	-	6.66	93.33
12	Perigona nigriceps	28.56	71.42	-	-	14.28	85.71
13	Agonum biramanicum	-	58.62	41.37	12.06	1.72	86.21
14	Tetragonoderus rambophorus	100	-	-	-	-	100

TABLE 24 : Seasonal occurrence of Carabidae in terms of total number caught per month during March '77 to February '78.

Sr. No.	Species	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
1	P. consularis	2	-	-	-	-	-	-	1	-	-	9	33
2	P. catoirei	7	-	-	-	-	-	-	-	-	8	13	39
3	C. humilis	-	3	-	-	-	2	-	-	5	5	11	13
4	D. bengalensis	-	-	-	-	-	2	-	-	6	-	-	-
5	C. pictus	2	-	1	-	-	-	-	-	-	-	-	-
6	C. memnonia	-	2	-	-	4	-	-	-	-	1	-	-
7	T. truncatus	-	-	-	-	-	-	-	1	-	-	-	-
8	G. orientalis	-	-	-	-	-	-	-	-	-	-	-	2
9	L. politocollis	-	3	1	-	1	3	-	-	-	-	-	-
10	P. tenebrosa	3	-	-	-	2	-	-	-	-	-	1	1
11	A. adeliodes	1	-	-	-	-	-	-	-	-	-	4	10
12	P. nigriceps	-	6	4	-	-	-	-	-	-	-	1	3
13	A. biramanicum	-	-	-	-	-	-	-	-	2	18	26	12
14	T. rambophorus	-	-	-	-	-	-	-	-	-	-	2	-

Table 25 Seasonal occurrence of the families of Coleoptera in terms of total catch per month during March '77 to February '78 in forest floor, tea garden and paddy field.

Sl.No.	FAMILIES	SPECIES	1977 MAR	APL	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	1978 JAN	FEB
1	Histeridae	Hister luciscus	198	92	37	72	12	16	1	1	5	1	4	2
		Saprinus optabilis	-	24	-	-	-	8	1	9	-	1	1	1
		S. chalcites	-	22	-	2	-	-	-	-	-	-	12	-
		Chaetobrocus fahir	-	4	1	-	-	-	-	-	-	-	-	-
		Burillister sincerus	-	2	1	-	-	-	-	-	-	-	-	-
2	Elateridae	Drasterius collaris	-	-	-	5	1	-	-	-	-	-	-	-
		Heterederes spinosus	-	-	-	4	1	-	-	-	-	-	-	-
		H. lenis	-	-	-	1	2	-	-	-	-	-	-	-
		Cardiophorus Sp.	-	-	-	1	-	-	-	-	-	-	-	-
3	Chrysomelidae	Chaetocnema Sp. A.	-	-	1	-	2	-	-	-	-	-	-	-
		Chaetocnema Sp. B.	-	-	-	1	3	-	-	-	-	-	-	-
		Lema Sp.	-	-	1	-	-	-	-	-	-	-	-	-
		Longitursus Sp.	-	1	4	-	-	3	-	-	-	-	-	-
4	Hydrophilidae	Oosternum horni	7	3	27	-	45	20	5	25	47	9	-	4
		Cercyon sp. A.	4	9	1	2	1	8	-	-	1	-	13	18
		Cercyon Sp. B.	-	-	-	-	-	-	-	-	-	-	-	1
5	Tenebrionidae	Gonocephalum depressum	28	128	10	-	3	3	2	-	-	1	4	4
		Uloma Sp	2	2	-	-	-	-	-	-	-	-	-	-
6	Trogidae	Trox Sp.A	18	4	2	5	-	-	1	10	5	-	11	29
		Trox Sp.B	-	1	-	1	-	-	-	2	-	-	-	-
7	Scydmaenidae	Scydmaenus Sp.A.	-	-	-	-	-	-	-	-	-	1	3	3
		Scydmaenus Sp.B.	-	-	-	-	-	-	-	-	-	1	5	8
8	Ptiliidae	Acrotrichis Sp.	37	51	125	147	2	110	-	-	10	34	88	67
9	Pselaphidae	Cyathiger Sp.	-	-	-	-	-	-	-	-	-	-	4	12
10	Cryptophagidae	Atomaria Sp.	-	-	-	-	-	-	-	-	-	-	6	5
11	Curculionidae	Tanymecus indicus	2	1	-	-	-	-	-	-	-	-	-	-
12	Nitidulidae	Haptoncus Sp.	-	1	-	-	-	-	-	-	-	1	-	-
13	Silphidae	Nicrophorus nepallensis	-	-	-	-	-	-	-	-	-	-	2	-
14	Lagridae	Lagria Sp.	-	-	-	-	-	-	-	-	-	-	1	-
15	Lathrididae	Corticarina sp	-	-	-	-	-	-	-	-	-	-	1	-

TABLE 26. Percentage of total catches per area and per trap of the species of five families of Coleoptera, trapped during March '77 to February '78.

Sl No.	FAMILIES	SPECIES	AREAS			TRAPS		
			Forest floor (%)	Tea garden (%)	Paddy field (%)	Fish (%)	Dung (%)	Empty Pit-fall (%)
1	Ptiliidae	Acrotrichis sp.	32.67	18.69	48.63	0.45	99.55	-
2	Histeridae	Hister luciscus	42	55.77	2.22	98.4	1.3	0.3
		Saprinus optabilis	86.66	8.88	4.44	97.47	2.51	-
		S. chalcites	13.88	2.77	83.33	94.41	-	5.56
		Eurilister sincerus	100	-	-	100	-	-
		Chaetobroeus fahir	100	-	-	100	-	-
3.	Hydrophilidae	Oosternum horni	33.68	21.05	45.26	32.4	67.6	-
		Cercyon sp.A	68.42	31.57	-	21.05	78.94	-
		Cercyon sp.B	100	-	-	-	100	-
4.	Tenebrionidae	Gonocephalum depressum	65	15	20	17.2	61.6	21.7
		Uloma sp.	-	50	50	75	25	-
5.	Trogidae	Trox sp. A	91.76	8.23	-	100	-	-
		Trox sp. B	25	25	50	100	-	-

Table 27 Trap preference of the species of five families of coleoptera, trapped during March '77 to February 78

Sl. No.	FAMILIES	SPECIES	Forest Floor			Tea Garden			Paddy Field		
			Fish (%)	'Dung (%)	'Empty pit-fall (%)	Fish (%)	'Dung (%)	'Empty pit-fall (%)	Fish (%)	'Dung (%)	'Empty pit-fall (%)
1	Ptiliidae	Acrotrichis sp.	0.3	32.37	-	-	18.69	-	0.1	48.48	-
2	Histeridae	Hister luciscus	40.4	1.31	0.31	55.77	-	-	2.22	-	-
		Saprinus notabilis	84.4	2.53	-	8.8	-	-	4.4	-	-
		S. chalcites	13.88	-	-	2.77	-	-	77.77	-	5.56
		Eurilister sincerus	100	-	-	-	-	-	-	-	-
		Chaetobrecus fabir	100	-	-	-	-	-	-	-	-
3	Hydrophilidae	Oosternum horni	32.1	1.67	-	-	21.05	-	-	45.26	-
		Cercyon sp.A	21.12	47.36	-	-	31.57	-	-	-	-
		Cercyon sp.B	-	100	-	-	-	-	-	-	-
4	Tenebrionidae	Gonocephalum depressum	3.8	53.5	7.7	-	1.6	13.4	13.3	6.1	0.6
		Uloma sp.	-	-	-	50	-	-	25	25	-
5	Trogidae	Trox sp. A	91.76	-	-	8.23	-	-	-	-	-
		Trox sp. B	25	-	-	25	-	-	50	-	-

Fig. 1. Map (diagramatic) of Khutimari forest of Gayerkata and its adjacent tea garden and paddy field showing pattern and location of 27 traps, 9 in each site.

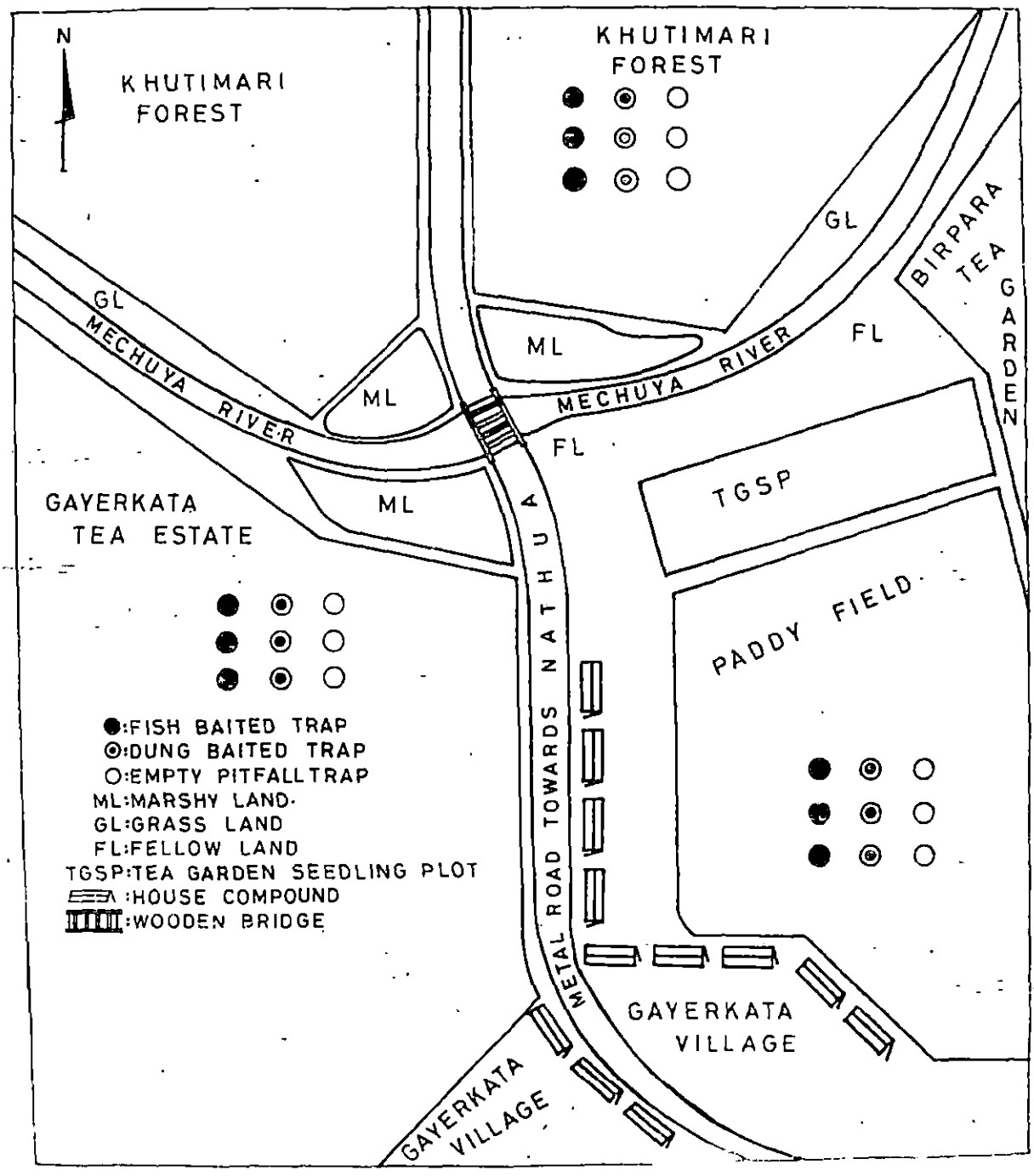

N
KHUTIMARI FOREST
KHUTIMARI FOREST
GL
MECHUYA RIVER
ML
ML
GL
MECHUYA RIVER
FL
BIRPARA TEA GARDEN
FL
TGSP
GAYERKATA TEA ESTATE
ML
PADDY FIELD
METAL ROAD TOWARDS NATHUA
GAYERKATA VILLAGE
GAYERKATA VILLAGE
●:FISH BAITED TRAP
⊙:DUNG BAITED TRAP
○:EMPTY PITFALLTRAP
ML:MARSHY LAND
GL:GRASS LAND
FL:FELLOW LAND
TGSP:TEA GARDEN SEEDLING PLOT
:HOUSE COMPOUND
:WOODEN BRIDGE

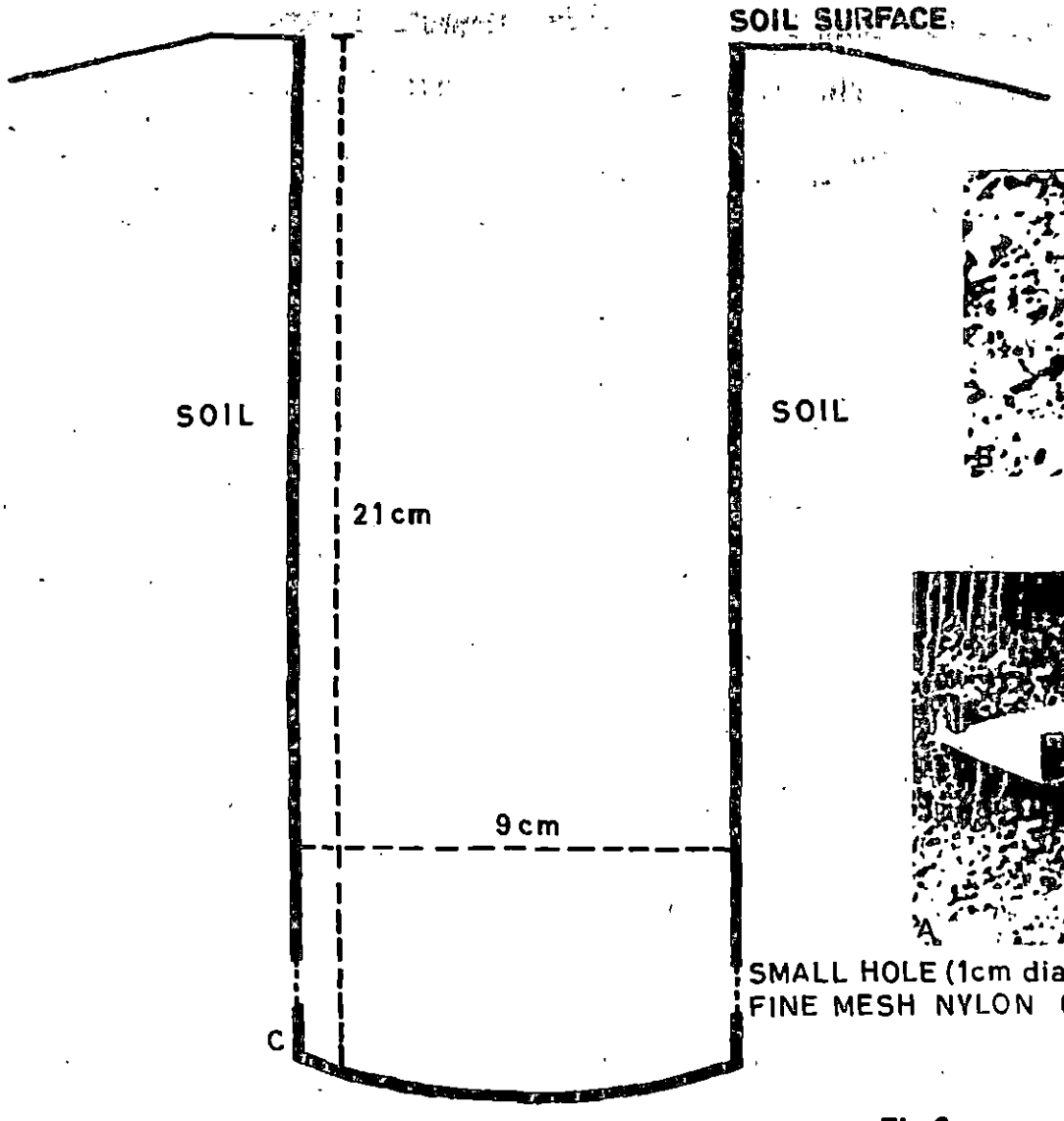
Fig. 1

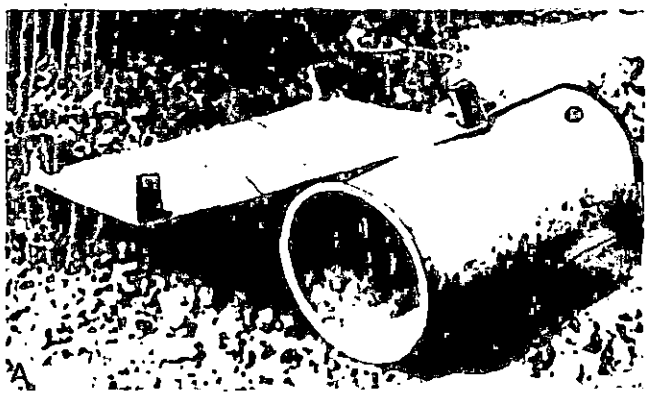
Fig. 2. A pitfall trap used in the present investigation

A. A pitfall trap showing its galvenised metal can and wooden shadeboard (22 cm X 12 cm).

B. The trap, engraved with FFB (Forest floor fish baited trap) in function. Its opening flush with the soil surface.

C. Diagramatic representation of a pitfall trap showing its length (21 cm), width (9 cm) and bottom pore (1 cm diameter) covered with fine mesh nylon gauge.





SMALL HOLE (1cm diam.) WITH
FINE MESH NYLON GAUGE

Fig.2

Fig. 3. Fortnightly variation in abundance of total Coleoptera catches in relation to certain environmental factors at Doomra are (Jalpaiguri district) during March '77 to February '78.

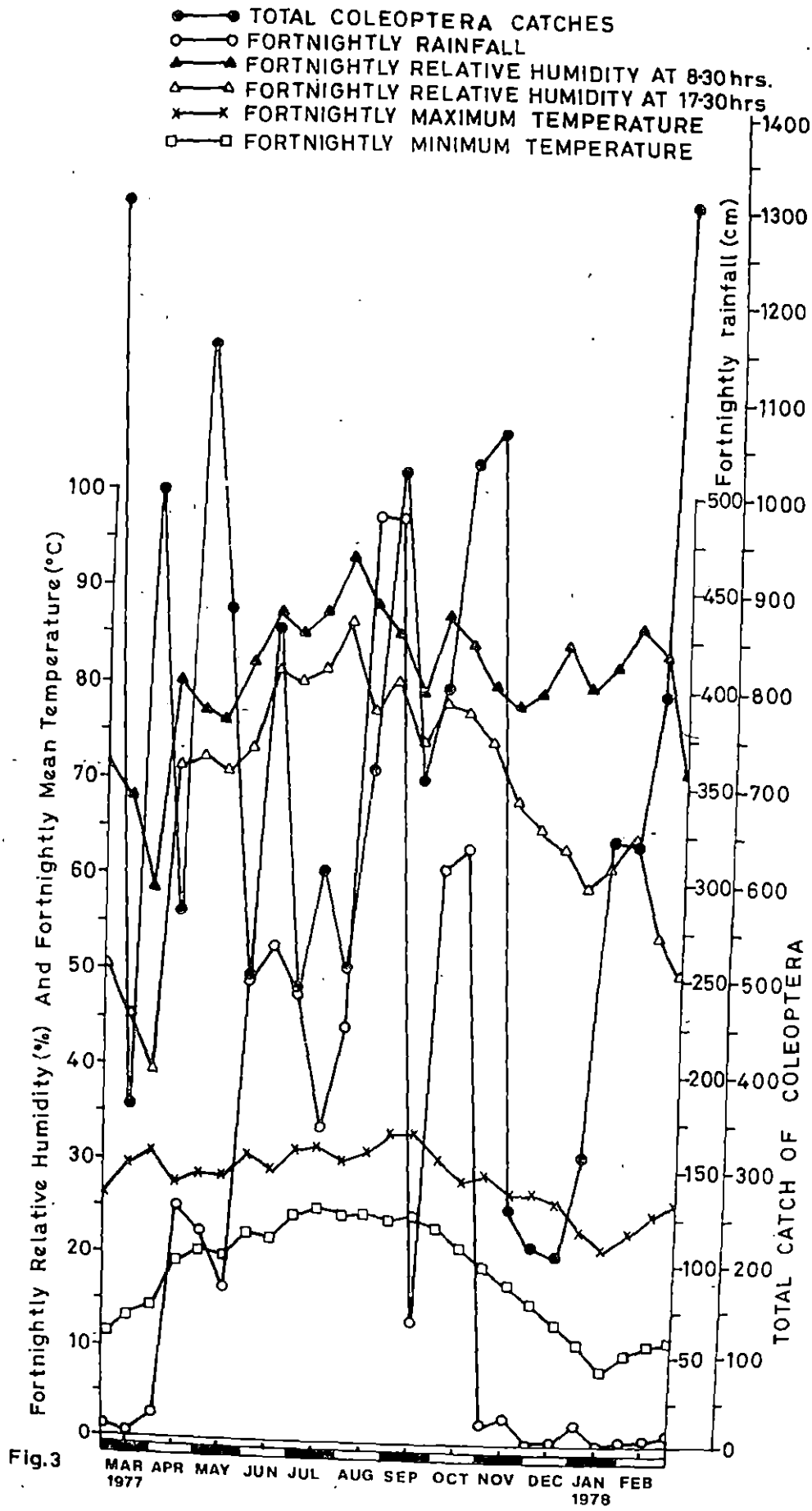

TOTAL COLEOPTERA CATCHES
FORTNIGHTLY RAINFALL
FORTNIGHTLY RELATIVE HUMIDITY AT 8-30 hrs.
FORTNIGHTLY RELATIVE HUMIDITY AT 17-30 hrs
FORTNIGHTLY MAXIMUM TEMPERATURE
FORTNIGHTLY MINIMUM TEMPERATURE
Fortnightly Relative Humidity (%) And Fortnightly Mean Temperature (°C)
Fortnightly rainfall (cm)
TOTAL CATCH OF COLEOPTERA
MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB
1977
1978

Fig.3

Fig. 4. Histogram to show the abundance of the families of Coleoptera trapped in forest floor, tea garden and paddy field in Coochs area (Jalpaiguri district) during March'77 to February'78.

Fig. 5. Histogram to show the trap preference of the families of Coleoptera in fish baited trap, dung baited trap and empty pitfall trap during March'77 to February'78.

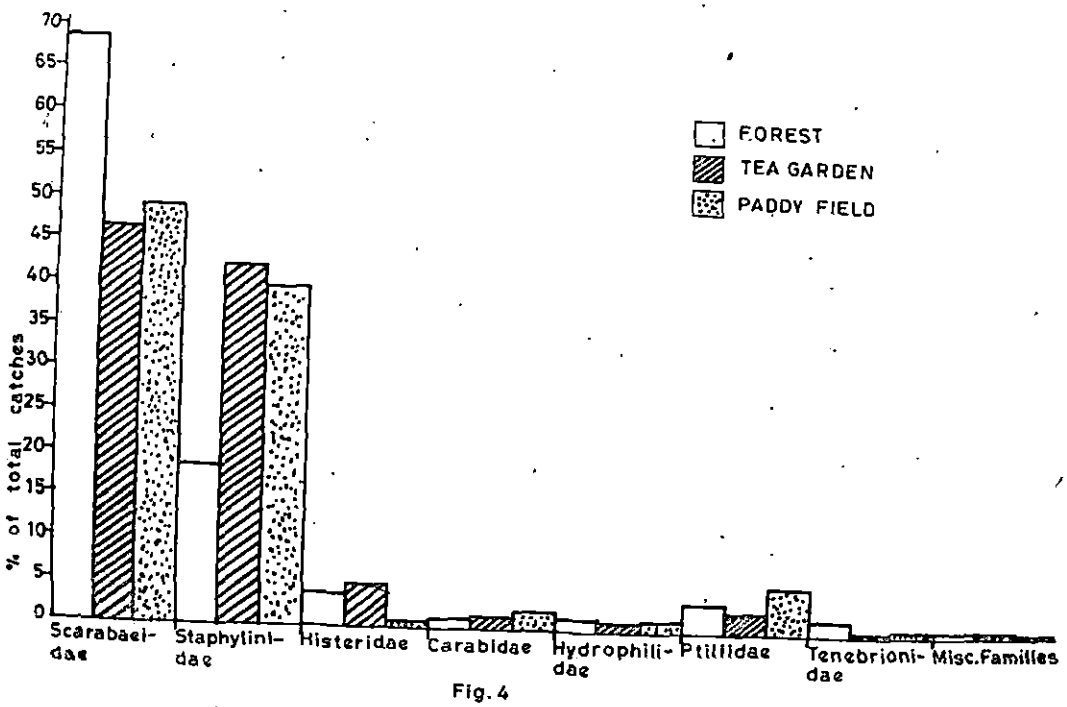

70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
% of total catches
FOREST
TEA GARDEN
PADDY FIELD
Scarabaei-dae
Staphylini-dae
Histeridae
Carabidae
Hydrophili-dae
Ptilliidae
Tenebrioni-dae
Misc.Families

Fig. 4

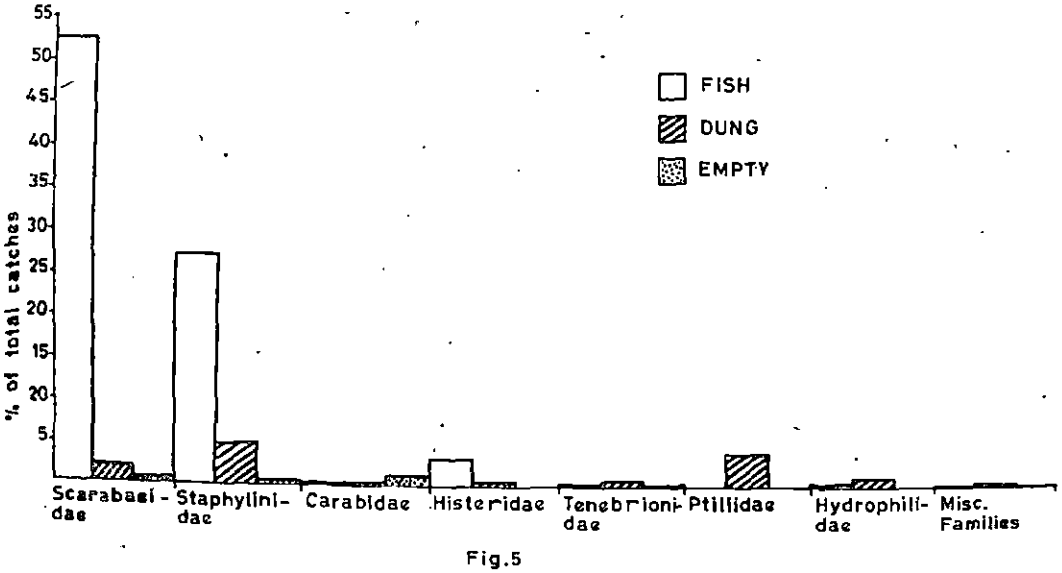

55
50
45
40
35
30
25
20
15
20
5
% of total catches
FISH
DUNG
EMPTY
Scarabaei-dae
Staphylini-dae
Carabidae
Histeridae
Tenebrioni-dae
Ptilliidae
Hydrophili-dae
Misc. Families

Fig.5

Fig. 6. Histogram to show the decreasing population size (shown as percentages of total catches) of the 23 abundant and common species of Coleoptera trapped in Dooars area during March'77 to February'78.

Fig. 7. Histogram to show the area preference (shown as percentages of total catches) of the 23 abundant and common species of Coleoptera trapped in three different adjoining areas, forest floor, tea garden and paddy field in Dooars area during March'77 to February'78.

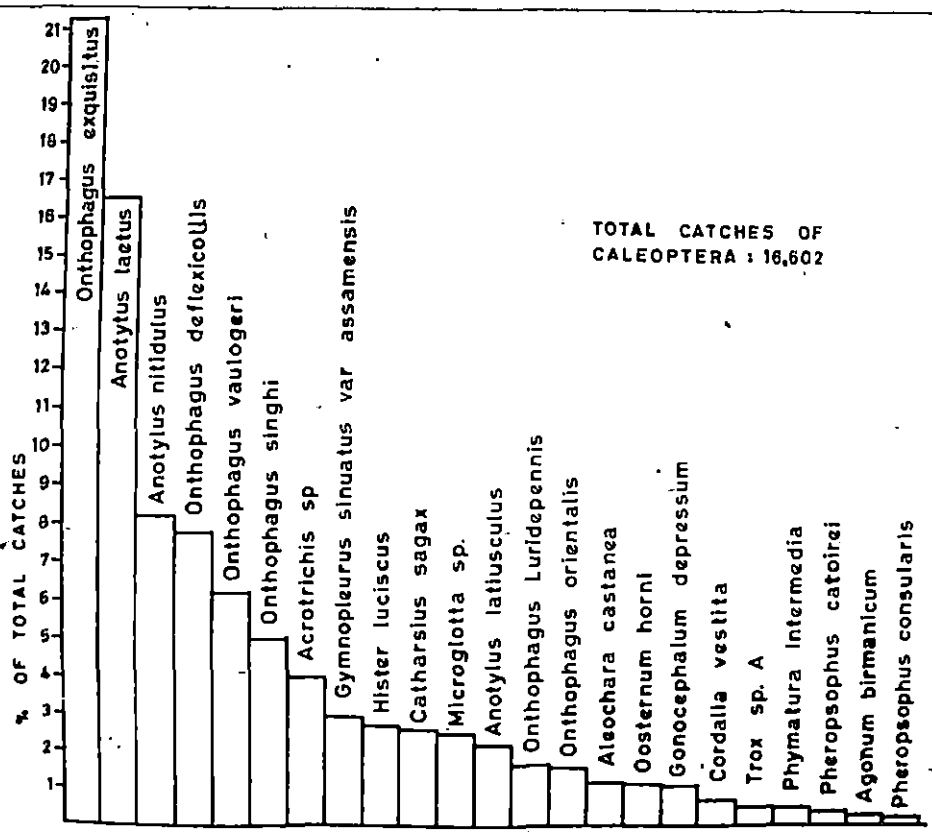

% OF TOTAL CATCHES
TOTAL CATCHES OF CALEOPTERA : 16,602
Onthophagus exquisitus
Anotytus laetus
Anotylus nitidulus
Onthophagus deflexicollis
Onthophagus vaulogeri
Onthophagus singhi
Acrotrichis sp
Gymnopleurus sinuatus var assamensis
Hister luciscus
Catharsius sagax
Microglotta sp.
Anotylus latiusculus
Onthophagus Luridepennis
Onthophagus orientalis
Aleochara castanea
Oosternum horni
Gonocephalum depressum
Cordalia vestita
Trox sp. A
Phymatura Intermedia
Pheropsophus catoirei
Agonum birmanicum
Pheropsophus consularis

Fig 6

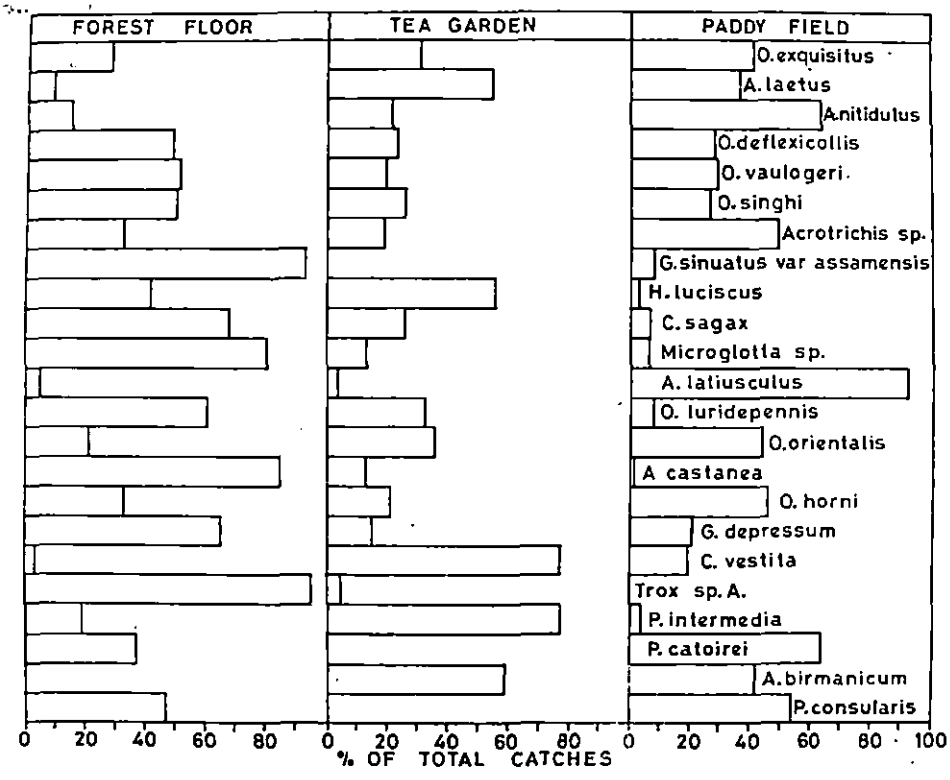

FOREST FLOOR
TEA GARDEN
PADDY FIELD
O.exquisitus
A. laetus
A.nitidulus
O.deflexicollis
O. vaulogeri.
O. singhi
Acrotrichis sp.
G.sinuatus var assamensis
H. luciscus
C. sagax
Microglotta sp.
A. latiusculus
O. luridepennis
O.orientalis
A castanea
O. horni
G. depressum
C. vestita
Trox sp. A.
P. intermedia
P. catoirei
A.birmanicum
P.consularis
0 20 40 60 80
0 20 40 60 80
0 20 40 60 80 100
% OF TOTAL CATCHES

Fig.7

Fig. 8. Graph to show the percentages of total catches of the beetle Onthophagus deflexicollis Lansberge caught in fish baited trap during March'77 to February'78 in forest floor, tea garden and paddy field.

Fig. 9. Graph to show the percentages of total catches of the beetle Onthophagus vaulogeri Boucomont caught in fish baited trap during March'77 to February'78 in forest floor, tea garden and paddy field.

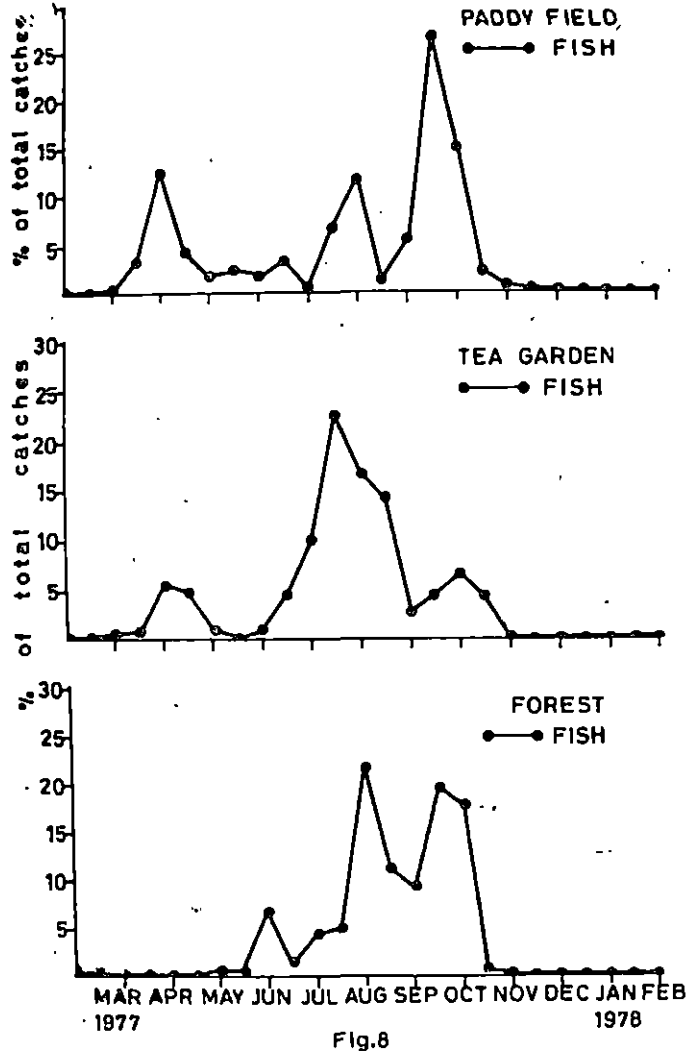

PADDY FIELD
FISH
% of total catches
TEA GARDEN
FISH
of total catches
FOREST
FISH
%
MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB
1977
1978

Fig.8

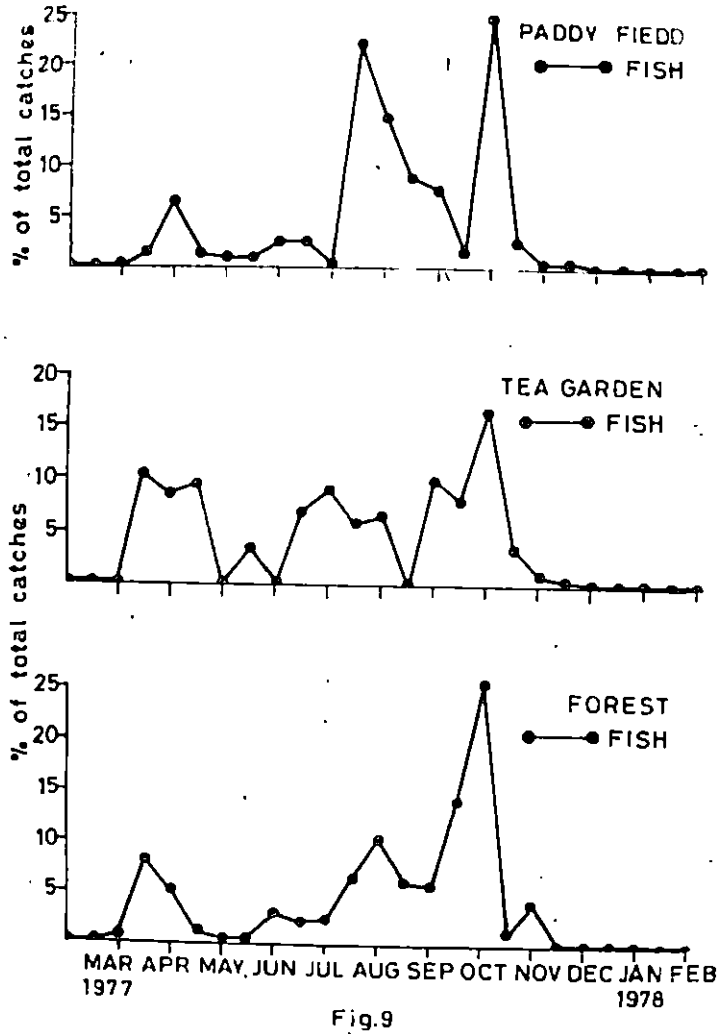

PADDY FIEDD
FISH
% of total catches
TEA GARDEN
FISH
% of total catches
FOREST
FISH
MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB
1977
1978

Fig.9

Fig. 10. Graph to show the percentages of total catches of the beetle Onthophagus orientalis Harold caught in fish baited trap during March'77 to February'78 in forest floor, tea garden and paddy field.

Fig. 11. Graph to show the percentages of total catches of the beetle Onthophagus luridenennis Boheman caught in fish baited trap during March'77 to February'78 in forest floor, tea garden and paddy field.

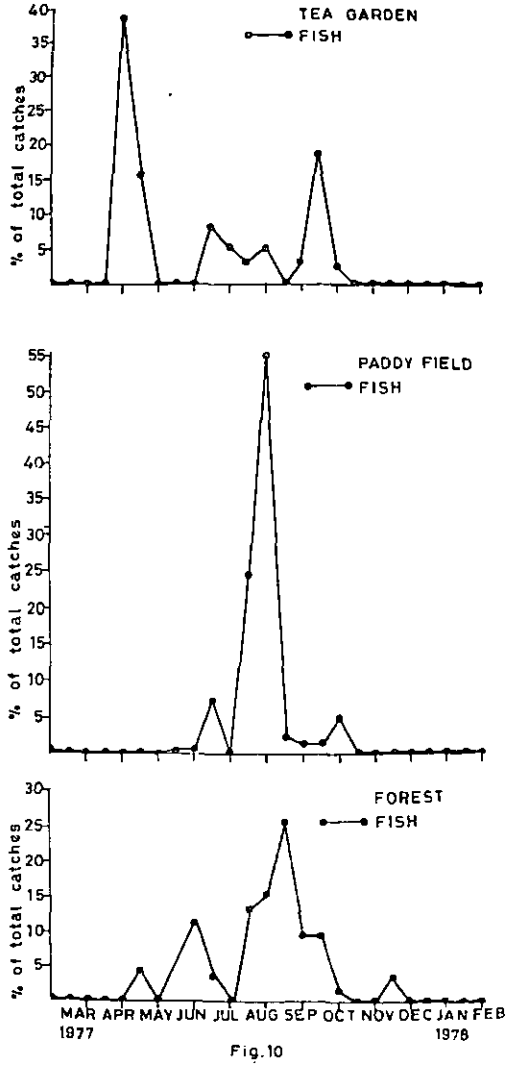

TEA GARDEN
FISH
% of total catches
PADDY FIELD
FISH
% of total catches
FOREST
FISH
% of total catches
MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB
1977
1978

Fig.10

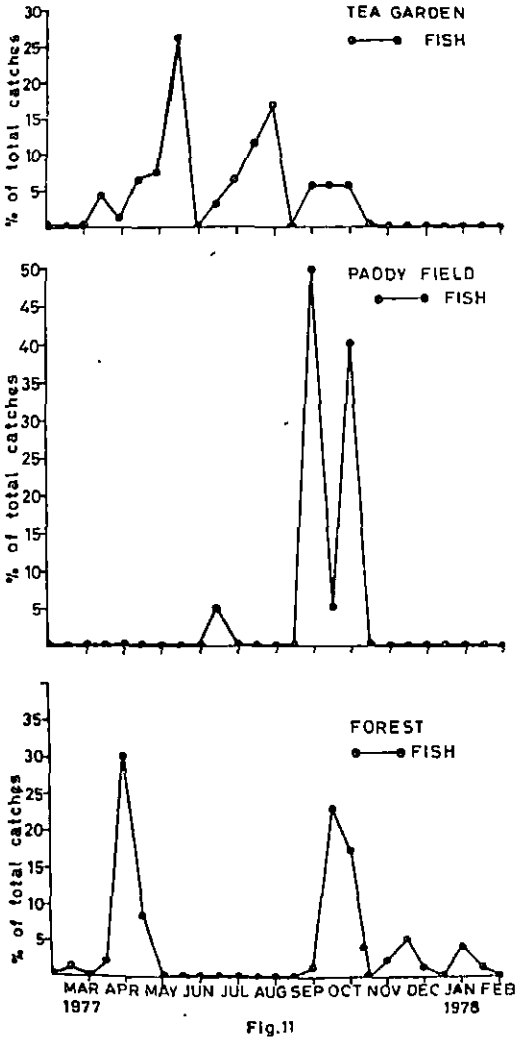

TEA GARDEN
FISH
% of total catches
PADDY FIELD
FISH
% of total catches
FOREST
FISH
% of total catches
MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB
1977
1978

Fig.11

Fig. 12. Graph to show the percentages of total catches of the beetle Onthophagus exculsitus Arrow caught in fish baited trap during March'77 to February'78 in forest floor, tea garden and paddy field.

Fig. 13. Graph to show the percentages of total catches of the beetle Onthophagus singhi Biswas (manuscript name) caught in fish baited trap during March'77 to February'78 in forest floor, tea garden and paddy field.

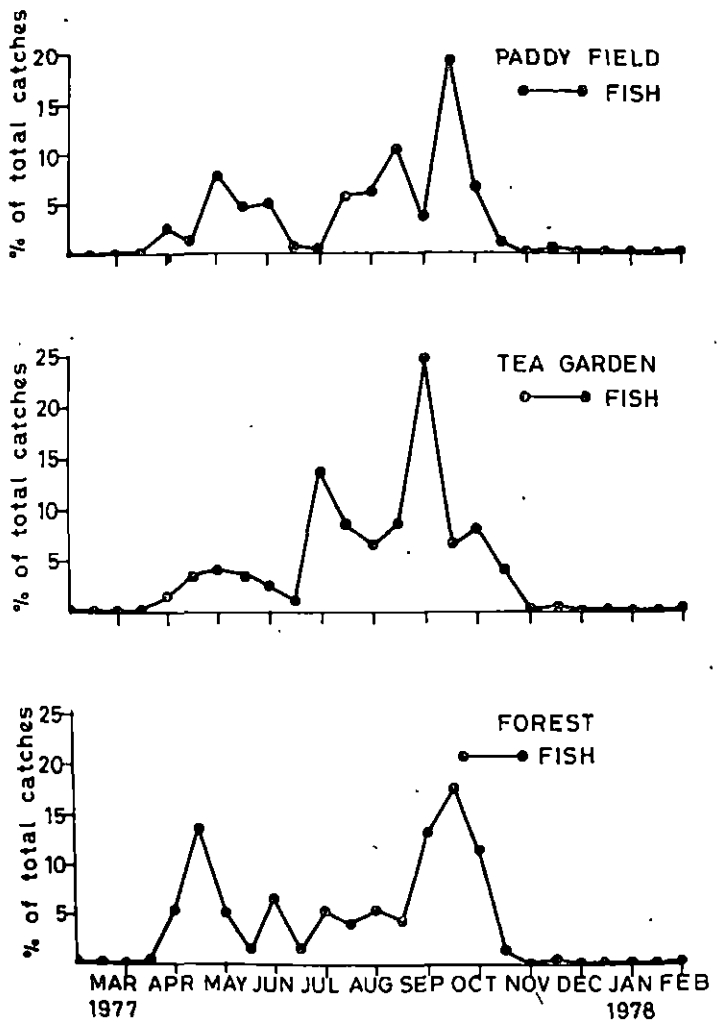

% of total catches
PADDY FIELD
FISH
TEA GARDEN
FISH
FOREST
FISH
MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB
1977
1978

Fig.12

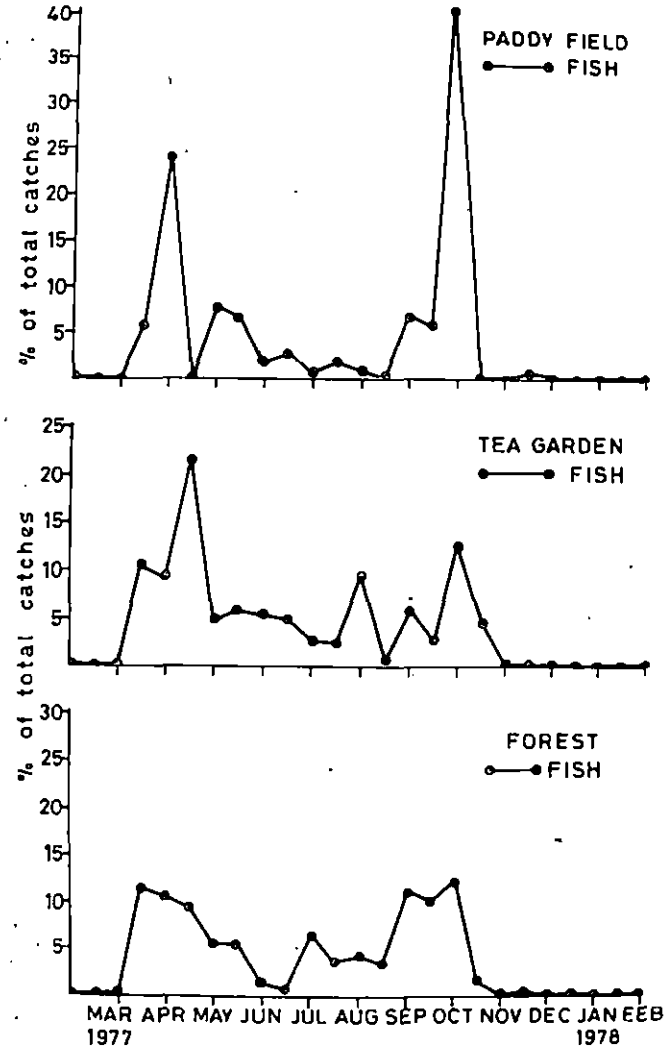

% of total catches
PADDY FIELD
FISH
TEA GARDEN
FISH
FOREST
FISH
MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB
1977
1978

Fig.13

Fig. 14. Graph to show the percentages of total catches of the beetle Onthophagus gangeticus Gillot caught in fish baited trap during March'77 to February'78 in forest floor, tea garden and paddy field.

Fig. 15. Graph to show the percentages of total catches of the beetle Onthophagus rudis Sharp caught in fish baited trap during March'77 to February'78 in forest floor.

Fig. 16. Graph to show the percentages of total catches of the beetle Onthophagus bifasciatus (Fabricius) caught in fish baited trap during March'77 to February'78 in tea garden and paddy field.

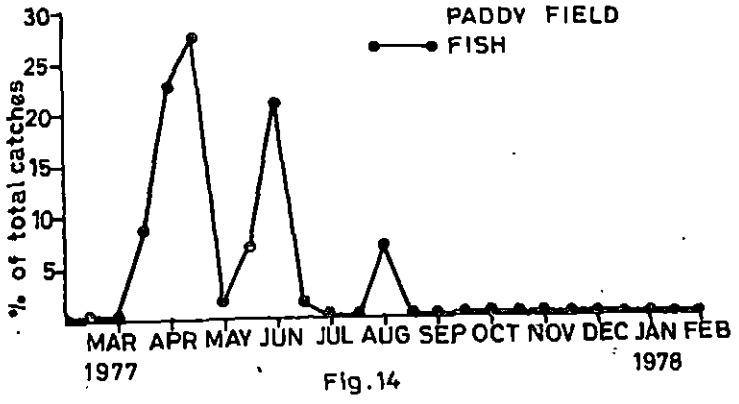


Fig.14

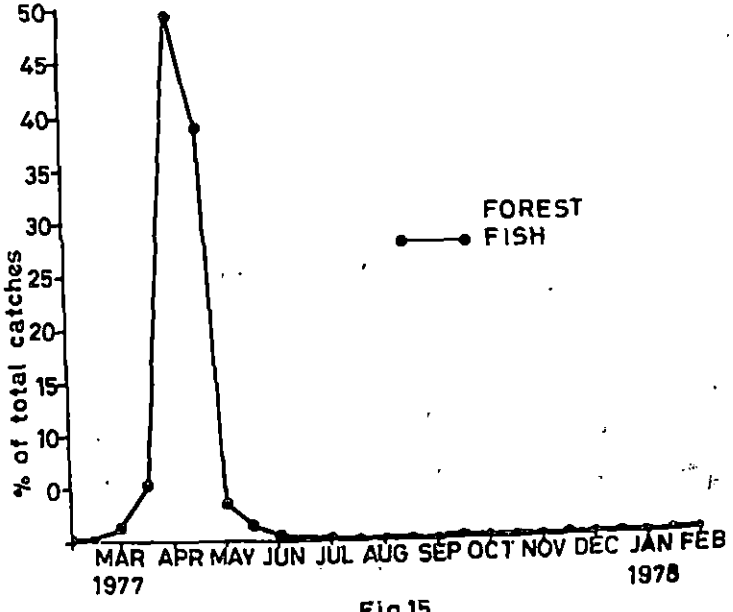
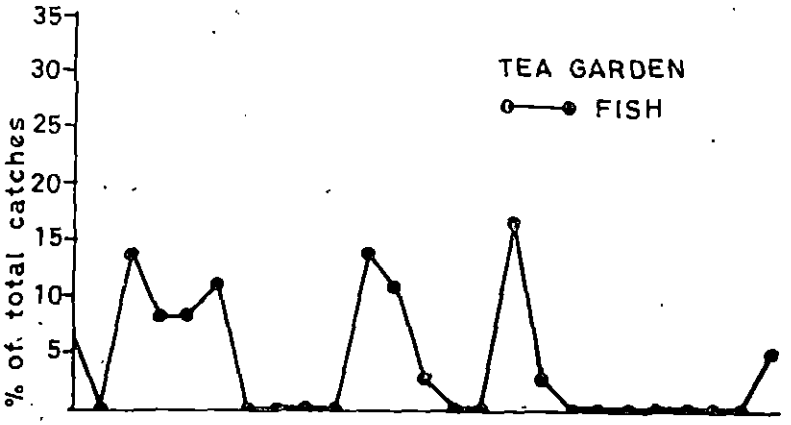


Fig.15



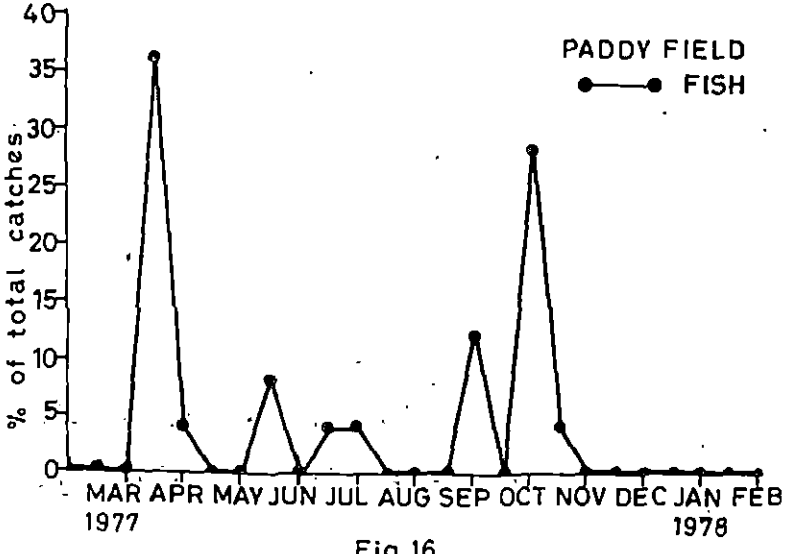


Fig.16

Fig. 17. Graph to show the percentages of total catches of the beetle Onthophagus phoneeiformis Boucomont caught in fish baited trap during March'77 to February'78 in forest floor.

Fig. 18. Graph to show the percentages of total catches of the beetle Onthophagus hastifer Lansberge caught in fish baited trap during March'77 to February'78 in tea garden.

Fig. 19. Graph to show the percentages of total catches of the beetle Parachorius hookeri Arrow caught in fish baited trap during March'77 to February'78 in tea garden.

Fig. 20. Graph to show the percentages of total catches of the beetle Gymnopleurus sinuatus var assamensis Waterhouse caught in fish and dung baited traps in forest floor, and dung baited trap in paddy field during March'77 to February'78.

Fig. 21. Graph to show the percentages of total catches of the beetle Phaeochrous emerginatus Castelnau caught in fish baited trap during March'77 to Februery'78 in forest floor.

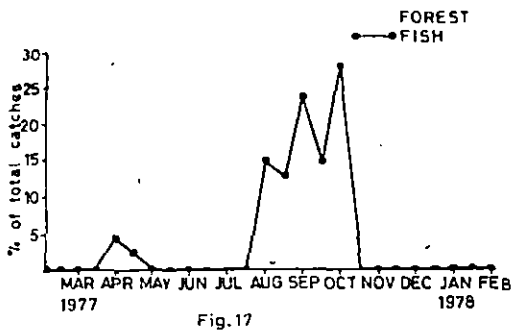
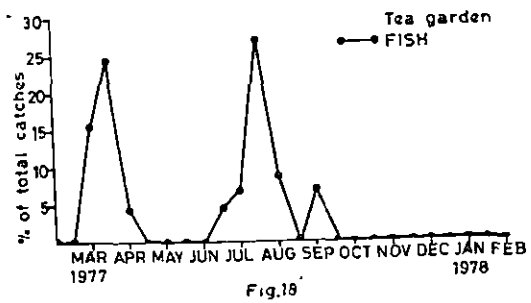


Fig.17



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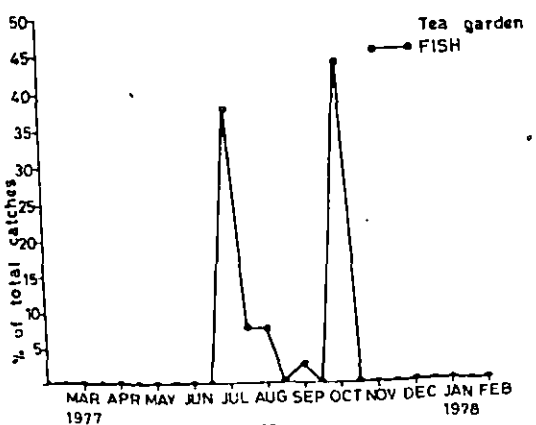

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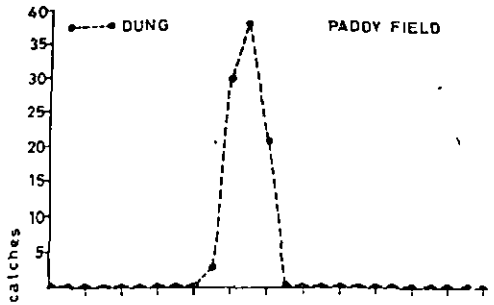

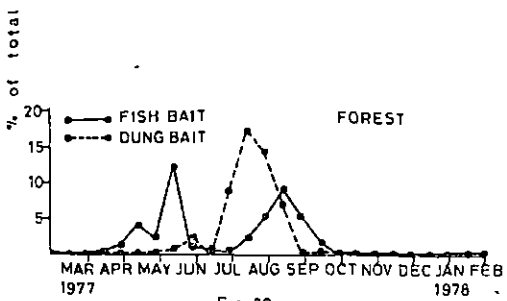

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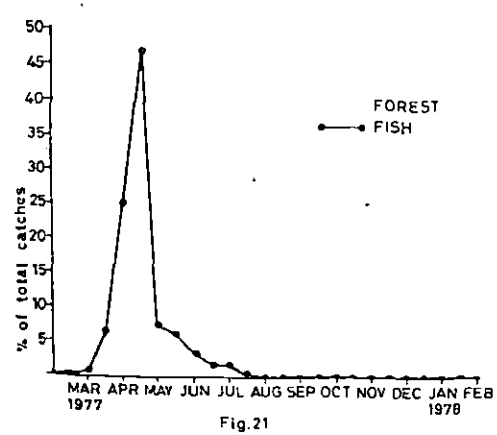


Fig.21

Fig. 22. Graph to show the percentages of total catches of the beetle Anotylus nitidulus (Gravelly) caught in fish baited trap during March'77 to February'78 in forest floor, tea garden and paddy field.

Fig. 23. Graph to show the percentages of total catches of the beetle Anotylus laetus (Cameron) caught in fish baited trap during March'77 to February'78 in forest floor, tea garden and paddy field.

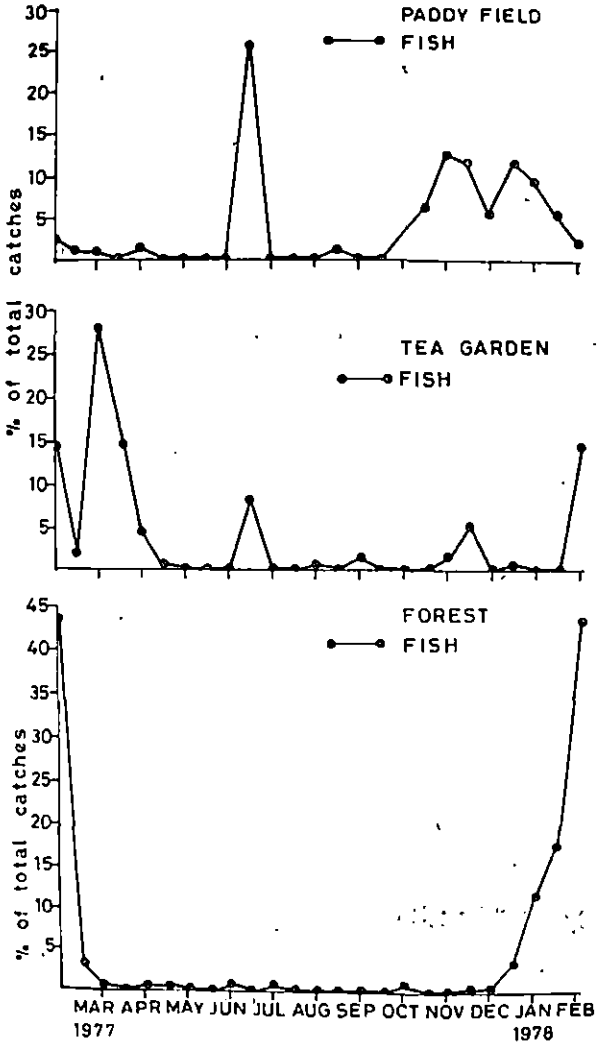

PADDY FIELD
FISH
% of total catches
TEA GARDEN
FISH
% of total catches
FOREST
FISH
% of total catches
MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB
1977
1978

Fig 22

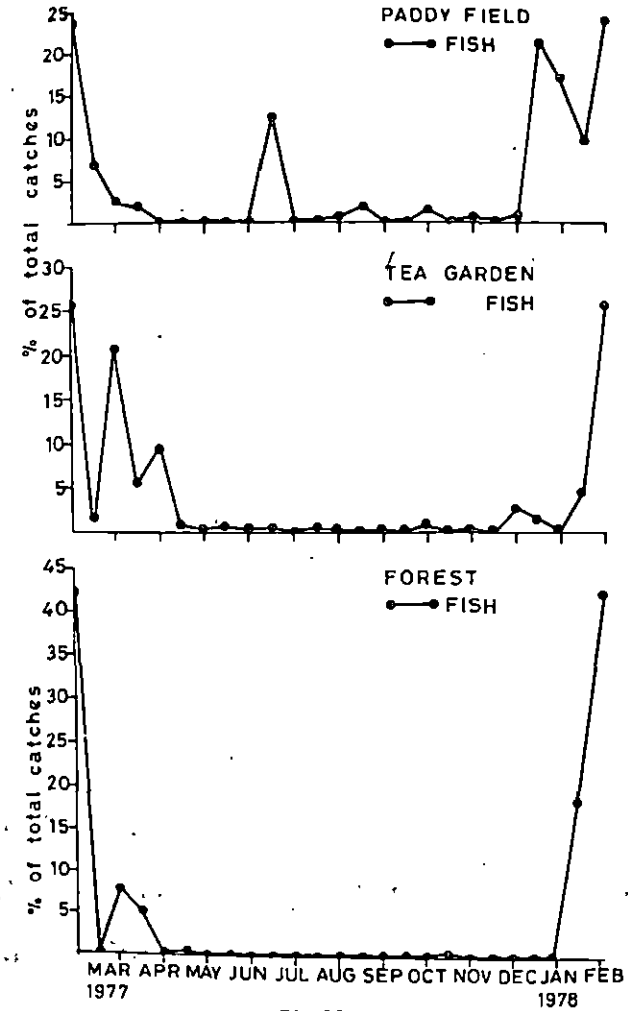

PADDY FIELD
FISH
% of total catches
TEA GARDEN
FISH
% of total catches
FOREST
FISH
% of total catches
MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB
1977
1978

Fig.23

Fig. 24. Graph to show the percentages of total catches of the beetle Anotylus latiusculus (Kraatz) caught in fish baited trap during March'77 to February'78 in tea garden.

Fig. 25. Graph to show the percentages of total catches of the beetle Cordalia vestita Bohemann caught in dung baited trap during March'77 to February'78 in tea garden.

Fig. 26. Graph to show the percentages of total catches of the beetle Phymatura intermedia Cameron caught in dung baited trap during March'77 to February'78 in tea garden.

Fig. 27. Graph to show the percentages of total catches of the beetle Microglotta sp. caught in fish baited trap in forest floor and in dung baited trap in tea garden during March'77 to February'78.

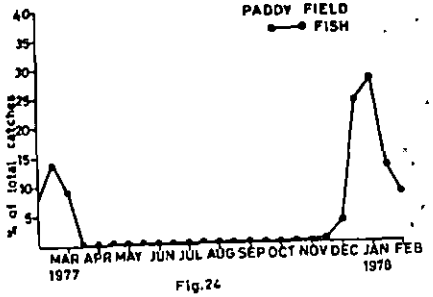


Fig.24

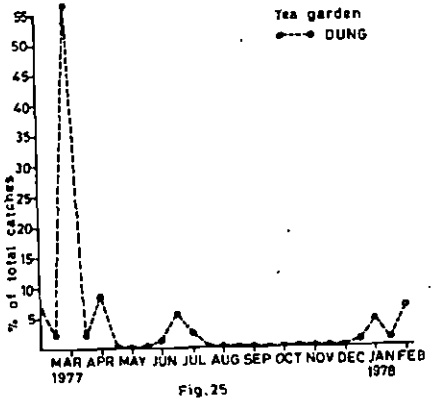


Fig.25

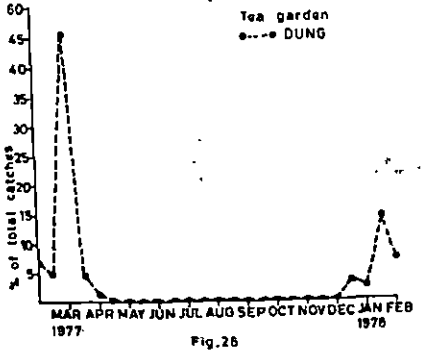


Fig.26

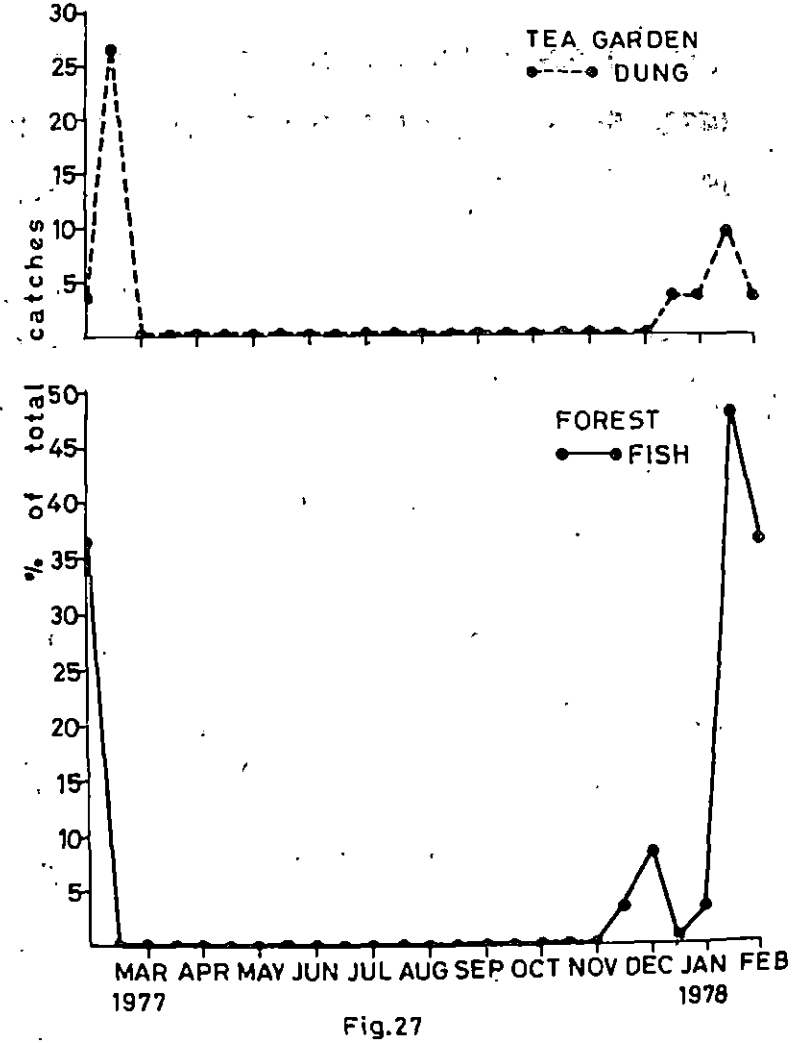


Fig.27

Fig. 28. Graph to show the percentages of total catches of the beetle Aleochara castanea Motschulsky caught in fish baited trap during March'77 to February'78 in forest floor and tea garden.

Fig. 29. Graph to show the percentages of total catches of the beetle Agonum birmanicum (Bates) caught in empty pitfall trap during March'77 to February'78 in tea garden and paddy field.

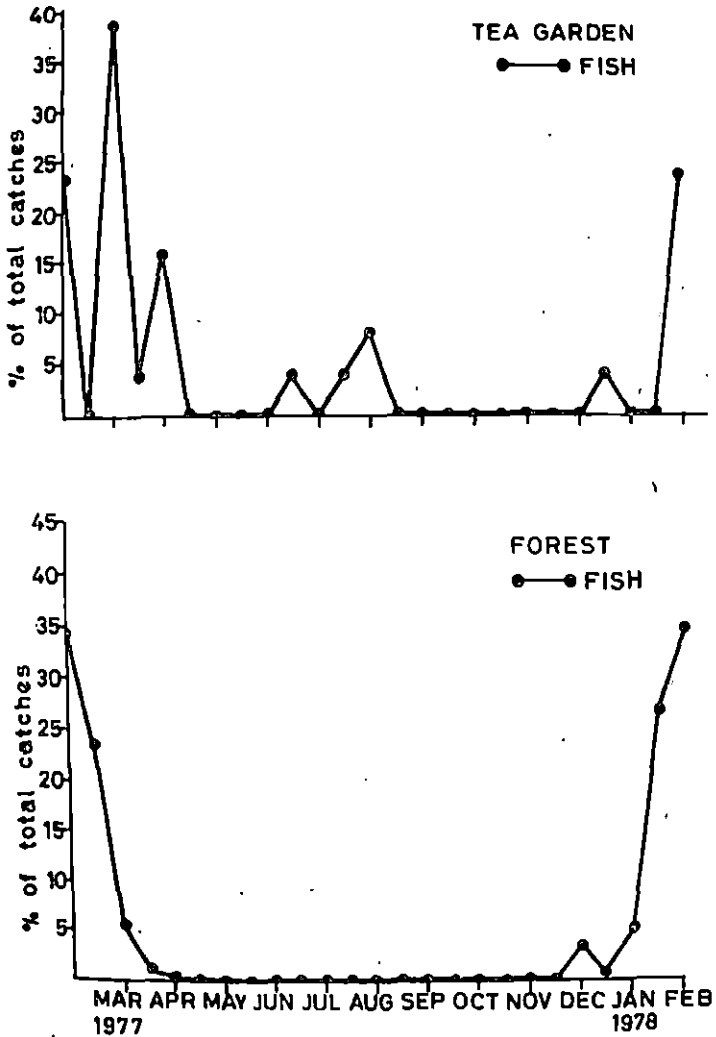

TEA GARDEN
FISH
% of total catches
40
35
30
25
20
15
10
5
FOREST
FISH
% of total catches
45
40
35
30
25
20
15
10
5
MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB
1977
1978

Fig.28

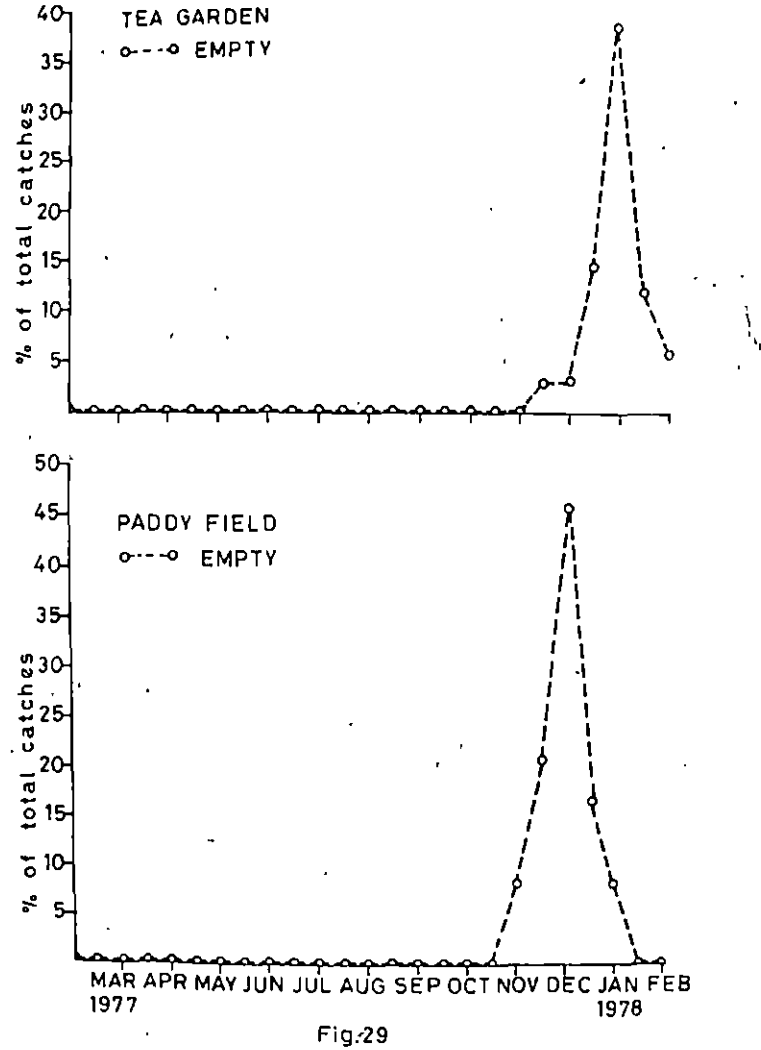

TEA GARDEN
EMPTY
% of total catches
40
35
30
25
20
15
10
5
PADDY FIELD
EMPTY
% of total catches
50
45
40
35
30
25
20
15
10
5
MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB
1977
1978

Fig.29

Fig. 30. Graph to show the percentages of total catches of the beetle Pheropsophus catoirei (Dejean) caught in empty pitfall trap during March'77 to February'78 in forest floor and paddy field.

Fig. 31. Graphs to show the percentages of total catches of the beetle Pheropsophus consularis (Schmidt-Goebel) caught in empty pitfall trap during March'77 to February'78 in forest floor and paddy field.

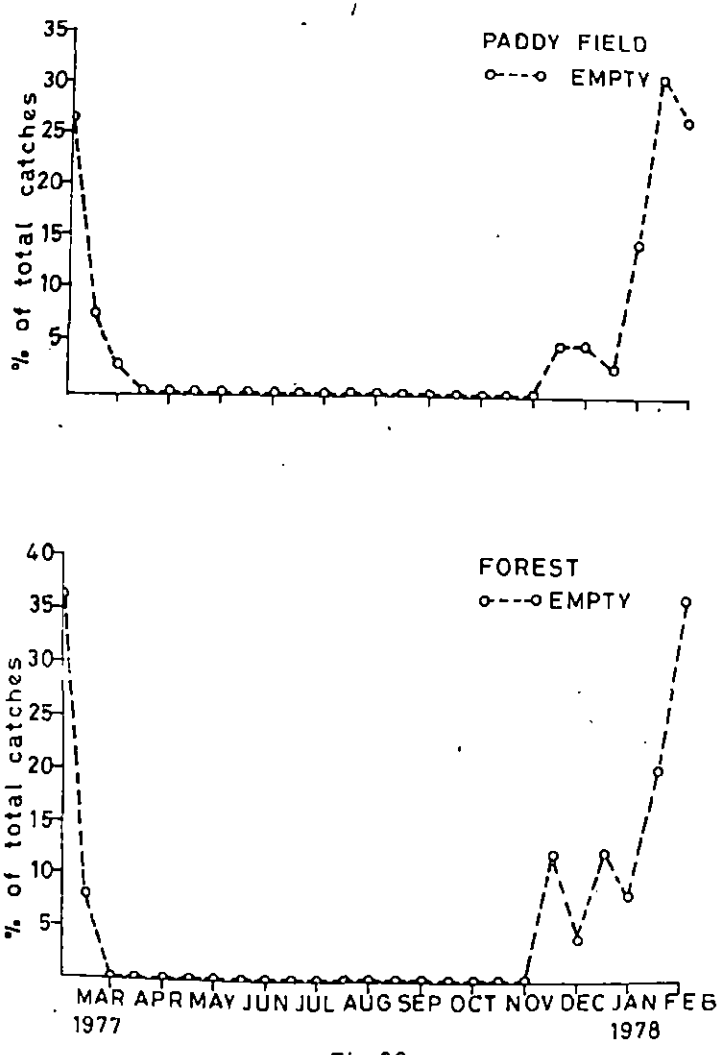

PADDY FIELD
EMPTY
% of total catches
35
30
25
20
15
10
5
FOREST
EMPTY
% of total catches
40
35
30
25
20
15
10
5
MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB
1977
1978

Fig. 30

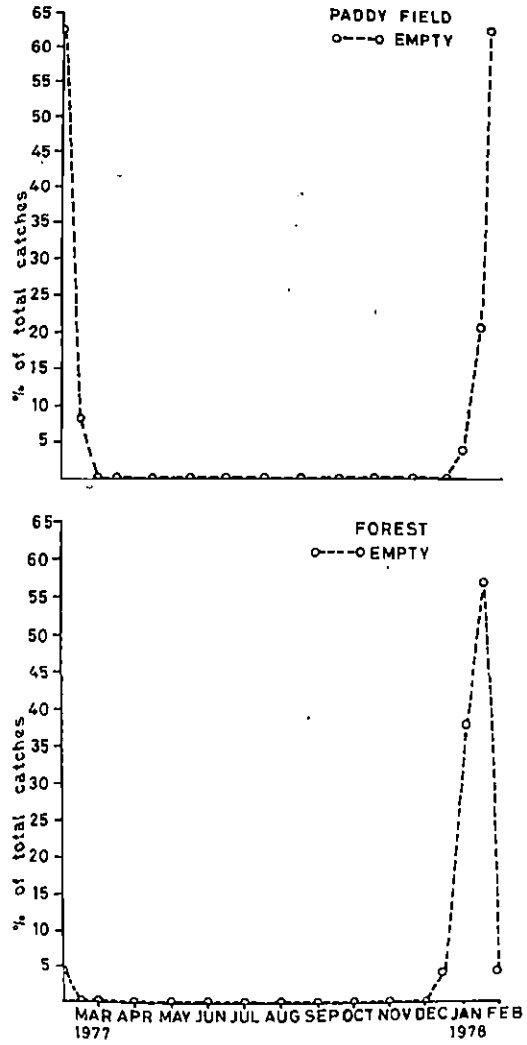

PADDY FIELD
EMPTY
% of total catches
65
60
55
50
45
40
35
30
25
20
15
10
5
FOREST
EMPTY
% of total catches
65
60
55
50
45
40
35
30
25
20
15
10
5
MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB
1977
1978

Fig. 31

Fig. 32. Graphs to show the percentages of total catches of the beetle Acrotrichis sp. caught in dung baited trap during March'77 to February'78 in forest floor, tea garden and paddy field.

Fig. 33. Graph to show the percentages of total catches of the beetle Trox sp.A. caught in fish baited trap during March'77 to February'78 in forest floor.

Fig. 34. Graphs to show the percentages of total catches of the beetle Hister luciscus Lewis caught in fish baited trap during March'77 to February'78 in forest floor and tea garden.

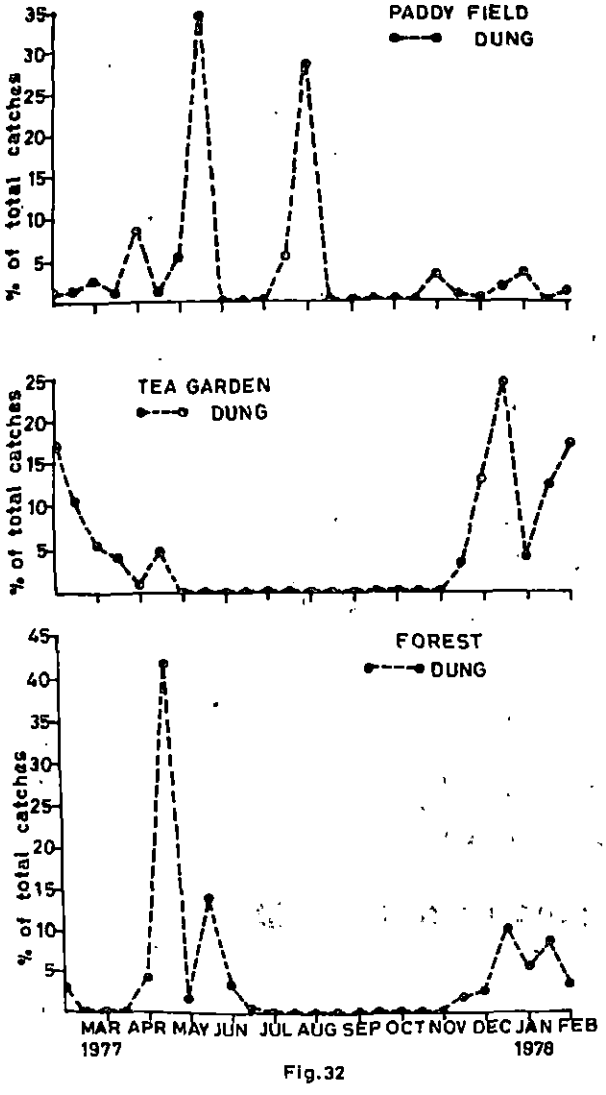


Fig.32

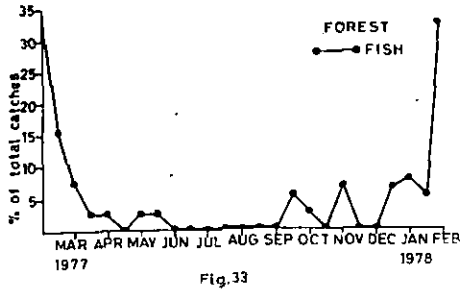


Fig.33

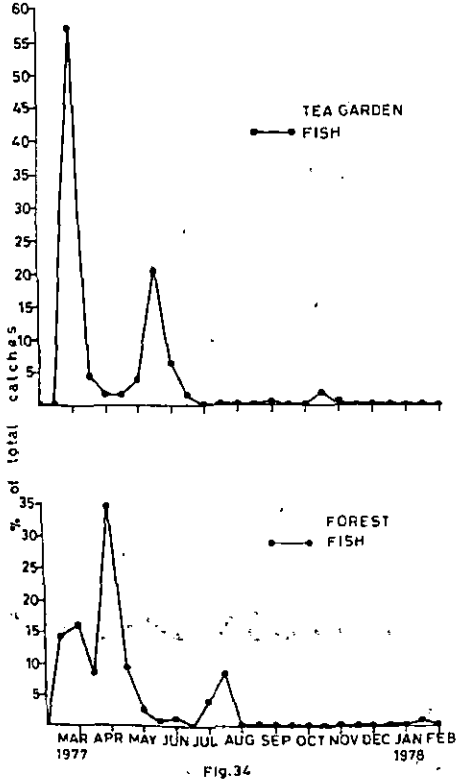


Fig.34

Fig. 35. Graph to show the percentages of total catches of the beetle Gonocephalum depressum Fabricius caught in dung baited trap in forest floor, in empty pitfall trap in tea garden and in fish baited trap in paddy field during March'77 to February'78.

Fig. 36. Graph to show the percentages of total catches of the beetle Catharsius sagax (Quenstedt) caught in fish baited trap in forest floor and tea garden during March'77 to February'78.

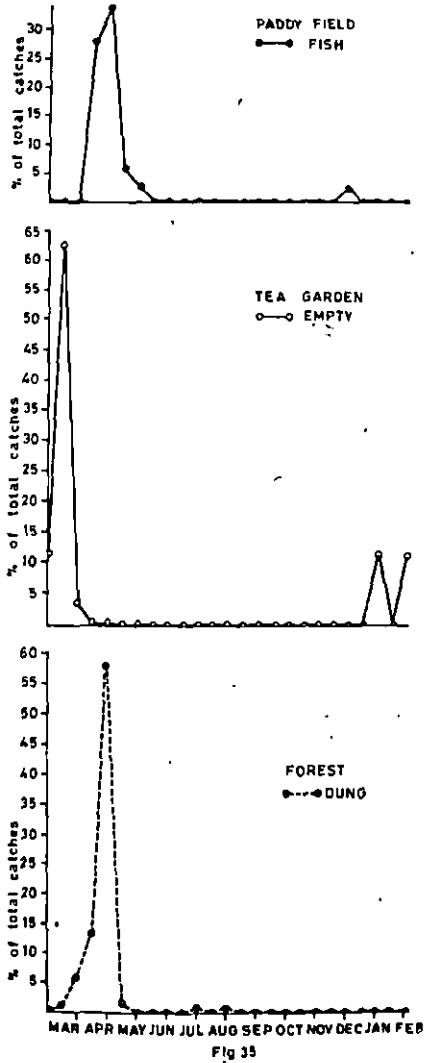

PADDY FIELD
FISH
% of total catches
TEA GARDEN
EMPTY
% of total catches
FOREST
DUNG
% of total catches
MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB

Fig 35

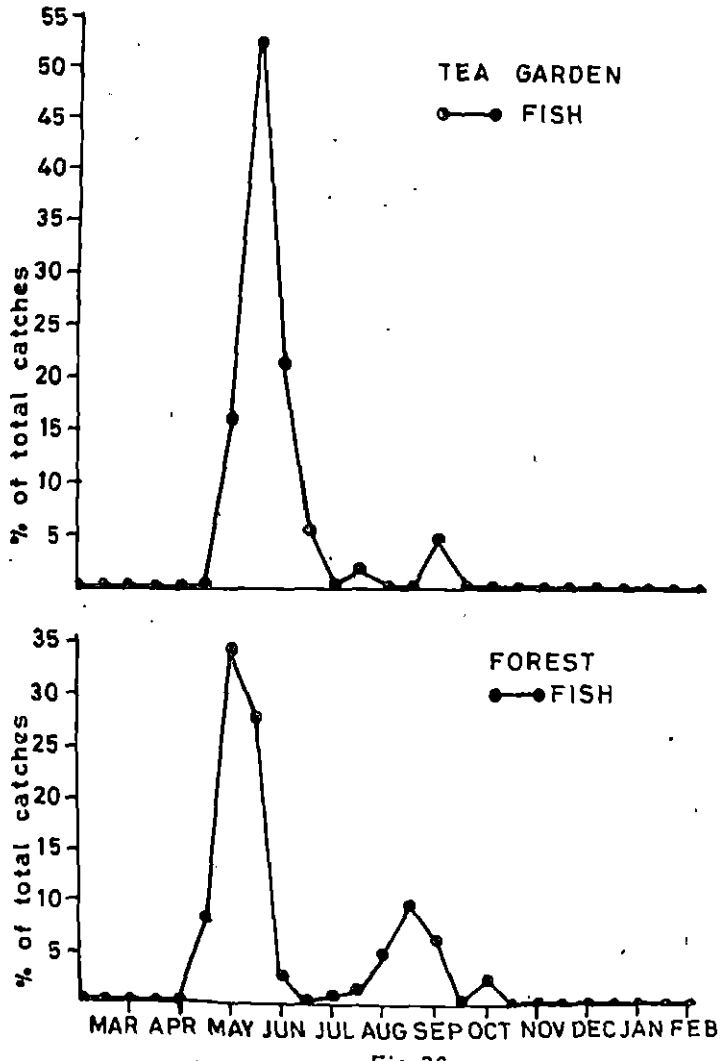

TEA GARDEN
FISH
% of total catches
FOREST
FISH
% of total catches
MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB

Fig.36

Fig. 37. Graph to show the percentages of total catches of the beetle Oosternum horni d'orchym caught in dung baited trap in paddy field during March'77 to February'78.

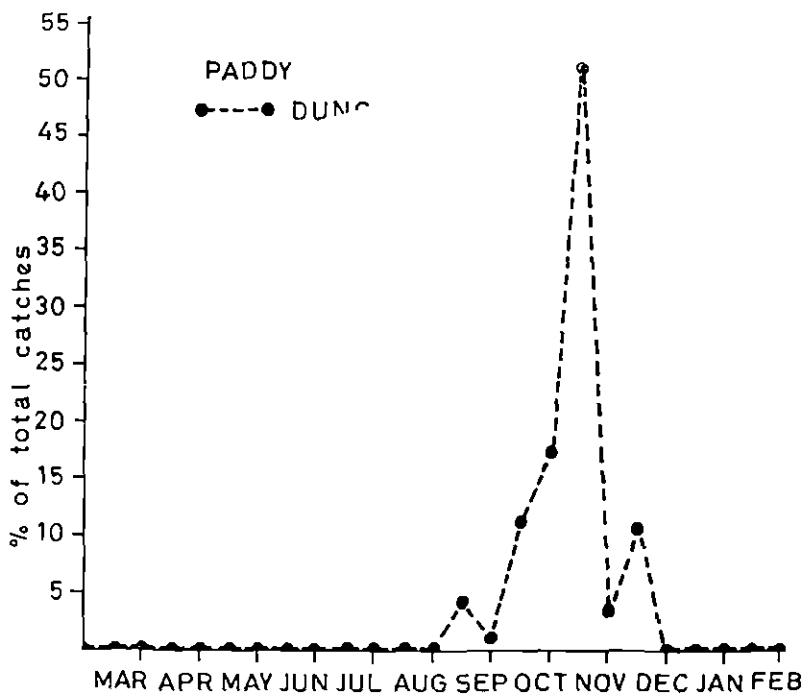

PADDY
DUNG
% of total catches
55
50
45
40
35
30
25
20
15
10
5
MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB

Fig 37

Explanation of Plate I

Fig. 1. *Onthophagus deflexicollis* Lansberge

Fig. 2. *Onthophagus vaulogeri* Boucomont

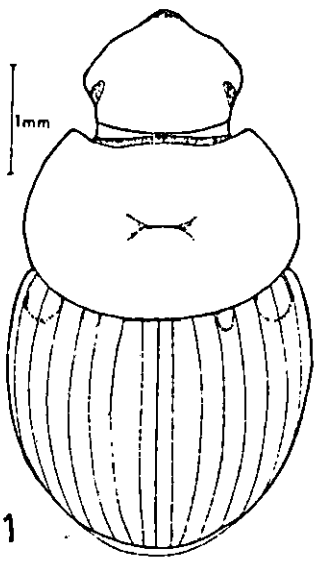
Fig. 3. *Onthophagus orientalis* Harold

Fig. 4. *Onthophagus lueidenensis* Bohemann

Fig. 5. *Onthophagus exquisitus* Arrow

Fig. 6. *Onthophagus singhi* Biswas (manuscript name)

PLATE 1



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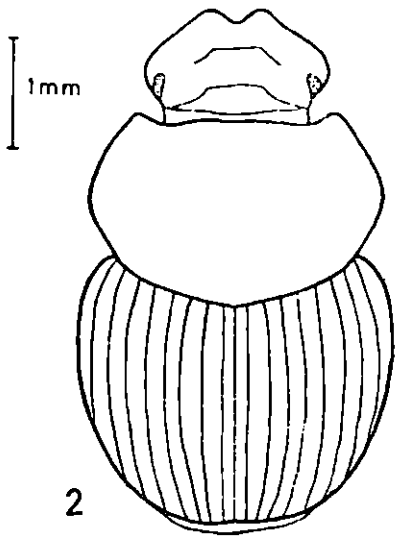

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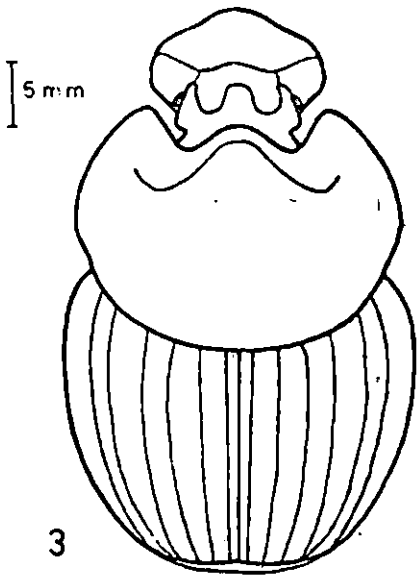

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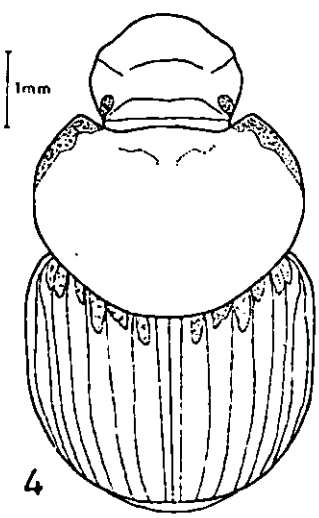

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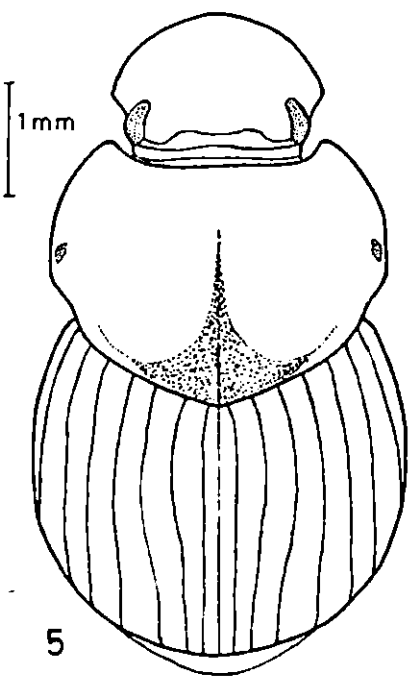

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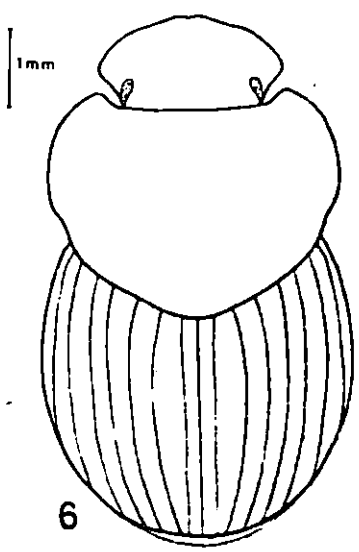


6

PLATE II

Explanation of Plate II

Fig. 7. Onthophagus gangeticus Gillet

Fig. 8. Onthophagus rudis Sharp

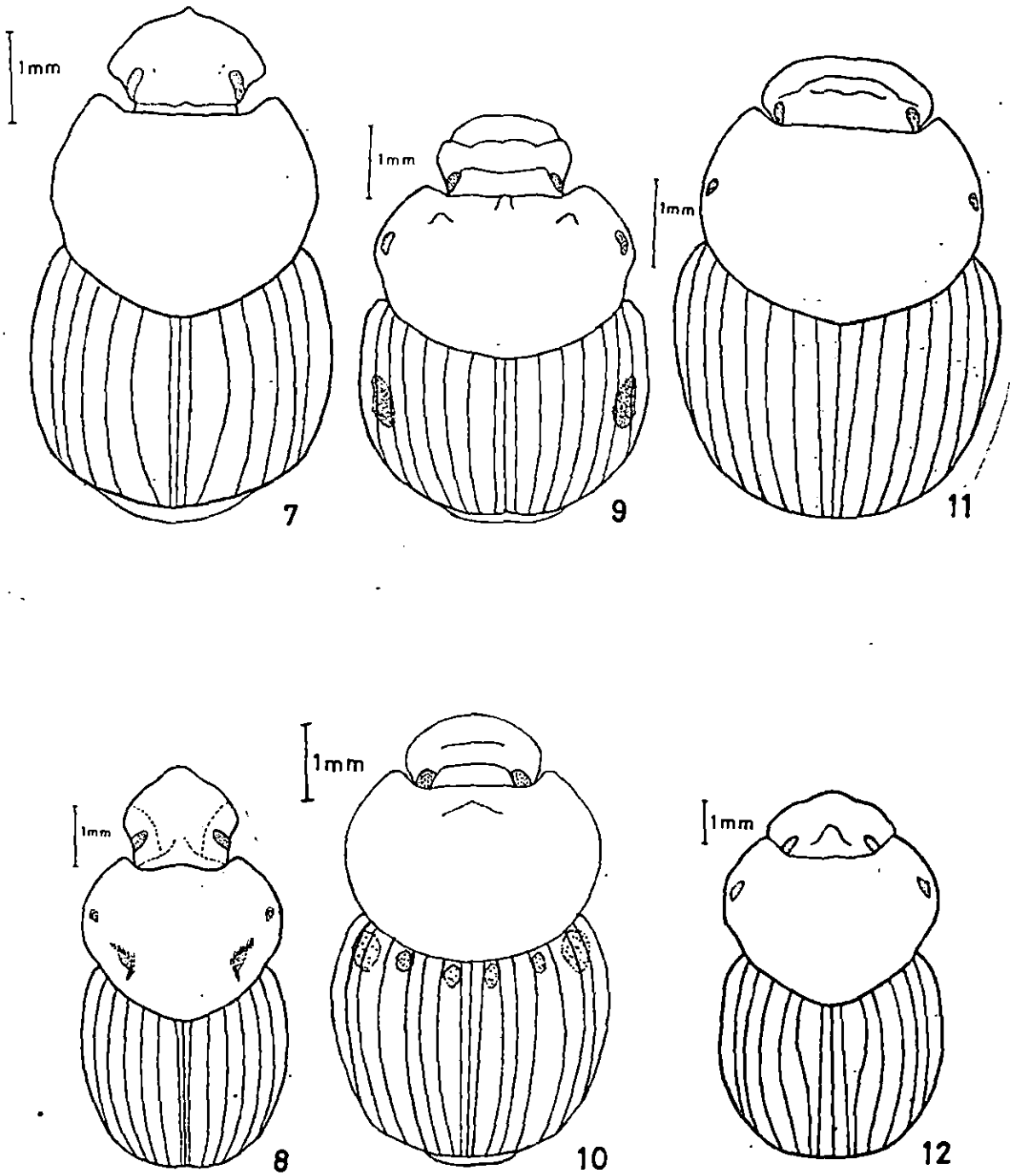
Fig. 9. Onthophagus bifasciatus (Fabricius)

Fig. 10. Onthophagus phanaeiformis Boucomont

Fig. 11. Onthophagus hastifer Lansborgo

Fig. 12. Onthophagus krishnai Biswas (manuscript name)

PLATE II



Explanation of Plate III

Fig. 13. *Onthophagus unifasciatus* (Sheller)

Fig. 14. *Onthophagus vigilans* Boucomont

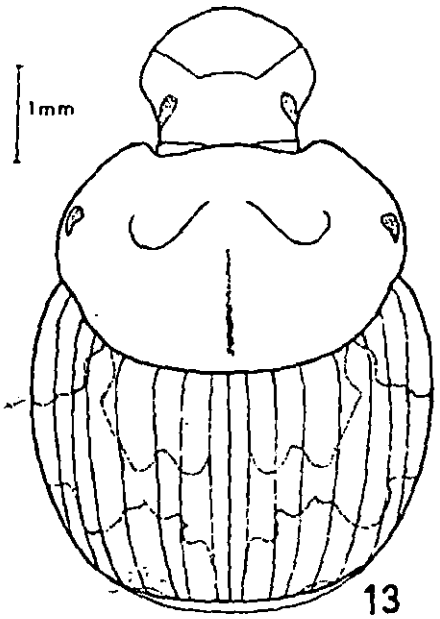
Fig. 15. *Onthophagus centricornis* (Fabricius)

Fig. 16. *Onthophagus tricornis* (Wiedemann)

Fig. 17. *Onthophagus atropolitus* d'orbigny

Fig. 18. *Onthophagus furcicollis* Arrow

PLATE III



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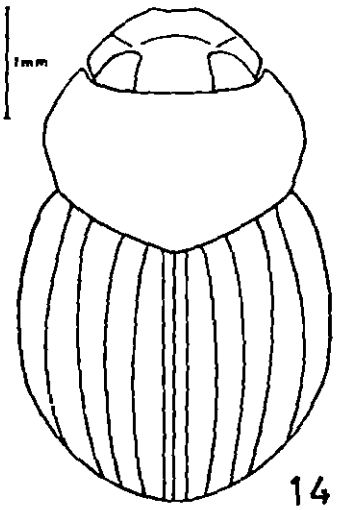

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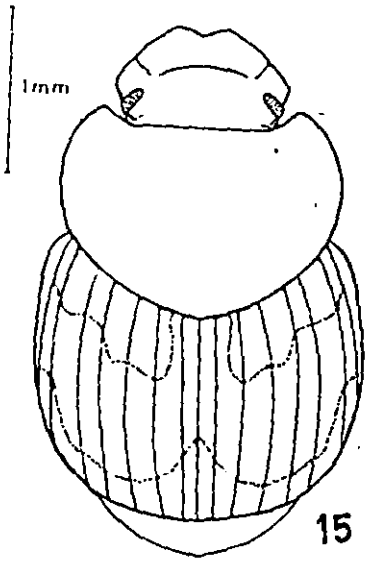

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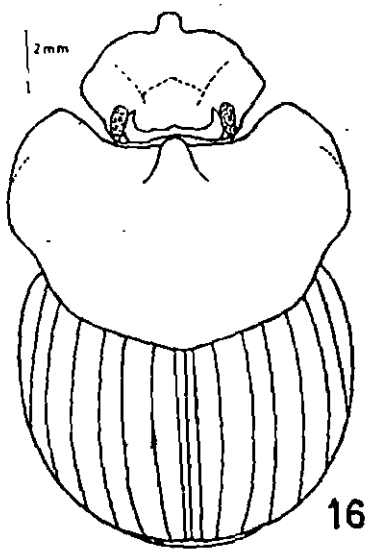

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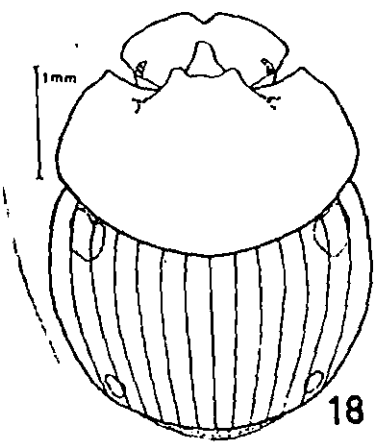

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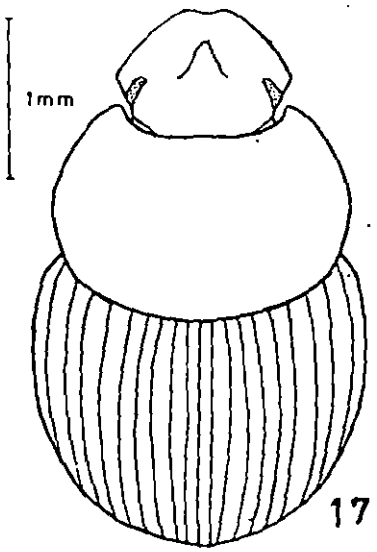


17

PLATE IV

Explanation of Plate IV

Fig. 19. Onthophagus nuchicornis Fabricius

Fig. 20. Onthophagus rumphi Biswas (manuscript name)

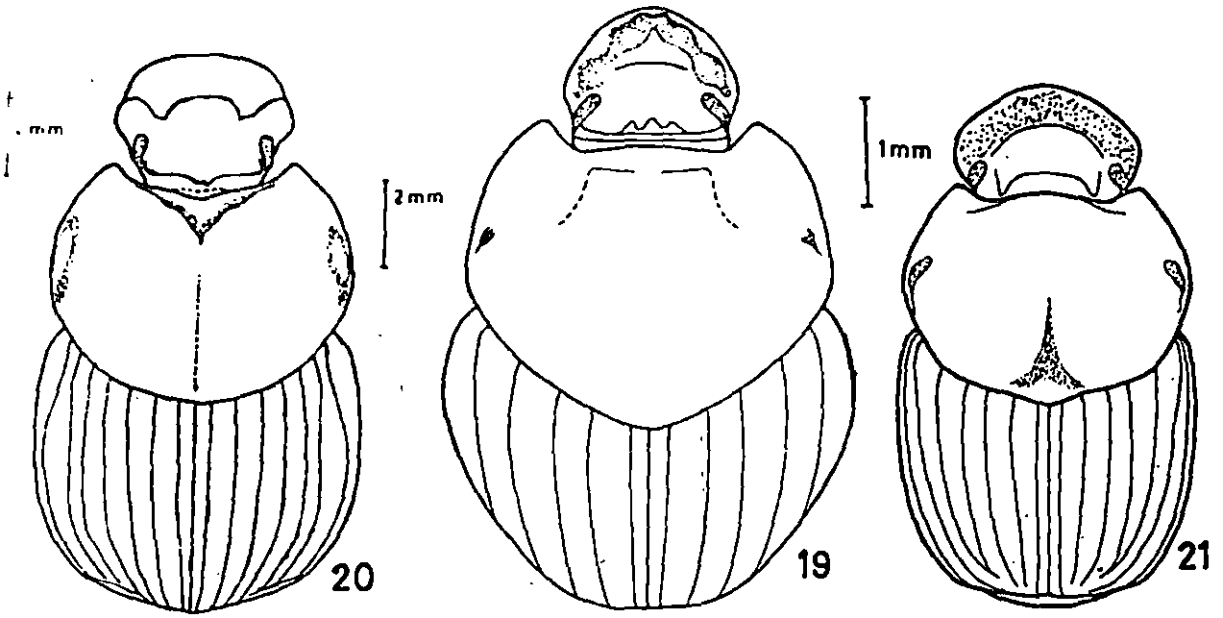
Fig. 21. Onthophagus rhinolophus sp. nov.

Fig. 22. Onthophagus sp. nr. Onthophagus luridipennis Boheman.

Fig. 23. Catharsius molossus (Linnaeus)

Fig. 24. Catharsius pithecius (Fabricius)

PLATE IV



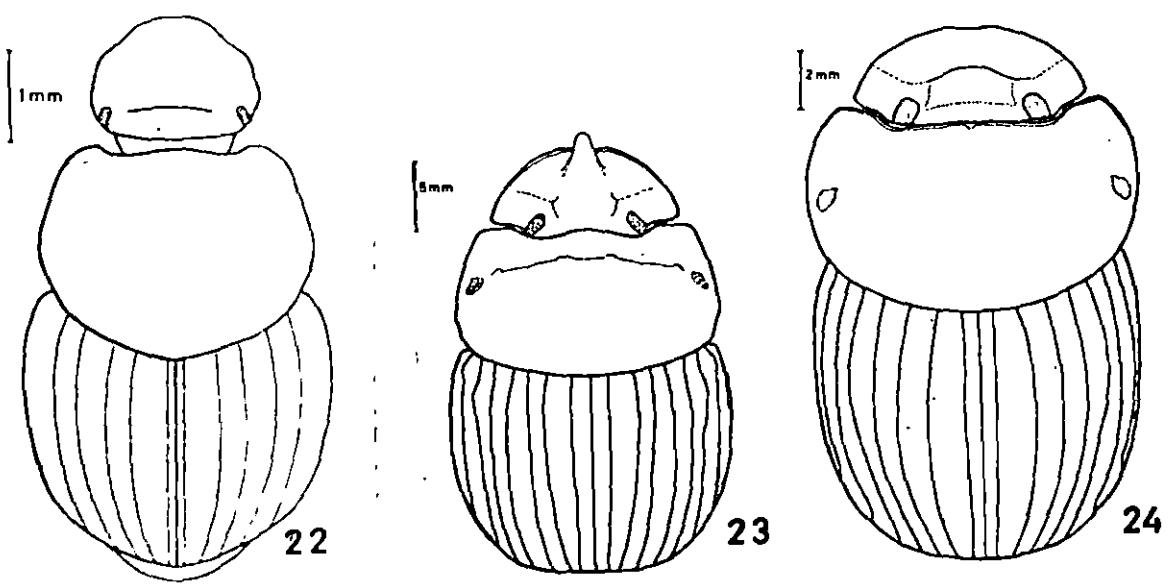


PLATE V

Explanation of Plate V

Fig. 25. *Gymnopleurus sinuatus* var *assamensis* Waterhouse

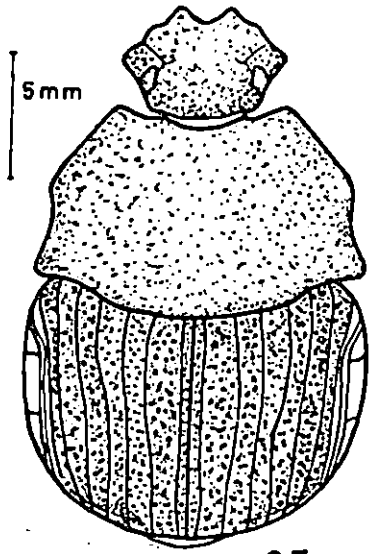
Fig. 26. *Parachorius hookeri* Arrow

Fig. 27. *Hyboserus orientalis* Westwood

Fig. 28. *Phaeochrous emarginatus* Castelnau

Fig. 29. *Oxynosus aciculatus* Schmidt

PLATE V



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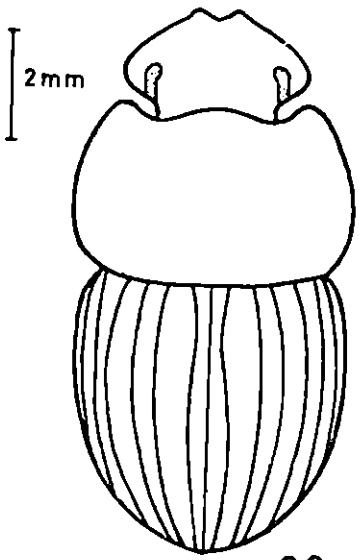

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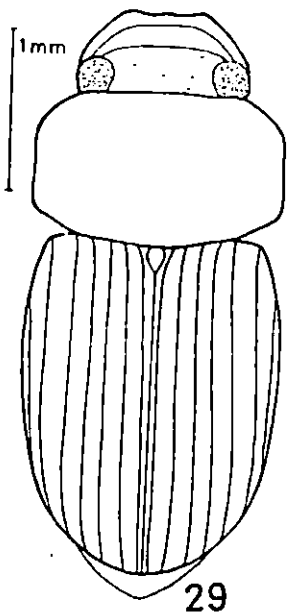

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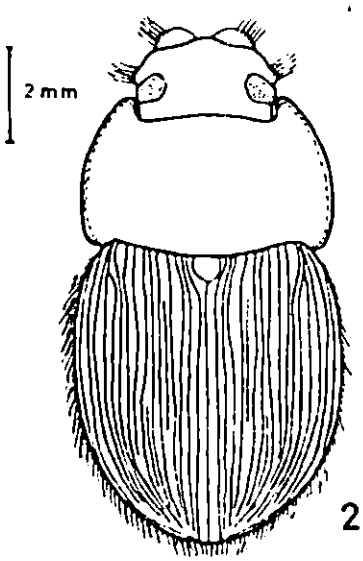

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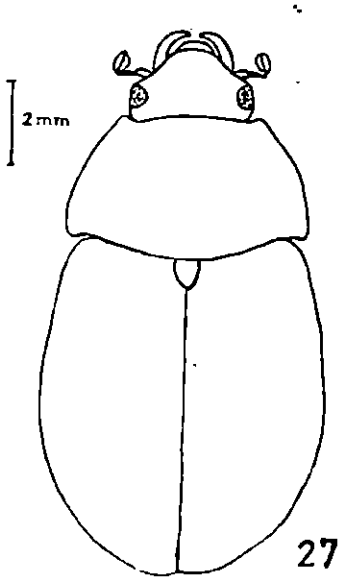

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PLATE VI

Explenation of Plate VI

Fig. 30. *Anotylus nitidulus* (Gravelly)

Fig. 31. *Anotylus laetus* (Cameron)

Fig. 32. *Anotylus latiusculus* (Kraatz)

Fig. 33. *Anotylus frater* (Cameron)

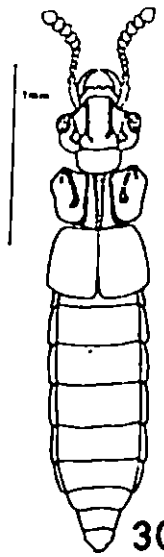
Fig. 34. *Anotylus sikkimi* (Fauvel)

Fig. 35. *Philonthus cuctilbus* Kraatz

Fig. 36. *Philonthus agasmensis* Cameron

Fig. 37. *Proteinus fuscotestaceus* Cameron

PLATE VI



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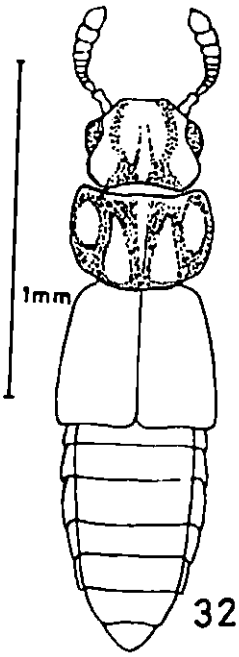

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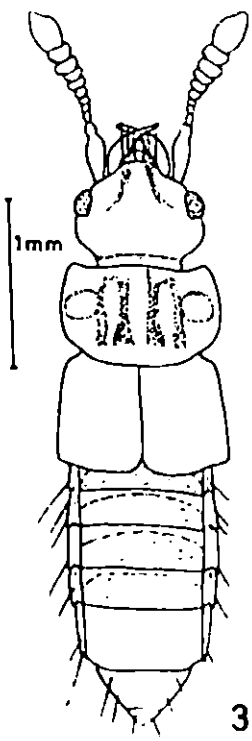

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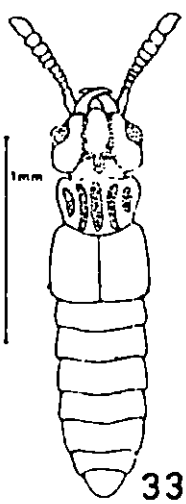

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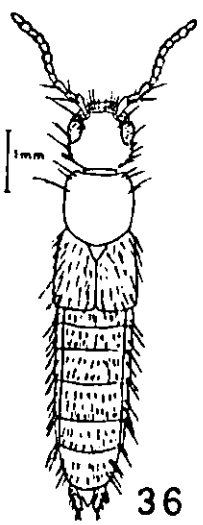

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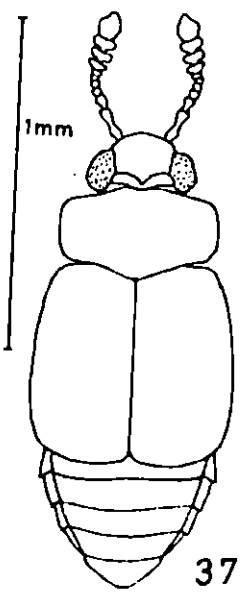

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Explanation of Plate VII

Fig. 38. *Lentacinus notabilis* Cameron

Fig. 39. *Oxytelopsis pseudosagina* Fauvel

Fig. 40. *Scopaeus nitidulus* Motschulsky

Fig. 41. *Thinocharis debilis* Cameron

Fig. 42. *Cordalia vestita* Bohemann

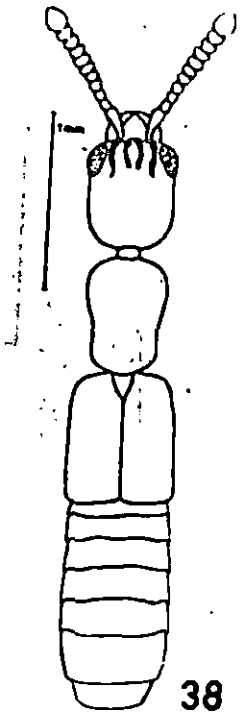
Fig. 43. *Phynatura intermedia* Cameron

Fig. 44. *Mierenlotta* sp.

Fig. 45. *Alaochara castanea* Motschulsky

Fig. 46. *Dinusa helmi* Wasmann

PLATE VII



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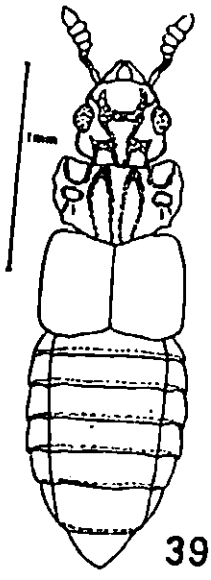

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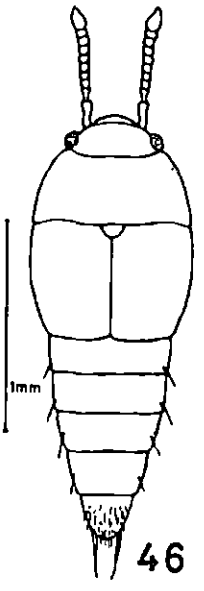

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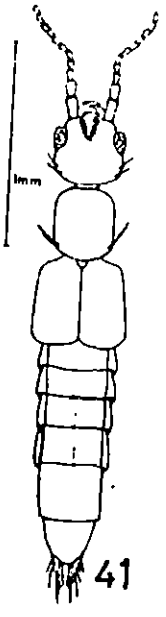

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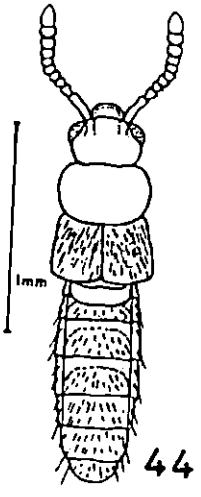

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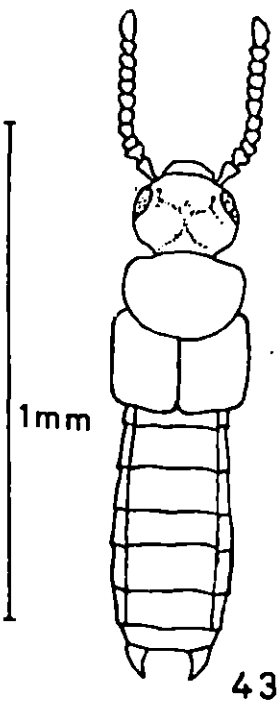

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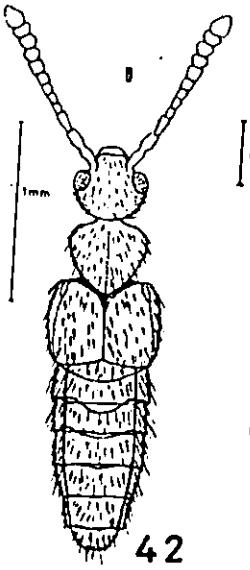

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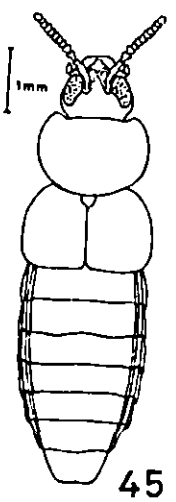

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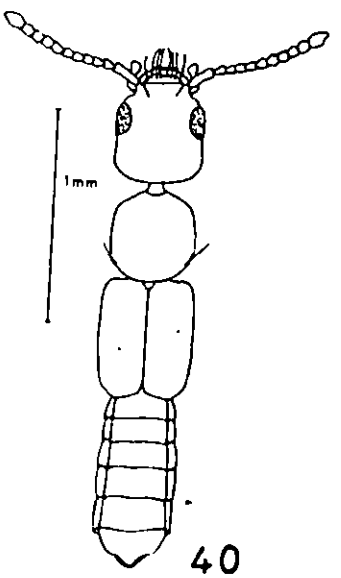

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PLATE VIII

Explanation of Plate VIII

Fig. 47. *Acrotrichis* sp.

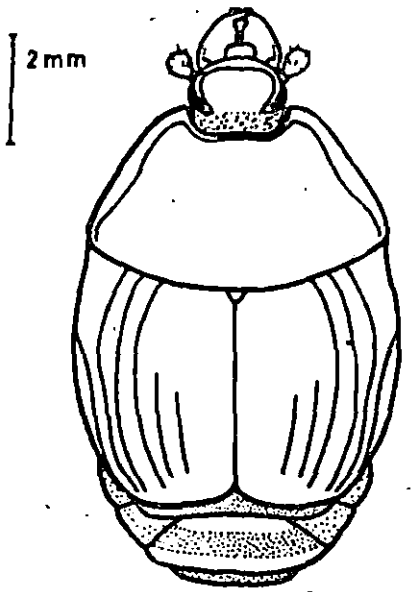
Fig. 48. *Hister luciscus* Lewis

Fig. 49. *Saprinus chalcites* Illiger

Fig. 50. *Saprinus optabilis* Marseul

Fig. 51. *Eurylister sincerus* Lewis

PLATE VIII



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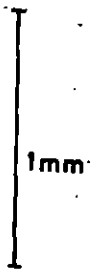

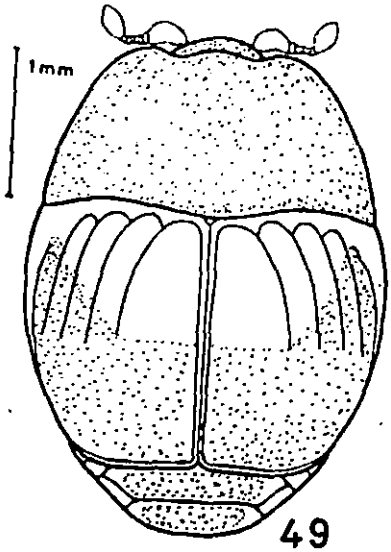

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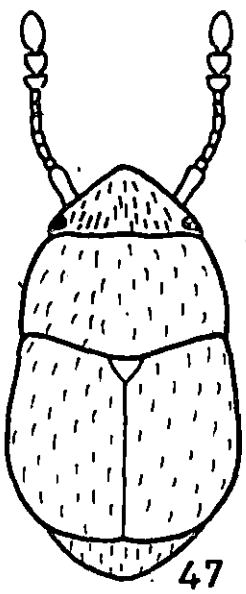

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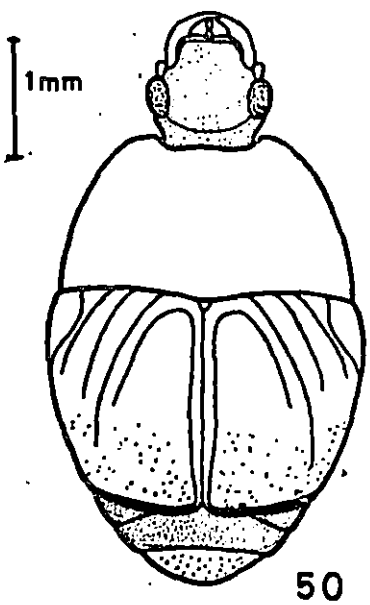

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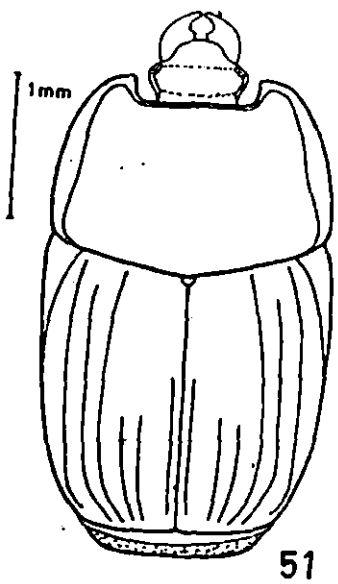

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PLATE IX

Explanation of Plate IX

Fig. 52. *Agonum birmanicum* (Bates)

Fig. 53. *Pharoscaphus* *catoirei* (Dejean)

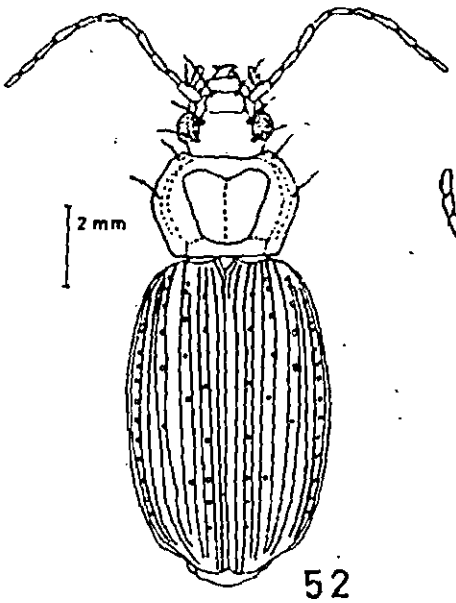
Fig. 54. *Pharoscaphus consularis* (Schmidt-Goebel)

Fig. 55. *Zachys truncatus* (Kietner)

Fig. 56. *Clivina semmonia* Dejean

Fig. 57. *Galerita orientalis* Schmidt-Goebel

PLATE IX



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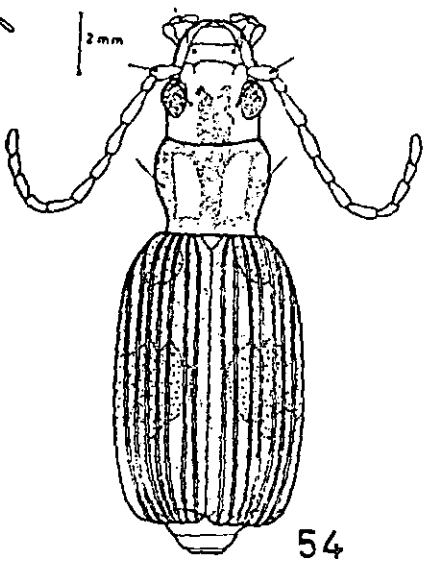

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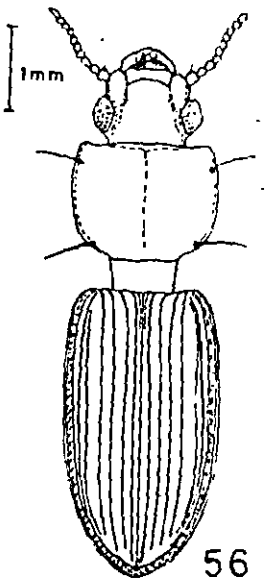

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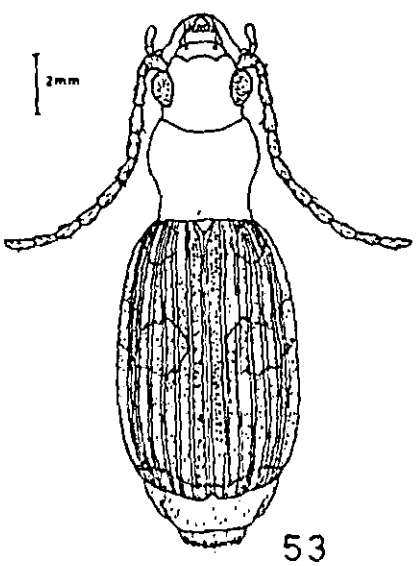

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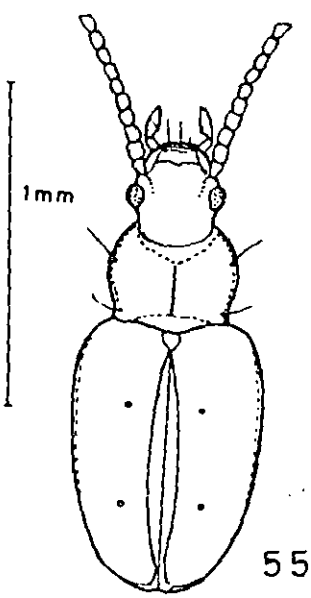

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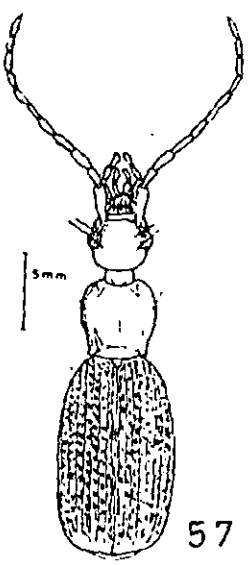

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PLATE X

Explanation of Plate X

Fig. 58. *Chalaenius pictus* Chaudoir

Fig. 59. *Perigona nigriceps* (Dejean)

Fig. 60. *Dyschirius bengalensis* Andrews

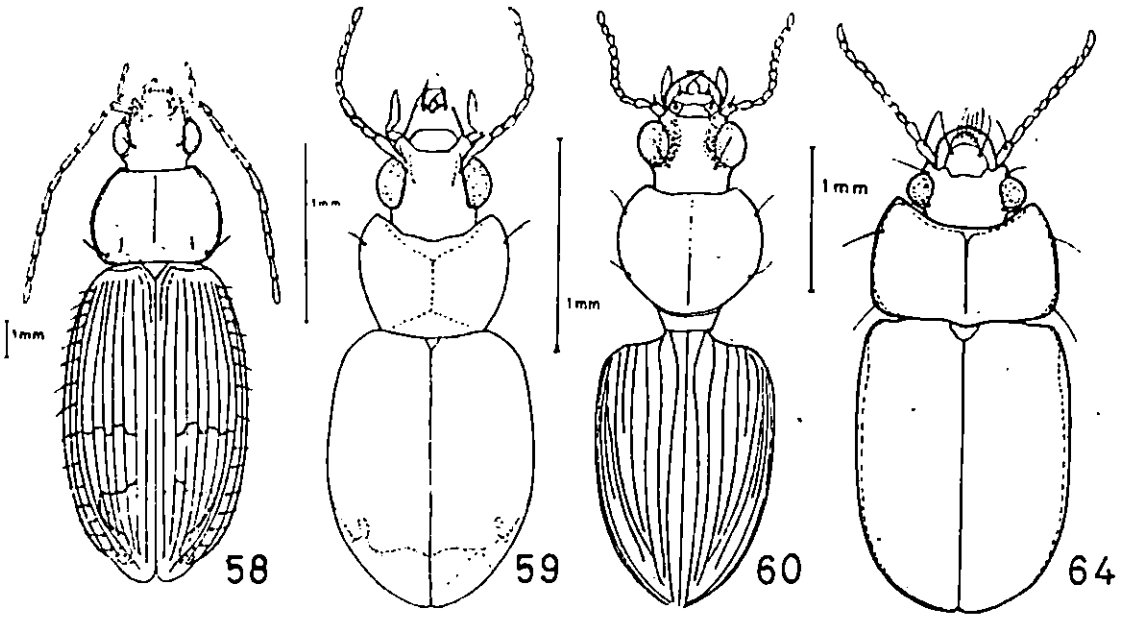
Fig. 61. *Pentagonica tenebrosa* Andrews

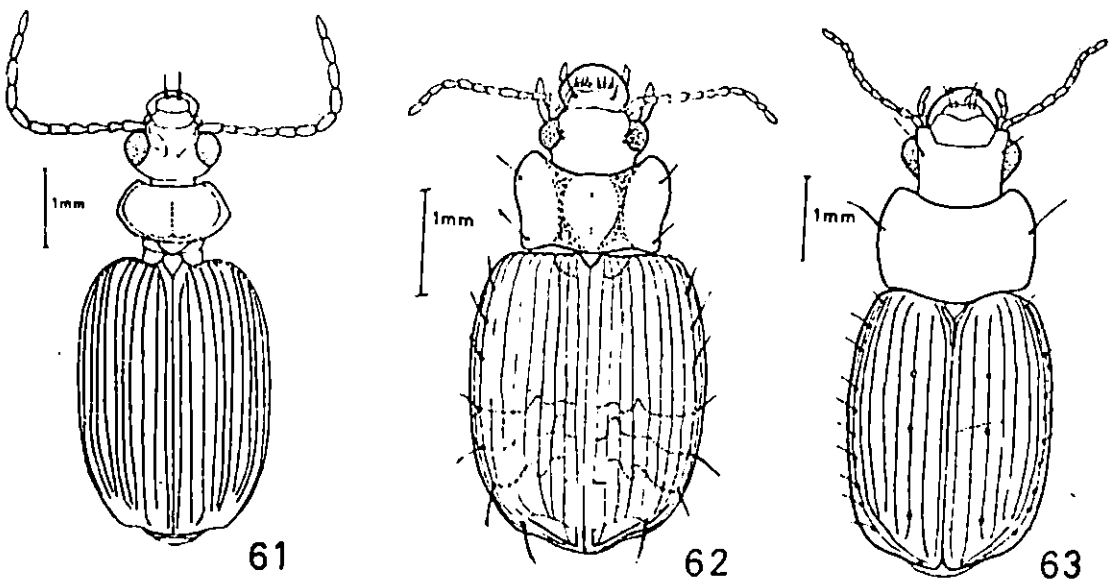
Fig. 62. *Tetragonoderus rombophorus* Schmidt-Goebel

Fig. 63. *Aephnidius adeliodes* (Macleay)

Fig. 64. *Cephora humilis* Schmidt-Goebel

PLATE X





Explanation of Plate XI

Fig. 65. Costernum horni d'orchym

Fig. 66. Cercyon sp. A

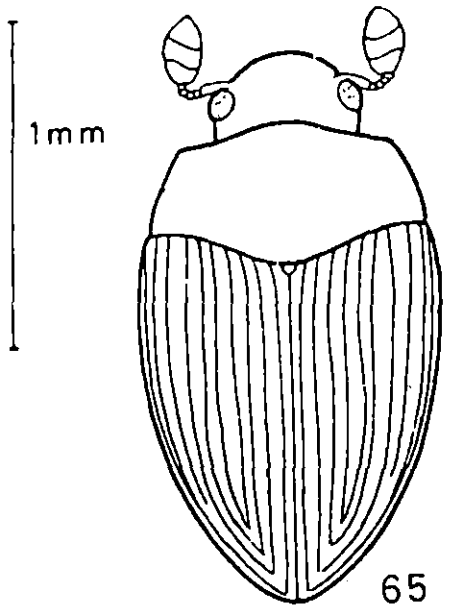
Fig. 67. Cercyon sp. B

Fig. 68. Conocephalum depressum Fabricius

Fig. 69. Trox sp. A

Fig. 70. Trox sp. B

PLATE XI



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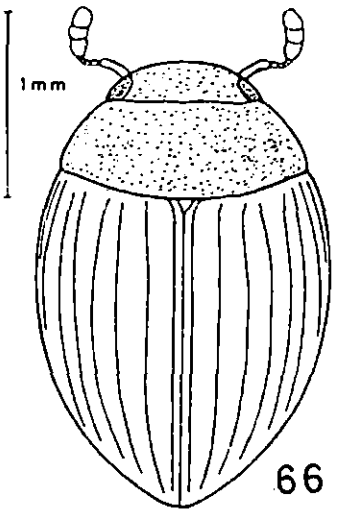

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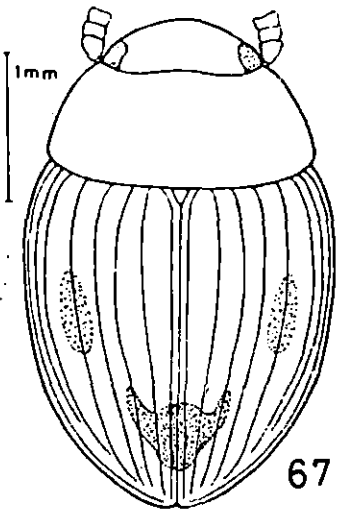

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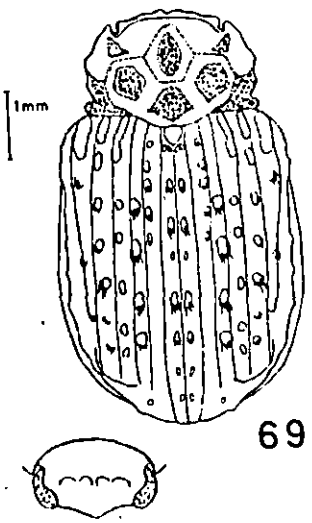

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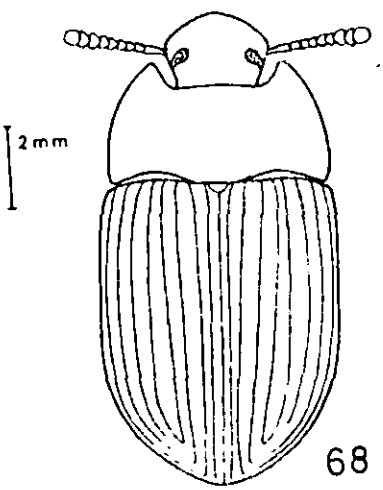

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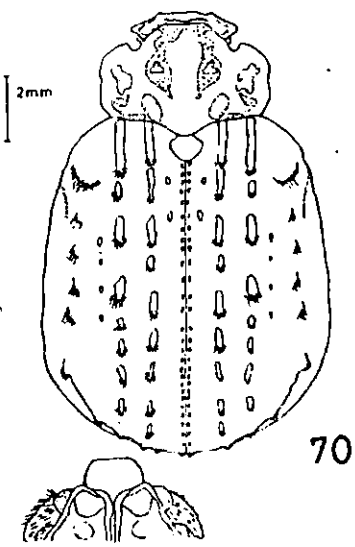

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