

TAXONOMIC STUDIES ON *Indomias* MARSHALL
(CURCULIONIDAE: COLEOPTERA) AND
ITS CLOSELY RELATED GENERA FROM
THE ORIENT

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2000

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ITS CLOSELY RELATED GENERA FROM
THE ORIENT**

by

G. RAVINDRA BABU

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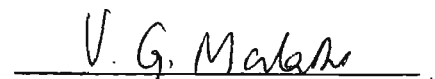
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CERTIFICATE

This is to certify that the thesis entitled "**Taxonomic Studies on *Indomias* Marshall (Curculionidae: Coleoptera) and its closely related genera from the Orient.**" submitted to the Post-Graduate School, Indian Agricultural Research Institute, New Delhi, in partial fulfilment of the requirements for the degree of **Doctor of Philosophy in Entomology**, embodies the results of *bona fide* research work carried out by **Mr. G. RAVINDRA BABU (Roll No. 8155)**, under my guidance and supervision. No part of the thesis has been submitted for any other degree or diploma.

All the assistance and help received during the course of the investigation have been duly acknowledged by him.



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List of abbreviations

The following abbreviations are used for the various museums / insect collections.

- BMNH - The Natural History Museum, London.
- NPC - National Pusa Collection, Division of Entomology, Indian Agricultural Research Institute, New Delhi.
- SMTD - Staatliches Museum für Tierkunde, Dresden.
- NRS - Naturhistoriska Riksmuseet, Swedish Museum of Natural History, Stockholm.
- PU - Punjab University, Chandigarh.
- ZSI - Zoological Survey of India, Calcutta.

1. INTRODUCTION

The superfamily Curculionoidea (weevils) contains a significant proportion all known species of Coleoptera, and includes, as presently understood the largest family of animals, the Curculionidae. (Alonzo-Zarazaga and Lyal, 1999). This family has around 6000 genera and 85000 species (O'Brien and Wibmer, 1978), which according to Thompson (1992) may have to be multiplied rather than augmented in view of the recent estimates. Although the group is large, conspicuous and important, its systematics at almost all levels is chaotic. The problem is still more serious as far as the Oriental fauna of Curculionidae is concerned, because we know hardly 5-10% of their species diversity. It is estimated that India being one of the biodiversity hotspots of the world (Myers *et al.*, 2000), should possess around 5000 genera and about 60000 species of Curculionidae. Among these, the short snout weevils are the major ones and are agriculturally the most important as many of them are defoliators in their adult stage and root feeders in their larval stages.

The subfamily Entiminae is one such group of short snout weevils. This subfamily is characterized by the presence of well developed, deciduous, mandibular processes and gonatoceros male genitalia. Among these, those adelognathous weevils with their scrobes sharply defined even dorsally, and strongly bent downwards in front of eyes or at some distance from the eyes, their mandibles multisetose, prothorax with vibrissae and without any ocular hairs constitute the tribe Brachyderini (Marshall, 1942), which now is the tribe Tanymecini (Alonzo-Zarazaga and Lyal, 1999).

Indomias is one such tanymecine genus characterized by their scrobes being sublinear and always curving at some distance from the

eye, epistome quite undefined, mentum with only two setae; anterior margin of prothorax with conspicuous vibrissae at the sides, elytra shallowly sinuate above the hind coxae, but without a distinct excision to receive the head of the metasternal episternum, mesosternum with epimera narrow, much smaller than episterna, episternal suture of metasternum distinct throughout; hind tibial apex with a well developed outer bevel with two rows of setae and an inner flange; and venter with second ventrite 1.5-2x as long as the third and fourth together.

This genus is entirely tropical and is seen in the Oriental region, namely India and Sri Lanka. So far only 14 species of *Indomias* are recorded and described under this genus, a few of which are pests of agricultural crops like cinchona, coffee, tea, mulberry (Marshall, 1916; Wadhi and Batra, 1964). In spite of its economic importance, no significant attempt has been made on its systematics after Marshall (1916). The latter study encompassed all short snout weevils and thus so far there is no exclusive study devoted to this genus, of which the taxonomy is in shambles. Though some of the confusion in its taxonomy had been clarified by Marshall (1941), there is no concerted effort to catalogue its species, streamline the concept of the genus, establish its monophyletic nature, describe the unknown fauna or evaluate its taxonomic characters. Many taxonomic characters like elytral vestiture and female or male genitalia, had not been explored so far. Its relation with other congeneric relatives namely *Sympiezomias*, *Burmotragus* and *Geotragus* has not been brought out. Hence, the present study, was undertaken with the following objectives:

- a. to make observations on the fauna of *Indomias* and related genera and to prepare a checklist of known species.
- b. to revise the hitherto described species of the genus *Indomias* and to describe the new ones encountered, if any.

- c. to determine the status of this genus vis-a-vis its relatives in the subfamily Entiminae.
- d. to formulate keys and modify the existing ones to facilitate easy identification.
- e. to compare *Indomias* with its closely related genera and to find out the validity of the classification given by Marshall, and
- f. to explore the possibility of using molecular techniques in studying the genus, its species and infraspecific population, wherever necessary.

2. REVIEW OF LITERATURE

2.1 TAXONOMIC POSITION OF *Indomias* Marshall

2.1.1 Suprageneric level

The genus *Indomias* which was originally considered as *Sympiezomias* by Faust (1887) was placed under division Adelognathi (where mentum is comparatively large and filling the buccal cavity behind, thereby concealing the maxillae and their palpi), subfamily Brachyderinae and group Tanymecides by Marshall (1916). Gunther and Zumpt (1933), while cataloguing the erstwhile Tanymecinae included *Sympiezomias*. The five tribes namely Amomphini Reitter, Herpisticini Winkler, Piaziomiini Reitter, Thylacitini Reitter and Tanymecini Reitter were also listed. Of these Piaziomiini of Reitter (1913) comprised of *Sympiezomias*, which includes the present day *Indomias*.

Later Emden (1944), while giving a key to the genera of subfamily Brachyderinae of the world considered *Sympiezomias* under the tribe Tanymecini and subtribe Piaziomiina. Thompson (1992) in his comprehensive review on the major groups of Curculionoidea, based his studies on adult weevil structures and demoted Brachyderinae as a tribe under subfamily Entiminae. This subfamily now comprises of all broad nosed, short snout weevils, possessing well developed, deciduous, mandibular processes and gonatoceros type of male genitalia. Thus, currently *Indomias* is placed under tribe Tanymecini of subfamily Entiminae of family Curculionidae (Alonzo-Zarazaga and Lyal, 1999).

2.1.2 Generic level

The species of the genus *Indomias* were originally included under *Sympiezomias* Faust (1887). Marshall (1916) in his comprehensive studies of the Curculionidae fauna of erstwhile British India retained it

under *Sympiezomias*. Later, Emden (1936) sunk it as a synonym of African *Iphisomus* Gerstaecker. Marshall (1941), while revising the Oriental species of *Sympiezomias* concluded that its species fall under three homogenous groups of generic significance. Thus came in to existence the three genera namely, *Indomias*, *Sympiezomias* and *Burmotragus* Marshall, for the species hitherto known under *Sympiezomias*. This revision was done on the basis of their zoogeographical distribution in the Indian, Indo-Sri Lankan and Myanmar regions. In addition, Marshall (1941) also provided the morphological characters and a key to distinguish them. This study further rejected the synonymy by Emden (1936), as *Sympiezomias* differs from *Iphisomus*, in a well marked epistome and absence of inflated, fore femora.

2.1.3 Genus description

Indomias which had been under *Sympiezomias* was first described by Faust (1887). This description was adopted by Marshall (1916), and the concept of the genus was explained by the following essential characters namely, the episternal suture of metasternum distinct throughout; base of elytra abruptly emarginate; rostrum with a longitudinal impression along the dorsal margin; submentum not pedunculate; mentum with two setae; scrobes sublinear and always curving downwards at some distance from the eye; elytra ovate, narrowly marginate at the base, without true shoulders, but often with a humeral fold or ridge, the lateral margin shallowly sinuate above the hind coxae, but without a distinct excision to receive the head of metasternal episternum; venter with segment 2 equal to or longer than 3+4; the corbels enclosed and slightly ascending the dorsal edge.

This genus differs from its congeneric *Geotragus* Schoenherr, in the following: metasternal episternum distinct only in the basal half

and fusing with metasternum in the posterior region; scutellum invisible; elytra without any humeral callus; venter with segment 2 longer than 3+4 and separated from 1 by a curved suture. Free tarsal claws, distinct humeral callus, aedeagus with median lobe flattened in the apical third with its apex as broad as the shaft and the mesosterna with epimera large differentiate *Indomias* from the other relative *Tanymecus* and it was confirmed by Supare *et al.*, (1990). Emden (1936), while considering the taxonomic details of the genera of Brachyderinae, considered *Sympiezomias* and explained its diagnosis by "Mentum with short peduncle and with 4-6 bristles; corbels enclosed" and synonymized it with *Iphisomus*.

Marshall (1941), while studying the Curculionidae from the erstwhile Burma, not only clarified the synonymy of *Iphisomus* with *Sympiezomias*, but gave a comprehensive review of the Oriental fauna. He concluded that the species so far known under *Sympiezomias* fall under three homogenous groups of generic significance, and distinguished these three genera, namely *Indomias*, *Sympiezomias* and *Burmotragus* on the basis of following characters (Table. 1).

Table.1. Differentiation of *Indomias*, *Sympiezomias* and *Burmotragus*

S.No.	Morphological characters	<i>Indomias</i>	<i>Sympiezomias</i>	<i>Burmotragus</i>
1.	Morphological part i) Scutellum ii) Elytra iii) Epistome iv) Intercostal process v) Suture between ventrite 1 and 2 vi) Morphometrics of ventrite 2/ventrite 3+4	Distinct With a humeral fold Quite undefined Narrower, arcuate or angulate Distinct throughout Much longer than 3+4	Concealed Without a humeral fold Well defined Narrower, arcuate or angulate Distinct throughout Much longer than 3+4 in the middle	Concealed Without a humeral fold Well defined Broader and truncate More or less obliterated in middle Not or only slightly longer than 3 + 4
2.	Zoogeographical distribution	Peninsular India, Sri Lanka	Myanmar, China and Japan	Myanmar

Indomias thus came into existence with the original description, “scutellum distinct; elytra with a humeral fold; hind tibia never denticulate; epistome quite undefined; mentum with only two setae; intercoxal process of venter narrower, arcuate or angulate; suture between ventrites 1 and 2 distinct throughout, ventrite 2 much longer than 3+4”. Further, *Indomias* got distinguished from *Burmotragus* in the characters namely, intercoxal process of venter broader and truncate; suture between ventrites 1 and 2 more or less obliterated in the middle, ventrite 2 not or only slightly longer than 3+4; funicle with the two basal joints equal; with more elongate facies, due to the greater prolongation of the apical area of the elytra”.

Sympiezomias when established had few species of it under *Brachyaspistes*, but it can be distinguished from such related genera, namely *Lepropus* and *Brachyaspistes* in the characters namely, prothorax always with a median furrow, posterior margin of prothorax always bisinuate; elytra with well developed shoulders, lateral notch to receive the head of metasternal episternum, and elytral vestiture with flat scales never ridged. These were later confirmed by Poorani and Ramamurthy (1997) and Ramamurthy *et al.* (1998), in their revisions of these generic groups.

2.1.4 Species of *Indomias*

Among the species of *Sympiezomias*, the earliest known is *velatus* Chevrolat (1845), which was originally described under *Brachyaspistes*. It was later designated as the type species of *Sympiezomias* (Faust, 1887). Boheman described *prasinus*, *perroteti* and *acutipennis* under *Brachyaspistes* which were brought to

Sympiezomias by Schoneherr (1845) and later to the *Indomias* by Marshall (1941). Also, the species *prasinus* was designated as type species of *Indomias* (Marshall, 1941).

The species namely, *velatus* (Chevrolat, 1845), *lewisi* (Roelofs, 1879), *herzi* (Faust, 1887), *basalis* (Aurivillius, 1892), *setosus* (Aurivillius, 1892), *ellipticus* (Faust, 1894), *inflatus* (Faust, 1895), *sulcicollis* (Faust, 1895) and *cretaceus* (Faust, 1897) were the ones to be described in the genus *Sympiezomias* between 1845 - 1897. Of these, *inflatus* and *setosus* are under genus *Geotragus*, and only *cretaceus* falls under *Indomias* (Marshall, 1941).

Fourteen species were described under *Sympiezomias* during the period between 1901 - 1932, of which eleven species namely *anamalainus*, *decipiens*, *frater*, *hispidus*, *lividus*, *metallescens*, *serratipes*, *similis*, *sulphuratus*, *cupreovirens* and *beesoni* are of Sir Guy A. K. Marshall (1916, 1918, 1921), three species namely *cicatricollis*, *consobrinus* and *variabilis* are of Voss (1932), one species each, namely *kraatzi* is of Heller (1901) and *cribricollis* that of Kono (1930).

Gunther and Zumpt (1933), in the *Coleopterum Catalogus pars 131* could catalogue twenty eight species under *Sympiezomias*. Marshall (1941), further described two new species namely *subvirens* and *shanensis* under *Sympiezomias* and three new species, namely *malaisei*, *affinis* and *excisiventris* under the genus *Burmotragus*. Marshall (1941), while revising the genus and splitting it into three genera, namely *Indomias*, *Sympiezomias* and *Burmotragus*; also the species *serratipes* was retained under *Sympiezomias*. He also placed the species namely, *metallescens* and *similis* under *Burmotragus* and *kraatzi*, *anamalainus*, *decipiens*, *frater*, *hispidus*, *lividus* and *beesoni*, under *Indomias*. Thus,

Marshall was the chief contributor to the fauna of *Indomias* and he also described / redescribed the genus. After his monumental work on short snout weevils, there was no further attempt on the systematics of *Indomias*, except for a stray description of *glabrirostris* by Pajni and Gandhi (1988). The contributions of different coleopterists to the species diversity is given in Table.2.

Table.2. Contribution of coleopterists to the species diversity

Contributions	Genera		
	<i>Indomias</i>	<i>Sympiezomias</i>	<i>Burmotragus</i>
By periods			
1845-1897	-	9	-
1901-1932	-	14	-
1941-1988	14	11	5
By Coleopterists			
Faust	1	3	-
Marshall	8	4	5
Chao	-	9	-
Voss	-	3	-
Aurivillius	-	1	-
Kono	-	1	-
Roelofs	-	1	-
Heller	1	-	-
Pajni & Gandhi	1	-	-
Boheman	3	-	-
Chevrolat	-	1	-

2.1.5 Zoogeographical distribution

The genus *Indomias* is entirely Oriental and is known so far from South India, namely Nilgiris, Anamalai hills, Yercaud (Tamil Nadu), Pondicherry, Kerala, Coorg (Karnataka). The genus *Sympiezomias* is distributed in Laos, Thailand, China, Macao, Taiwan, South Africa, Korea, Japan and Hongkong. *Burmotragus* has been recorded from Meghalaya, Bangladesh and Myanmar.

2.1.6 Economic Importance

The following species of *Indomias* and *Sympiezomias* have been reported to be damaging the crops mainly as defoliators and *cretaceus* has been recorded as a vector of sandalwood spike disease.

Table.3. Economic Importance

S.No.	Genus	Species	Locality	Crop	Reference
1.	<i>Indomias</i>	<i>beesoni</i>	Chennai	Teak	Marshall, 1921 Atkinson, 1926
			Kerala	Teak	TVR Ayyar, 1922
2.	<i>I</i>	<i>cretaceus</i>	Nilgiris	Coffee	TVR Ayyar, 1922
			Bangalore	Mulberry	Wadhi and Batra, 1964.
3.	<i>I</i>	<i>cretaceus</i>	Bangalore	Vector of Sandalwood spike disease	Hart and Rengaswamy, 1926; Anonymous, 1932, 1933
			Coimbatore	<i>Rawolfia serpentina</i>	Singh, Pratap, 1964
3b.	<i>I</i>	<i>frater</i>	Nilgiris, Palur, Coorg and Yercaud	Coffee	TVR Ayyar, 1922
4.	<i>I</i>	<i>decipiens</i>	Kukal orange valley, Nilgiris	Cinchona	TVRK Ayyar, 1922
5.	<i>Sympiezomias</i>	<i>lewisi</i>	Fukien province of China	Citrus	Anonymous, 1965
6.	<i>S</i>	<i>lewisi</i>	-	Edible burdock (<i>Arctium</i> sp.)	Tokumaru <i>et al.</i> , 1979

2.1.7 Molecular systematics of Cuticular hydrocarbons

Present knowledge of the hydrocarbon compositions of insect species is highly fragmentary as only a relatively small proportion of species have been investigated. Several of the largest insect orders such as Diptera, Hymenoptera and Coleoptera are represented by only a few examined species while other orders such as Ephemeroptera and Dermaptera are unrepresented.

Notwithstanding this fact, on a practical level hydrocarbon composition has been used to identify species of Orthoptera, Dictyoptera, Isoptera, Hymenoptera and Diptera in addition to Coleoptera. The details of the studies done on these excluding Coleoptera are briefly given in Table 4. Hydrocarbon composition had been proved to be particularly useful in separation of species of insect vectors which are closely related, in some genera and otherwise difficult or impossible to separate.

Table.4. Studies on the cuticular hydrocarbons in insect orders (excluding Coleoptera)

Insect Order	Test Insect	Reference
Orthoptera	Mole cricket	Castner and Nation, 1984; 1986
	Locust (<i>Melanoplus</i>)	Nelson <i>et al.</i> , 1988
	Acridids	Lockey and Oraha, 1990
	Locusts (<i>Locusta</i> , <i>Schistocerca</i>)	Lockey, 1976
	Australian Plague locust	Hooper <i>et al.</i> , 1996
Dictyoptera	Cockroach (<i>Blatella</i>)	Carlson, 1988
	Cockroach (<i>Periplaneta</i>)	Carlson and Brenner, 1988 Augustynowicz <i>et al.</i> , 1987 Brenner <i>et al.</i> , 1993
Phasmida	<i>Diapheromera femorata</i>	Warthen <i>et al.</i> , 1981
Isoptera	<i>Reticulitermes</i>	Haverty <i>et al.</i> , 1996
	<i>Zootermopsis</i>	Howard <i>et al.</i> , 1982
	<i>Drepanotermes</i>	Brown <i>et al.</i> , 1996 a, b
Hemiptera	Milkweed (<i>Oncopeltus</i>)	Lockey and Oraha, 1990 Jackson, 1983
Hymenoptera	Ants (<i>Solenopsis</i>)	Brill <i>et al.</i> , 1985a, b Vander Meer <i>et al.</i> , 1989
	Torymidae	Espelie <i>et al.</i> , 1996 Carlson, 1988 Francis <i>et al.</i> , 1985
	Bees	Lavine and Carlson, 1987 McDaniel <i>et al.</i> , 1984 Carlson and Bolten, 1984
Diptera	Tsetse fly	Carlson, 1988; Nelson <i>et al.</i> , 1988
	Drosophila	Nelson <i>et al.</i> , 1988; Bartelt <i>et al.</i> , 1986
	Tephritid fruit fly	Carlson and Yocom, 1986
	Mosquitoes	Carlson and Service, 1979; 1980 Service, 1983; 1988 Hamilton and Service, 1983 Milligan <i>et al.</i> , 1986 Zhao <i>et al.</i> , 1996
	Black fly	Carlson and Walsh, 1981 Philips <i>et al.</i> , 1985; 1988
	Sand fly	Kamhawi <i>et al.</i> , 1987 Lane, 1988 Philips <i>et al.</i> , 1988; 1989; 1990; Ryan <i>et al.</i> , 1986
		Screworm fly

Such studies conducted in Coleoptera are included in Table 5. These studies had proved that there exists great scope for detailed investigations utilizing GLC and GCMS by which the quantitative and qualitative differences in the cuticular hydrocarbons could be brought out in detail.

Table 5. Cuticular hydrocarbon studies on Coleoptera

Sl. No.	Family	Taxa	Reference
1	Tenebrionidae	22 species representing 10 tribes including 5 sets of congeneric species	Lockey and Metcalfe, 1988
2	Tenebrionidae	<i>Tenebrio molitor</i> and <i>T. obscurus</i>	Lockey, 1978
3	Tenebrionidae	Tribolini <i>Tribolium</i> spp., <i>Palorus</i> , <i>Latheticus</i>	Howard, 1987
4	Tenebrionidae	<i>Stenochora granulipes</i>	Lockey, 1982
5	Dytiscidae	<i>Agabus anthracinus</i>	Alaire <i>et al.</i> , 1998
6	Scolytidae	<i>Ips annulipes montana</i> <i>I. montanus</i> <i>I. amatinus</i>	Stauffer and Zuber, 1988
7	Scolytidae	<i>Ips grandicollis</i>	Page <i>et al.</i> , 1997
8	Bruchidae	<i>Callosobruchus maculatus</i>	Baker and Nelson, 1981
9	Curculionidae	<i>Sitophilus oryzae</i> <i>Lepropus</i> , <i>Brachyaspistes</i> <i>Eleodes</i>	Baker <i>et al.</i> , 1981 Ramamurthy <i>et al.</i> , 1998; Jackson <i>et al.</i> , 1980

The extent to which the hydrocarbon composition reflects the known taxonomy of a group has been demonstrated in many studies of which the studies on the olefins of *Drosophila virilis* group (Bartelt *et al.*, 1988) and methylalkanes of species of adult tenebrionid beetles (Lockey and Metcalfe,

1988) are noteworthy. These studies had confirmed that hydrocarbon composition is species specific, congeneric species tend to have mixtures which are qualitatively and quantitatively dissimilar (Lockey, 1991). These studies had also shown that the interrelationships at generic or tribal level tend to be reflected in the hydrocarbon compositions of species (Lockey and Metcalfe, 1988). Cluster analysis of the hydrocarbons of these species had also shown that the composition is largely consistent with the known phylogeny of the group.

Biochemical investigations by Lockey, Blomquist and coworkers (Lockey, 1976; 1978; 1991) had shown that insects have the potential to synthesize most of their hydrocarbons and in principle it follows that hydrocarbon composition of the lipid layer of epicuticle is a reflection of an insects' genotype and available for taxonomy. Three main hydrocarbon classes have been identified in extracts from insects cuticle and these are n-alkanes, olefins and methyl alkanes. All examined species have mixtures of n-alkanes, the most abundant having odd chain lengths ranging from nC_{23} to nC_{31} (Lockey, 1991). The olefins and methyl alkanes mainly occur as isomeric mixtures, most examined species have 3 methyl alkanes (Nelson *et al.*, 1988). The experimental procedure for obtaining and examining the hydrocarbons usually involves

- a) extraction of lipid from the cuticle with organic solvent.
- b) separation of hydrocarbons by either column chromatography or TLC and,
- c) analysis by GC and identification by combined GCMS (Lockey, 1988).

3. MATERIALS AND METHODS

3.1 MATERIALS

The present study on the genus *Indomias* was based on specimens obtained from following sources.

3.1.1 National Pusa Collection (NPC) of the Division of Entomology, Indian Agricultural Research Institute, New Delhi

The identified and unidentified specimens sorted out from the collections of NPC formed the basic material for this study. These included specimens authentically identified by Sir Guy A.K. Marshall, among which are also included paratypes of some species.

3.1.2 Donations, loans and personal collections

Of the specimens studied some were obtained as donation from Agricultural College and Research Institute, Coimbatore, Tamil Nadu. Many specimens were obtained from Project Directorate on Biological Control (PDBC), Bangalore. Few specimens were obtained on loan from the collections of International Institute of Entomology / Natural History Museum, London. In addition, attempts were made by undertaking field surveys to the tea growing areas of Nilgiris, United Planters Association of Southern India (UPASI), Valparai, in Anamalai ranges of Tamil Nadu, fields of IARI and adjoining areas at Delhi. Few species were also studied at UPASI, Valparai in Tamil Nadu.

3.2 METHODS OF STUDY

3.2.1 Collecting, killing, drying, mounting and preservation

Studies were carried out on preserved specimens after cleaning them with a brush and in case of very old, dirty specimens by swabbing with a cotton swab soaked in glacial acetic acid. Very old and dirty specimens were relaxed in a relaxing box, in a relaxing fluid, containing distilled water and ethyl alcohol in 7:3 ratio, overnight.

3.2.2 Processing of different parts for morphological studies

All taxonomic characters, except the genitalia and ultrastructure of elytral vestiture were studied in intact specimens. For study of genitalia, specimens were processed following the method of Supare *et al.*, (1990) with slight modifications and the process mainly involved following steps:

- i) Relaxing in a relaxing box containing relaxing fluid, overnight.
- ii) Detaching the venter by inserting a minuten pin between metasternum and its intercoxal process with a gentle jerk.
- iii) Boiling in 10% KOH (potassium hydroxide) for 20 minutes at 90-95 °C for softening the tissues.
- iv) Dissecting the genitalia and clearing the associated muscles and other tissues.
- v) Washing the genitalia first with distilled water, then passing through graded alcohol series levels 30%, 50%, 70%, and finally in glacial acetic acid, retaining in each for a minute, to neutralize the excess potassium hydroxide.
- vi) Staining the male genitalia with chlorazol black in 70% ethyl alcohol, then washing it in distilled water to remove excess stain.
- vii) Removing excess stain by transferring to 30% ethyl alcohol.
- viii) Storing the genitalia after study, in microvials containing small drop of glycerol and then pinning on to the respective specimens.
- ix) Replacing the venter on to the dissected specimen.

For studying the elytral vestiture, the method of Ramamurthy and Ghai (1988) was followed which involved scratching of elytra with a pointed end of a minuten pin, the scales and hairs thus removed were allowed to fall on a cavity slide, having a drop of ethyl alcohol mixed with glycerol to avoid instant drying. Glycerol medium in the cavity

slide was gently stirred with a fine needle to avoid overlapping of scales, and then observed for elytral vestiture. The terminology of Howden (1982), Ramamurthy *et al.*, (1992) and Poorani and Ramamurthy (1997) were followed for the description of female and male genitalia.

General taxonomic characters and genitalia were studied with the help of WILD M8 stereozoom microscope and the elytral vestiture studied with LEITZ ORTHOLUX II interference, phase contrast, compound microscope. For taking microphotographs, a wild MPS 45 microphotoautomat was used. Illustrations were made using a drawing tube fitted with a camera lucida. For carrying out various measurements, a NIKON SMZ-10 model stereozoom microscope was used. The scales of magnification are provided on the illustrations.

3.3 CUTICULAR HYDROCARBON ANALYSIS

Cuticular hydrocarbon profiles of the different species were compared by analysing extracts using gas chromatography.

a) Extraction of insect cuticular hydrocarbons

One specimen of each species was taken in a 5 mL test tube, wax free, freshly distilled n-hexane (2 mL) was added to each such tube and left aside for 1, 2, 3, 6, 9, 12 and 24 hours. The experiment was replicated thrice. The extractants were similar in GC at different time intervals, however, six hour extraction was taken as standard because of finer separation of cuticular hydrocarbons in gas chromatogram. The supernatant hexane solution was filtered through Whatman filter (No. 42) (13 dia) discs using Millipore membrane holder. To the filtrate, solvent mixture of AR ethylene glycol + AR acetone (1:10) (2 drops) was added and hexane was purged off using N₂ stream. The concentrated extract was made up to 1 mL with AR n-hexane and the solution labelled as test solution was used further, for gas chromatographic analysis.

b) Gas chromatographic analysis

i) Using standard analytical kit of hydrocarbons

Authentic hydrocarbons, obtained from M/s. Aldrich, USA were utilized as standards. A standard solution of 12000 ppm of n-tridecane in AR n-hexane was prepared by dissolving 60 mg in 5 mL. From this stock solution, dilute solutions of 3000 ppm and 1000 ppm concentrations were derived by appropriate dilution. Similarly standard solutions of other homologues viz., C₂ to C₁₂ were prepared.

ii) Gas chromatographic analysis of extracts of individual species of insects

One µl of test solution was injected and analyzed by gas chromatography using a megabore column (1 mm x 2 mm ID, packed with 3% OV - 17 on 80 - 120 mesh chromsorb Q) in a Hewlett-Packard model 5890 Series II gas chromatograph equipped with on column injector, flame ionization detector (FID) and a Hewlett Packard Model 3380A integrator. The column temperature regime was programmed as follows; initial temperature 80 °C, subsequent rate of increase @ 9.9 °C per minute to final temperature of 260 °C. Kovat's retention indices (KI) were assigned to sample peaks using authentic hydrocarbon standards, C₉-C₁₃ n alkanes procured from Aldrich, USA). KI's were calculated using the formula given by Kovats, 1965.

$$KI = (I_{\theta}^{St ph}) = 100 \times \frac{R_{test} - R_n}{R_{n+1} - R_n} + 100 n$$

where R = Retention time

n = Carbon number of the standard hydrocarbon.

$I_{\theta}^{St ph}$ = Index at a particular stationary phase of the column and temperature programme.

Detector and injector temperatures were maintained at 250 °C. Nitrogen was used as carrier gas at a flow rate of 20 mL/min. A peak that co-eluted with n-tridecane ($C_{13}H_{26}$) was assigned KI value of 1300. The KI values were computed following the method of Kovats (1965) and the cuticular waxes from different species were compared.

4. RESULTS

4.1 GENERAL MORPHOLOGY OF *Indomias* Marshall

4.1.1 General structure, shape and size

Species of *Indomias* are variable in size and shape. In general, they are elongate, more than 2x as long as broad, commonly cylindrical, but sometimes ovate (Fig. 1 & 2). Elytra usually broader than pronotum, but almost equal to that of pronotum in *albizziae* sp.nov. Dorsal surface almost convex, rarely flat or even, and ventral surface always flat. Smallest species are *praeteritus*, *frater*, *decipiens* and *maicykuttyae* sp.nov. (7.1-7.4 x 2.3-2.65 mm), while the largest are *anasuryae* sp.nov., *anamalainus* and *megakraatzi* sp.nov. (10.00-10.91 x 3.13-3.99 mm).

4.1.2 Colour

The colour varies from black to piceous, covered by varying shades of greenish vestiture viz., pale or apple green (*cretaceus*, *albizziae* sp.nov. and *megakraatzi* sp.nov.) or dense green or bluish green (*prasinus*), or metallic green (*frater* and *praeteritus*), while in few species it is grey or bluish grey (*anamalainus*, *beesoni* and *hispidus*) or jet black (*satyanarayanai* sp.nov.) or black with yellow and white stripes (*perroteti*). In few species, inflexed margins of prothorax and elytra are covered with powdery yellow coating (*frater*, *praeteritus* and *prasinus*), while the species like *anamalainus* possesses ochereous yellow stripes on elytral intervals six and seven.

4.1.3 Sexual dimorphism

Genus *Indomias* does not exhibit any striking, sexual dimorphic characters, but the species mentioned below, on careful examination show sexual dimorphism in their pronotum and elytra.

Sexual dimorphic characters in *Indomias*

Character	Description	Diagnosis
1. Pronotum	i. Slightly longer than broad (1.0:0.9)	♂ <i>acutipennis</i>
	ii. Broader than long (1.1:1.0)	♀ <i>acutipennis</i>
	iii. As long as broad	♂ <i>decipiens</i>
	iv. Slightly broader than long (1:0.9)	♀ <i>decipiens</i>
	v. Sides more rounded and narrower in front	♀ <i>lividus</i>
2. Elytra		
a. General shape	i. Narrowly ovate	♂ <i>beesoni</i> ♂ <i>prasinus</i>
	ii. Slightly broader	♀ <i>beesoni</i>
	iii. Broader	♀ <i>prasinus</i>
b. Development of humeral fold	i. Practically absent	♂ <i>praeteritus</i>
	ii. Developed but does not project beyond lateral outline of elytra	♀ <i>praeteritus</i>
	iii. Humeral fold forming a distinctly projecting angle	♀ <i>prasinus</i>
	iv. Humeral fold distinct but does not form a projecting angle	♂ <i>prasinus</i>
c. Apex of elytra	i. Rounded	♂ <i>cretaceus</i>
	ii. Separately pointed but not truly mucronate	♀ <i>cretaceus</i>
	iii. Almost rounded	♂ <i>frater</i>
	iv. Slightly mucronate	♀ <i>frater</i>
	v. With short, apical mucros	♂ <i>anamalainus</i>
	vi. Each apex with a distinct, short mucro	♀ <i>decipiens</i>
	vii. Not mucronate or rounded	♂ <i>lividus</i>
	viii. Scarcely mucronate	♀ <i>lividus</i>

4.1.4 Head:

Morphological features of the head, namely vertex, frons, rostrum, scrobes, eyes and antennae are useful in identification of species (Figs. 3-28).

Vertex: This is the part of the head lying in between the eyes just behind the frons. It is generally convex. The shape and ascension of central furrow of rostrum is helpful in distinguishing species. Ascending up to the middle of eyes (*acutipennis* and *hispidus*), or to slightly beyond the posterior margin of eyes (*anamalainus*) are few such examples. A dumbbell shaped, distinct, short furrow on the vertex, which does not fuse with central furrow of rostrum is present in *hispidus*.

Frons: It is the part of head lying in front of vertex in between the anterior margin of eyes. The surface of frons is normally plane (*cretaceus*, *decipiens*, *prasinus* and *hispidus*) or impressed (*lividus*) or convex (*anamalainus* and *beesoni*). In *mucronatus* sp.nov., the frons has a faint, central stria which merges with central furrow of rostrum (Fig.21). The breadth of frons is compared with breadth of rostrum at anterior margin or with the space between the scrobes and it aids in identifying few species. Frons is broader than the breadth of rostrum at anterior margin in *hispidus* (1.7:1.5), *mayarami* sp.nov. (1.6:1.3), *maicykuttyae* sp.nov. (1.5:1.3) and *yercaudensis* sp.nov. (1.5:1.3) (Figs.5,18,26 and 17) or broader than the space between scrobes in *subdecipiens* sp.nov. (1.5:1.25) and *subkraatzi* sp.nov. (1.6:1.4) or much broader than the space between scrobes in *albizziae* sp.nov. (2.0:1.5), *megakraatzi* sp.nov. (2.2:1.7), *menoni* sp.nov. (1.5:1.1), *anasuryae* sp.nov. (1.8:1.4) and *satinarayanai* sp.nov. (1.7:1.2) (Figs.24, 27, 15, 19, 23, 25 and 22).

Rostrum: It is that part of the head, which is drawn in front of the eyes in the form of a snout. The characteristics of rostrum such as

length: breadth ratio, ratio of breadth at the anterior and posterior margins, sinuation and emargination of the posterior margin, plane of dorsal surface, lateral carinae and central furrow are taxonomically very important in identifying the species (Figs.3-28).

Rostrum is slightly longer than broad at the posterior margin in *satyanarayanai* sp.nov. with length: breadth ratio 1:0.95 or as long as broad (*acutipennis*, *anamalainus*, *decipiens*, *praeteritus*, *lividus*, *subacutipennis* sp.nov., *marshalli* sp.nov., *mucronatus* sp.nov., *ramakrishnani* sp.nov., *menoni* sp.nov., *subdecipiens* sp.nov., *anasuryae* sp.nov. and *yercaudensis* sp.nov. or slightly broader than long (*cretaceus*, *frater*, *beesoni*, *hispidus*, *prasinus*, *albizziae* sp.nov., *megakraatzi* sp.nov. and *subkraatzi* sp.nov.) with length: breadth ratios between 1:1.11 to 1:1.25. In almost all the species, the rostrum is narrowed from the posterior to anterior margin, but it is uniformly broad throughout its length in female of *subdecipiens* sp.nov..

Length of rostrum is many times compared with the length of head and it may be equal to length of head (*anamalainus*, *cretaceus*, *frater*, *praeteritus*, *prasinus*, *subacutipennis* sp.nov., *albizziae* sp.nov., *megakraatzi* sp.nov., *mucronatus* sp.nov., *ramakrishnani* sp.nov., *menoni* sp.nov., *subdecipiens* sp.nov., *mayarami* sp.nov., *yercaudensis* sp.nov. and *subkraatzi* sp.nov. or it may be shorter than the length of head (*hispidus*, *lividus*, and *maicykuttyae* sp.nov.) with ratios between 1:1.05 to 1:1.1 or it may be slightly longer than the length of head (*beesoni*, *marshalli* sp.nov., and *satyanarayanai* sp.nov.) with ratios between 1.1:1 to 1:0.8. Sides of rostrum may be straight from posterior to anterior margin (*anamalainus*, *beesoni*, *subacutipennis* sp.nov., *megakraatzi* sp.nov., *mucronatus* sp.nov., *ramakrishnani* sp.nov., *anasuryae* sp.nov. and *yercaudensis* sp.nov.) or slightly narrowed from posterior to anterior margin (*praeteritus*, *marshalli* sp.nov.,

satyanarayanai sp.nov., *menoni* sp.nov. and *maicykuttyae* sp.nov.) or strongly narrowed from posterior to anterior margin (*albizziae* sp.nov.). The anterior margin is many times normal, without any dilation, except in species namely, *subdecepiens* sp.nov. and *maicykuttyae* sp.nov.. Posterior emargination is generally shallow and obtuse (*cretaceus*, *anamalainus*, *satyanarayanai* sp.nov. and *subdecepiens* sp.nov.), but it is deep and acute in *acutipennis* and flat in *frater* and *yercaudensis* sp.nov.

The dorsal surface of rostrum may be plane above (*cretaceus*, *frater*, *perroteti* and *yercaudensis* sp.nov.) or shallowly impressed (*acutipennis*, *anamalainus* and *beesoni*) or deeply impressed (*prasinus*, *lividus* and *megakraatzi* sp.nov.) or the entire rostrum may be coarsely punctate (*acutipennis*, *subacutipennis* sp.nov. and *ramakrishnani* sp.nov.). The central furrow of the rostrum is well developed and usually occupies the posterior two thirds, except in *frater* and *praeteritus*, where it is short and pushed towards the anterior margin of rostrum. In species namely, *cretaceus*, *decepiens*, *acutipennis*, *anamalainus*, *beesoni*, *hispidus*, *lividus*, *subacutipennis* sp.nov., and *subdecepiens* sp.nov., it is well developed and distinct. It is small, fork shaped and restricted to the anterior margin in *prasinus*, oval shaped in *satyanarayanai* sp.nov., and club shaped in *decepiens*, *acutipennis* and *mucronatus* sp.nov.

Rostrum is bound on the lateral sides by a pair of carinae in many species, (*menoni* sp.nov., *subdecepiens* sp.nov. and *anasuryae* sp.nov.), or these become parallel towards the anterior margin (*anamalainus*). These may extend beyond the anterior margin of eyes, at least to a distance of upto 0.25x, the length of eye (*subkraatzi* sp.nov.) or does not extend beyond the anterior margin of eyes (*megakraatzi* sp.nov.).

Scrobes: These are well marked, deep, furrows, receiving elongate scape of antennae and are always lateral, and sublinear (Figs.29-54). These

may become divergent (*albizziae* sp.nov., *megakraatzi* sp.nov., *menoni* sp.nov., *subdeciens* sp.nov. and *maicykuttyae* sp.nov.) or convergent (*marshalli* sp.nov. and *anasuryae* sp.nov.) or parallel towards the eyes (*beesoni*, *deciens*, *praeteritus* and *mucronatus* sp.nov.). These may be uniformly broad throughout (*deciens*, *frater*, *lividus*, *subacutipennis* sp.nov., *albizziae* sp.nov. and *megakraatzi* sp.nov.) or of varying breadths (*maicykuttyae* sp.nov. and *subkraatzi* sp.nov.).

Eyes: Eyes may be located dorsally (*beesoni*, *prasinus*) with the ratio of the breadth of rostrum at posterior margin with the distance between the eyes at middle being 1:1.2 or dorsolateral (*cretaceus*, *acutipennis*, *anamalainus*, *praeteritus*, *lividus*, *marshalli* sp.nov., *menoni* sp.nov. and *hispidus*) with this ratio being 1.0:1.1 or lateral (*deciens* and *frater*) with the ratio being between 1:1 and 0.9:1. The size and shape of eyes also vary. These may be oval and moderately convex (*cretaceus*), rounded and moderately convex (*deciens* and *subdeciens* sp.nov.), slightly convex (*subkraatzi* sp.nov.) or conical (*yercaudensis* sp.nov.). In general, the eyes are convex as in species namely, *acutipennis*, *anamalainus*, *beesoni*, *albizziae* sp.nov., *megakraatzi* sp.nov., *marshalli* sp.nov., *ramakrishnani* sp.nov., *satyanarayanai* sp.nov. and *subdeciens* sp.nov. rarely concave as in *frater*, *subacutipennis* sp.nov. and *yercaudensis* sp.nov. and much convex as in *anamalainus* (Fig.12).

Antennae: Antennae in *Indomias* are geniculate and consist of a scape, a seven segmented funicle and a four segmented club (Figs.256-280). The characters of antennae utilized for distinguishing some species of *Indomias* are its colour, relative thickness of the scape, length and breadth of first two funicle segments, their shape and the hairiness of club.

Colour varies from dark brown (*deciens* and *frater*) to reddish brown (*cretaceus* and *lividus*) to piceous (*anamalainus*, *beesoni* and

marshalli sp.nov., *subdecipiens* sp.nov., *anasuryae* sp.nov. and *maicykuttyae* sp.nov.) or abruptly clavate (*anamalainus*, *mucronatus* sp.nov. and *ramakrishnani* sp.nov.) or gradually clavate (*lividus* and *megakraatzi* sp.nov.). Sometimes it is extremely slender (*hispidus* and *albizziae* sp.nov.).

The relative length of first and second segments of funicle is many times utilized the ratio of their relative lengths may be 1.1:1 in *decipiens*, *anamalainus*, *prasinus*, *mucronatus* sp.nov. and *menoni* sp.nov., or 1.2 : 1 as in *albizziae* sp.nov. and *satyanarayanai* sp.nov., or 1.5 : 1 as in *megakraatzi* sp.nov., *marshalli* sp.nov., and *ramakrishnani* sp.nov.) or 1 : 1.1 as in *acutipennis*, *beesoni*, *hispidus* and *lividus*. Shape of club is either bulbous (*prasinus*) or transverse (*ramakrishnani* sp.nov.) or cylindrical (*mayarami* sp.nov.) or conical (*yercaudensis* sp.nov.) or peculiarly shaped as in *subkraatzi* sp.nov., where its segments are telescoped and narrowed from base to apex.

Entire antennae may be sparsely hairy (*acutipennis* and *beesoni*) or scape alone is glabrous (*hispidus*) or only the last two i.e., third and fourth segments of club are hairy (*frater*) or middle of first funicle segment with whorl of hairs and club densely hairy throughout its length (*lividus*).

4.1.5. Prothorax

The general shape, length: breadth ratio, margins, ornamentation, presence or absence of stria, and colour of the inflexed margins are the characters useful for the diagnosis of species.

Prothorax is either slightly broader than long (*cretaceus*, ♀ *decipiens*, *anamalainus*, *beesoni*, *mucronatus* sp.nov. and *hispidus*) with the length: breadth ratio of 0.9 : 1 or broader than long (♀ *acutipennis*, *albizziae* sp.nov., *megakraatzi* sp.nov., *marshalli* sp.nov., and *prasinus*) with a ratio between 0.7 and 0.8:1 or as long as broad (♂ *decipiens*, *frater*, *lividus*, *satyanarayanai* sp.nov. and *menoni* sp.nov.)

or slightly longer than broad (*♂ acutipennis*) with a ratio of 1.1 : 1 or much broader than long (*anasuryae* sp.nov.) with a ratio of 1.2 : 1.

Sides of prothorax are either strongly rounded (*cretaceus, frater, praeteritus, lividus* and *mucronatus* sp.nov.) or smoothly rounded (*anamalainus, acutipennis* and *beesoni*) or rounded in front and constricted behind (*decipiens, hispidus* and *albizziae* sp.nov.) or very slightly rounded and broadly constricted in the front (*perroteti*); in some species prothorax is subcylindrical with sides almost straight (*albizziae* sp.nov.). Anterior of margin is either truncate dorsally (*cretaceus, megakraatzi* sp.nov., *marshalli* sp.nov., and *mucronatus* sp.nov.) or rounded (*anamalainus, satyanarayanai* sp.nov., *menoni* sp.nov. and *subdecipiens* sp.nov.). Angle formed laterally by this margin varies from vertical (*hispidus* and *prasinus*) to oblique (*beesoni*) to acute (*praeteritus, subacutipennis* sp.nov., and *satyanarayanai* sp.nov.). Posterior margin is either subtruncate (*cretaceus* and *decipiens*) or truncate (*frater, acutipennis* and *beesoni*) or basal lobe slightly emarginate (*ramakrishnani* sp.nov.). Generally, prothorax is broadest at about middle, but in *acutipennis*, it is broadest a little distance away from the middle and towards anterior margin.

Ornamentation and colour: Surface of prothorax is sometimes with shallow, confluent punctations (*frater, acutipennis, prasinus* and *lividus*) or with coarse, confluent punctations (*cretaceus, anamalainus* and *beesoni*) or finely coriaceous (*perroteti*) or with pits on the lateral sides due to impression (*lividus*). A faint central stria on the prothorax is seen in *prasinus, praeteritus* and *perroteti*, this stria becomes deep and zigzag in *lividus* and straight in *albizziae* sp.nov. Inflexed margins of prothorax are yellowish in *frater* and *praeteritus*.

4.1.6. Elytra

All species of *Indomias* have their elytral margins at base slightly or strongly elevated, without true shoulders but with a humeral fold.

The lateral margin is shallowly sinuate above hind coxae, but without a distinct excision to receive the head of metasternal episternum. The shape and colour, vestiture, slope or curvature from basal margin to the posterior declivity, development of humeral fold, condition of apices, especially the mucronate nature are the characters that help in identification of species.

Shape and colour: Elytra are elongate or broadly or narrowly ovate. Basal margin of elytra either very slightly raised and its external angle obtuse (*lividus*) or it is strongly raised, with the external angle of 90° or less (*cretaceus* and *decipiens*). Elytra are either well rounded at the sides (*anamalainus*), or narrowly ovate (♂ *beelsoni* and ♂ *prasinus*) or broader (♀ *beelsoni*, ♀ *prasinus*) or more elongate (*praeteritus*). Their apices are either sharply (*acutipennis*, *prasinus* and *perroteti*) or not mucronate (*beelsoni*, *cretaceus* and *lividus*).

Longitudinal curvature of elytra is much convex, deepest near the middle and gradually sloping behind (*cretaceus*), or gradually sloping behind with short, erect, elongate scales on its apical half (*hispidus*) or longitudinal curvature less convex, deepest near base, then gradually sloping backwards and becoming abruptly steeper behind (*decipiens*) or steeply narrowed from base to the posterior declivity (*subacutipennis* sp. nov.).

Ratio of length of elytra from the basal margin to the posterior declivity and posterior declivity to the apex is a valuable character for distinguishing *cretaceus* and *decipiens*, which is 0.9:1 in *cretaceus* and 4:1 in *decipiens*. Elytra are either with a yellow, powdery patch at the base and apex of intervals four and five (*frater*) or with ochreous yellow stripe on the intervals six and seven (*anamalainus*) or with a broad, yellow stripe along the extreme edge, but ceasing before apex, and a similar stripe on intervals five and six, encroaching a little on four and

seven at the base, and a narrower white stripe along the suture from the base to the declivity (*perroteti*).

Stria and intervals: Elytra are either finely (*frater*, *acutipennis*, *prasinus*) or deeply punctatostriate (*cretaceus*, *beesoni* and *lividus*). An ochreous stripe on the intervals six and seven extending inwards at the base is seen in *anamalainus*. Second and third intervals are 2x as broad as the one and five (*decipiens*) or interval three not higher than two, on declivity (*frater*) or intervals three and five 1.33 x as broad as others (*lividus*) or three and four not broader than the others (*yercaudensis* sp.nov.). The surface of intervals are either even and almost plane (*frater* and *prasinus*) or slightly convex (*cretaceus*, *beesoni*, *decipiens* and *perroteti*) or much convex (*acutipennis*).

Development of humeral fold: Humeral fold of elytra either forms a distinctly projecting angle (♀ *prasinus*) or not (*praeteritus*) or it is slight and not form a prominent tubercle (*perroteti*).

Vestiture: General colour of vestiture varies from pale to metallic or bluish green in many species, while some have it brown (*acutipennis*) or greyish brown (*anamalainus*) or piceous (*lividus*) or black (*satyanarayanai* sp.nov. and *perroteti*). The elytral vestiture in general comprises of two types of scales, the predominant flat, ovate or circular, broad and large, and the less predominant more elongate, with four to five ridges running throughout their length. The shape and structure of these scales vary in different species. The colour of these scales differ from their *in situ* colour, when their structure is observed under light microscope; after removal, the colour of flat, oval or circular scales varies from reddish to reddish brown and pink to yellowish orange with brown and greenish tinge. The more elongate scales are generally brown to brownish yellow to orange coloured, with inner core opaque and granulated. In *frater*, the flat and in *mayarami* sp.nov., the elongate scales have a small pedicel at their base.

4.1.7. Abdomen

In the dorsal aspect, it has seven tergites, but of no taxonomic value as these are covered by elytra. Ventral aspect of abdomen is called "venter" which has five visible ventrites which are morphologically sternites 3-7, sternites one and two being absorbed or pushed into hind coxal cavity. First two ventrites are greatly enlarged and occupy two thirds of the whole venter and are divided by a distinct, curved suture. Second ventrite is always 1.5-2x as long as the third and fourth together.

4.1.8. Female genitalia

These are species specific and valuable in identifying the species. It includes spermatheca (Figs.97-108) and spiculum ventrale (Figs.81-96). Spermatheca has a proximal arm and a distal arm i.e., cornu. Junction of spermathecal duct with body of spermatheca is nodulus while the junction of the gland with spermatheca is ramus. Characters like curvature of nodulus and the relative thickness of ramus over nodulus, angle between proximal and distal arm, and apex of spicule are valuable in distinguishing species.

4.1.9. Male genitalia

It consists of aedeagus or male genital tube and spiculum gastrale. The aedeagus has a median lobe or penis and tegmen (Figs.136-137). The parts of median lobe like apophyses, transfer apparatus, ratio of relative lengths of apophyses and aedeagus, length: breadth ratio of aedeagus are important taxonomic characters. In tegmen, the length and shape of parameres, relative thickness of basal and dorsal piece, and length and apex of manubrium are useful. Spiculum gastrale has an elongate, slender or thick shaft and two basal prongs. Relative thickness of shaft, shape of apex, and the shape of prongs are the important characters in identification of a species.

4.2 CHECKLIST OF SPECIES OF *Indomias*,
Burmotragus and *Sympiezomias*

A. Genus *Indomias* Marshall

Piazomias Lacordaire (in part), 1863:90; Marshall, 1916:159

Sympiezomias Faust, 1887:5; Marshall, 1941:350

Type species :

Indomias prasinus (Boheman, 1845:416); Marshall, 1916:159
by designation Marshall, 1941:350.

- | | | |
|-----|---|-------|
| 1. | <i>acutipennis</i> (Boheman)
<i>Brachyaspistes acutipennis</i> Boheman, 1845:415;
Marshall, 1916:166

<i>Sympiezomias acutipennis</i> (Boheman) Marshall,
1916:166; 1941:350 [NRS] | India |
| 2. | <i>albizziae</i> sp. nov. [NPC] | India |
| 3. | <i>anamalainus</i> (Marshall)
<i>Sympiezomias anamalainus</i> Marshall,
1916:168; 1941:350 [BMNH] | India |
| 4. | <i>anasuryae</i> sp. nov. [NPC] | India |
| 5. | <i>beesoni</i> (Marshall)
<i>Sympiezomias beesoni</i> Marshall, 1921:165;
1941:350 [BMNH] | India |
| 6. | <i>cretaceus</i> (Faust)
<i>Sympiezomias cretaceus</i> Faust, 1897:340;
Marshall, 1916:167; 1941:350 [SMTD] | India |
| 7. | <i>decipiens</i> (Marshall)
<i>Sympiezomias decipiens</i> Marshall, 1916:167;
1941:350 [BMNH] | India |
| 8. | <i>frater</i> (Marshall)
<i>Sympiezomias frater</i> Marshall, 1916:164;
1941:350 [BMNH] | India |
| 9. | <i>glabrirostris</i> Pajni and Gandhi, 1988:173 [PU] | India |
| 10. | <i>hispidus</i> (Marshall)
<i>Sympiezomias hispidus</i> Marshall, 1916:166;
1941:350 [ZSI] | India |

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| 11. <i>kraatzi</i> (Heller)
<i>Sympiezomias kraatzi</i> Heller, 1901:340;
Marshall, 1916:169; 1941:350 | Sri Lanka |
| 12. <i>lividus</i> (Marshall)
<i>Sympiezomias lividus</i> Marshall, 1916:166;
1941:350 [BMNH] | India |
| 13. <i>maicykuttyae</i> sp.nov [NPC] | India |
| 14. <i>marshalli</i> sp.nov. [NPC] | India |
| 15. <i>mayarami</i> sp.nov. [NPC] | India |
| 16. <i>megakraatzi</i> sp.nov [NPC] | India |
| 17. <i>menoni</i> sp.nov. [NPC] | India |
| 18. <i>mucronatus</i> sp.nov [NPC] | India |
| 19. <i>perroteti</i> (Boheman)
<i>Brachyaspistes perroteti</i> Boheman, 1845:416.
<i>Sympiezomias perroteti</i> (Boheman) Marshall,
1916:164; 1941: 350 [NRS] | India |
| 20. <i>praeteritus</i> (Marshall)
<i>Sympiezomias praeteritus</i> Marshall, 1916:164;
1941: 350 [BMNH] | India |
| 21. <i>prasinus</i> (Boheman)
<i>Brachyaspistes prasinus</i> Boheman, 1845:416.
<i>Sympiezomias prasinus</i> (Boheman) Marshall,
1916:162; 1941:350 [NRS]
<i>prasinus</i> var. <i>subcostatus</i> (Marshall) | India |
| 22. <i>ramakrishnani</i> sp.nov. [NPC] | India |
| 23. <i>satyanarayanai</i> sp.nov. [NPC] | India |
| 24. <i>subacutipennis</i> sp.nov. [NPC] | India |
| 25. <i>subdecepiens</i> sp.nov. [NPC] | India |
| 26. <i>subkraatzi</i> sp.nov [NPC] | India |
| 27. <i>sulphuratus</i> (Marshall)
<i>Sympiezomias sulphuratus</i> Marshall 1916:168;
1941:350 [BMNH] | India |
| 28. <i>yercaudensis</i> sp.nov. [NPC] | India |

B. Genus *Burmotragus* Marshall

Piazomias Lacordaire 1863:90 (in part); Marshall, 1916:159.

Sympiezomias Faust, 1887:5; Marshall, 1916:159; 1941:351.

Type species :

Sympiezomias metallescens Marshall, 1916:170; by designation Marshall, 1941:351.

- | | |
|--|-------------------|
| 1. <i>affinis</i> Marshall, 1941:352 [NRS] | Myanmar |
| 2. <i>excisiventris</i> Marshall, 1941:352 [NRS] | Myanmar |
| 3. <i>malaisei</i> Marshall, 1941:351 [NRS] | Myanmar |
| 4. <i>metallescens</i> (Marshall)
<i>Sympiezomias metallescens</i> Marshall, 1916:170;
1941:351 [BMNH] | Myanmar |
| 5. <i>similis</i> (Marshall)
<i>Sympiezomias similis</i> Marshall, 1916:171;
1941:351 [BMNH] | India:
Manipur |

C. Genus *Sympiezomias* Faust

Piazomias Lacordaire, 1863:90 (in part); Marshall, 1916:159.

Sympiezomias Faust, 1887:5; Marshall, 1916:159; 1941:350.

Type species:

Brachyaspistes velatus (Chevrolat) by designation Faust, 1887:5

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|---|-------------------|
| 1. <i>basalis</i> Aurivillius, 1891:207 | Laos,
Thailand |
| 2. <i>chenggongensis</i> Chao, 1977:226 | China |
| 3. <i>cicatricollis</i> Voss, 1932:63 | China |
| 4. <i>citri</i> Chao, 1977:225 | China |
| 5. <i>clarus</i> Chao, 1977:224 | China |
| 6. <i>cribricollis</i> Kono, 1930:189 | Taiwan |
| 7. <i>consobrinus</i> Voss, 1932:63 | China |

- | | |
|---|-------------------------------|
| 8. <i>cupreovirens</i> Marshall, 1918:1 [BMNH] | S. Africa |
| 9. <i>ellipticus</i> Faust, 1894:172 | Myanmar |
| 10. <i>elongatus</i> Chao, 1977:224 | China |
| 11. <i>guangxiensis</i> Chao, 1977:225 | China |
| 12. <i>herzi</i> Faust, 1887:30 [SMTD] | China, Korea |
| 13. <i>lewisi</i> Roelofs, 1879:53;
Gunther and Zumpt, 1933:20. | Japan, China |
| 14. <i>menglongensis</i> Chao, 1977:225 | China |
| 15. <i>menzhehensis</i> Chao, 1977:224 | China |
| 16. <i>serratipes</i> Marshall, 1916:169 [BMNH] | Myanmar |
| 17. <i>shanensis</i> Marshall, 1941:349 [NRS] | Myanmar |
| 18. <i>shanghaiensis</i> Chao, 1977:226 | China |
| 19. <i>subserratipes</i> sp.nov. [NPC] | India:
Himachal
Pradesh |
| 20. <i>subvirens</i> Marshall, 1941:348 [NRS] | Myanmar |
| 21. <i>sulcicollis</i> Faust, 1895:172 | Africa |
| 22. <i>unicolor</i> Chao, 1977:224 | China |
| 23. <i>variabilis</i> Voss, 1932:62 | China |
| 24. <i>velatus</i> (Chevrolat)
<i>Brachyaspistes velatus</i> Chevrolat, 1845:98;
Faust, 1887:5. | China |

4.3 TAXONOMIC STUDIES ON THE GENUS *Indomias*

The present study on the genus *Indomias* includes 25 species and one species from *Sympiezomias*. During the course of present study, many specimens including paratypes of Sir Guy A.K. Marshall were examined for their classificatory taxonomic characters. All species known from India, except *kraatzi*, *glabrirostris* and *sulphuratus* are included. Fourteen new species, namely, *albizziae* sp.nov., *anasuryae* sp.nov., *maicykuttyae* sp.nov., *marshalli* sp.nov., *mayarami* sp.nov., *megakraatzi* sp.nov., *menoni* sp.nov., *mucronatus* sp.nov., *ramakrishnani* sp.nov., *satyanarayanai* sp.nov., *subacutipennis* sp.nov., *subdecipiens* sp.nov., *subkraatzi* sp.nov., and *yercaudensis* sp.nov., are discovered and described. A diagnostic key supplemented with new characters, namely female and male genitalia and elytral vestiture has been developed. The generic characters of *Indomias* and its type species *I. prasinus* are redefined and redescribed. Descriptions of all species have been supplemented with morphometric ratios and details of genitalia and elytral vestiture. Additional details such as host range, economic importance and distribution are given. All the taxonomic characters have been suitably illustrated.

***Indomias* Marshall**

Gender: Masculine

Type species: *Indomias prasinus* (Boheman, 1845) by designation Marshall, 1941:350.

General description: GENERAL COLOUR varies from black to piceous, covered by varying shades of greenish vestiture viz., pale to dense or metallic green to grey or blue grey, with stripes or patches of yellowish vestiture. HEAD with the eyes dorsal, lateral or dorsolateral, varying in size and curvature. ROSTRUM longer than the head but in few species shorter, shallowly or deeply emarginate at the apex, plane

in few species, always with a central furrow, and also a lateral furrow bordered on each side by a carina; scrobes sublinear and always curving downwards at some distance from the eye; mandibles with a very conspicuous projecting scar, mandibular processes deciduous, epistome quite undefined, mentum with only two setae. ANTENNAE with the scape hardly exceeding the middle of the eye, cylindrical, slender at the base, either gradually or abruptly clavate and curving slightly forwards when erect; funicle with two basal joints more elongate and subequal, equal in few species, segments three to six subequal and generally bead like, seventh longer, broader and subconical, club conical and distinctly four jointed. PROTHORAX truncate at the anterior margin, posterior margin truncate or subtruncate, narrowly elevated in few species, the sides rounded, anterior margin narrower than posterior margin, anterior margin with conspicuous vibrissae at the sides, the gular margin narrowly sinuate. PROSTERNUM with front coxae either separated or contiguous and always nearer to its anterior margin; mesosternum with epimera narrow, much smaller than episterna and not separating them from base of elytra; metasternum as long as or slightly shorter than median coxae, the episterna narrow, the episternal suture distinct throughout, the hind coxae not reaching the elytra. SCUTELLUM distinct and rounded. ELYTRA ovate, with a humeral fold, the lateral margin shallowly sinuate above the hind coxae, but without a distinct excision to receive the head of the metasternal episternum, punctatostriate, intervals broader than striae. LEGS of variable length, the femora clavate, the front pair slightly thicker than others, front tibiae longer than the rest, strongly curved, denticulate internally and with a sharp, apical spine, directed inwards at right angles; median pair straight, produced internally at the apex and having there a short, slender spine; hind pair straight and not produced internally at the apex, hind tibiae never denticulate, hind tibial

apex with a well developed, outer bevel and an inner flange, with two rows of setae; tarsi with third segment broadly bilobate, claws connate or fused throughout, except at apex where they are free. VENTER with the intercoxal process narrower, arcuate or angulate, suture between ventrites one and two distinct throughout, ventrite two, 1.5-2x as long as three and four together, throughout its length.

4.4 KEY TO THE SPECIES OF *Indomias*

1. Hind tibial apex without any dense, golden yellow hairs2
 Hind tibial apex with well developed, dense, golden yellow hairs 23
2. Elytra more or less strongly impressed on the declivity.....3
 Elytra not at all impressed on the declivity..... 10
3. Elytra with the outline of its posterior declivity either straight or slightly convex but never sinuate..... 4
 Elytra with the outline of its posterior declivity distinctly sinuate5
4. Antennae with funicle segments first and second equal. Elytra with the apex of its posterior declivity not having any erect, elongate scales; with a whitish, sutural stripe; and a broad, yellow, discal stripe extending from prothorax on to the intervals 5 and 6. Male genitalia with aedeagus having its apophyses 0.75x as long as the median lobe, female genitalia with the ratio of length of basal plate to that of shaft 1:3.2.*perroteti*
 Antennae with first segment of funicle 1.25x as long as the second. Elytra with the apex of its posterior declivity having distinct, erect, elongate scales. Male genitalia with aedeagus having its apophyses only 0.43x as long as the median lobe, female genitalia with the ratio of length of basal plate to that of shaft 1:4.5.*hispidus*
5. Antennae with funicle segment first as long as or only slightly longer (1.1x) than the second.6
 Antennae with funicle segment first at least 1.4x as long as the second.9
6. Elytra with their apices rounded.7
 Elytra with their apices either distinctly mucronate or pointed.8
7. Scrobes 0.87x as long as rostrum, head 1.1x as long as rostrum; prothorax with upper surface having shallow, scattered punctations, their interspaces tuberculate; female genitalia with spiculum ventrale having its basal plate 1.5x as long as broad, spermatheca with nodulus bulbous, having a cylindrical projection.*anasuryae* sp.nov.
 Scrobes only 0.55x as long as rostrum, head as long as rostrum; prothorax with upper surface having coarse punctations, their interspaces obscurely granulate; elytra with intervals third, fourth and fifth impressed on their declivity; male genitalia with aedeagus

- having length: breadth ratio 10:1, spiculum gastrale with shaft as long as the median lobe. *subacutipennis* sp.nov.
8. Elytral vestiture with predominant scales ovate, with 5-6 ridges; male genitalia with median lobe having length: breadth ratio 5.5:1, tegmen with dorsal piece 5x as broad as its basal piece, manubrium very short, only 0.31x as long as the median lobe; female genitalia having its spiculum ventrale with ratio of length of basal plate to that of shaft 1:4.8. *mayarami* sp.nov.
- Elytral vestiture with predominant scales ovate, but with patches of granulated areas; male genitalia with median lobe having length: breadth ratio 8.5:1, tegmen with dorsal piece only 2.5x as broad as its basal piece, manubrium 0.52x as long as the median lobe, its apex broadened and subconical; female genitalia with spermatheca having its proximal arm 3x as broad and 1.3x as long as the distal arm, spiculum ventrale with ratio of length of basal plate to that of shaft 1:4.3. *acutipennis*
9. Rostrum with its anterior margin 0.85x as broad as its posterior margin; prothorax with its anterior margin 0.62x as broad as the posterior margin; male genitalia with aedeagus having its apophyses 0.44x as long as the median lobe, tegmen with dorsal piece 2.5x as broad as its basal piece, spiculum gastrale with its shaft 0.88x as long as the median lobe. *maicykuttyae* sp.nov.
- Rostrum with its anterior margin only 0.54x as broad as the posterior margin; Prothorax with its anterior margin 0.83x as broad as the posterior margin; male genitalia with aedeagus having its apophyses 0.63x as long as the median lobe, tegmen with dorsal piece 5x as broad as its basal piece, spiculum gastrale with its shaft 1.06x as long as the median lobe. *menoni* sp.nov.
10. Elytra with its basal margin only slightly raised, its external angle obtuse. 11
 Elytra with its basal margin strongly raised, its external angle perpendicular or acute. ... 12
11. Head as long as rostrum, antennae with funicle segment first only 0.85x as long as the second, rostrum 1.1x as broad as long; elytra with their apices mucronate in both sexes, interval three distinctly raised over two at its posterior declivity near apex; male genitalia having tegmen with its dorsal piece very long, 0.2x as long as the manubrium, and 3x as broad as the basal piece. *prasimus*
- Head 1.1x as long as rostrum, antennae with funicle segment first 1.1x as long as the second, rostrum as broad as long, with scrobes much longer, 0.8x as long as rostrum; elytra with their apices not mucronate, stria with large and deep punctations, intervals three and five 1.33x as broad as others and more raised; male genitalia with tegmen having its dorsal and basal piece equal, length: breadth ratio of median lobe 5.3:1. *lividus*
12. Rostrum strongly impressed at the middle dorsally. 13
 Rostrum plane dorsally or at the most very shallowly impressed at the middle dorsally
 17
13. Antennae with funicle segment first either shorter or only slightly longer (1.1:1) than second; elytra with intervals four, five and six not impressed on their posterior declivity. 14

- Antennae with funicle segment first atleast 1.3-1.5x as long as the second; elytra with intervals four, five and six either slightly or deeply impressed on their posterior declivity. 15
14. Prothorax as long as broad, its upper surface with shallow, confluent punctations; elytra with their intervals coriaceous, humeral fold much less developed, their apices mucronate in both sexes, vestiture with the less predominant scales oval, bluish orange with bifurcated ridges; male genitalia with aedeagus having the length: breadth ratio of median lobe 7:1, apophyses 0.66x as long as the median lobe, tegmen with parameres very long and 0.33x as long as the manubrium. *praeteritus*
- Prothorax 1.06x as broad as long, its upper surface rugosely punctate with interspaces granulate; elytra with their apices rounded, humeral fold prominent, vestiture with the less predominant scales elongate, their inner core opaque and granulated with four ridges; male genitalia with aedeagus having the length: breadth ratio of median lobe 6:1, apophyses only 0.42x as long as the median lobe, spiculum gastrale with the apex of its shaft clefted; venter with segments one and two having long, fine and recumbent setae *subdecipiens* sp.nov.
15. Elytra with their apices rounded, vestiture with the predominant scales circular, reddish brown, with patches of granulated areas, humeral fold small and not projecting; male genitalia with tegmen having its dorsal piece 3x as broad as the basal piece, manubrium with its apex enlarged and rounded. *ramakrishnani* sp.nov.
- Elytra with their apices either distinctly mucronate or atleast separately pointed, vestiture with the predominant scales either elongate or subrectangular, but invariably with ridges. 16
16. Head as long as rostrum, rostrum as long as broad, its central furrow club shaped, ending in a narrow, faint line before reaching the vertex; elytral vestiture with the predominant scales curved, elongate, reddish brown with a short pedicel, their inner core opaque with 2-3 ridges. Female genitalia with spiculum ventrale having its basal plate spatulate and slightly longer than broad (1.1:1) *mucronatus* sp.nov.
- Head only 0.8x as long as rostrum, rostrum 1.05x as long as broad, its central furrow short, broad and oval; elytral vestiture with the predominant scales subrectangular to subovate, yellow, with 9-10 ridges; male genitalia with aedeagus having the length: breadth ratio of median lobe 9:1, apophyses 0.77x as long as the median lobe, tegmen with dorsal piece 7x as broad as basal piece. *satyanarayanai* sp.nov.
17. General colour always characterized by a bright yellow, powdery vestiture; elytra with their apices scarcely mucronate in male and with a short mucro in female; rostrum with its lateral carinae gradually convergent behind; legs with second joint of tarsi bearing atleast a few scales. *sulphuratus*
- General colour never characterized by a yellow vestiture, either grey or green or with metallic green; elytral with their apices rounded in male, either pointed separately or scarcely mucronate or with well defined mucros in female. 18
18. Antennae with funicle segment first distinctly longer than second (1.3 to 1.5:1) 19
- Antennae with funicle segment first either equal to or only slightly longer than the second (1.1:1) 20

19. Head with nine distinct rows of elongate, curved scales, slightly shorter than rostrum (1:1.1); elytral vestiture with the predominant scales elongate, reddish brown with their base truncate and apex rounded, with 4 ridges; female genitalia with spermatheca having nodulus rounded, spiculum ventrale with the basal plate laminate, its apical half subconical and basal half trapezoidal. *marshalli* sp.nov.

Head with a faint, broad, transparent impression behind the eyes, vertex with a median fovea, elytra with disk as far as the fourth stria covered mainly with black vestiture, first interval somewhat raised at apex, elytral vestiture with predominant scales subcircular, light brown, with surface irregularly impressed. Male genitalia with manubrium very short, only 0.17x as long as the median lobe. *beesoni*

20. Elytra with the humeral fold only slightly developed, its longitudinal curvature less convex or almost flat, deepest near the base and becoming abruptly steeper towards the apex, ratio of length of elytra from basal margin to the posterior declivity and from the posterior declivity to apex 4:1; head 1.1x as long as rostrum; male genitalia with aedeagus having its length: breadth ratio of median lobe 9:1, tegmen with its manubrium only 0.33x as long as the median lobe, bent at apex, spiculum gastrale with its shaft only 0.66x as long as the median lobe. *decipiens*

Elytra with the humeral fold much prominent, its longitudinal curvature either moderately or much convex, deepest near the middle and gradually sloping behind; male genitalia with tegmen having its manubrium never less than 0.5x as long as the median lobe, and never bent at apex, spiculum gastrale with its shaft at least equal to slightly longer than median lobe. 20

20. Elytra with its intervals five and six with an impression at base; prothorax with its central stria uniformly broad, rounded at either ends, running in the posterior two thirds; male genitalia with aedeagus having the length: breadth ratio of median lobe 10:1, its apophyses 0.85x as long as the median lobe, endophallus with a sclerotized patch. *yercaudensis* sp.nov.

Elytra with its intervals five and six without any impression at base; prothorax without any central stria; male genitalia with aedeagus having its apophyses only 0.5-0.6x as long as the median lobe, endophallus never with a sclerotized patch. 21

21. General vestiture metallic or bluish green, elytra with a common yellow patch at its base and at the apex of intervals four and five, with inflexed margins of prothorax and elytra with yellow powdering, elytral vestiture with the scales having pedicel; male genitalia with tegmen having its dorsal piece 7x as broad as the basal piece and 0.44x as long as the median lobe; female genitalia with spermatheca having its proximal arm without any distinction between nodulus and ramus, distal arm almost parallel to the proximal arm, and the angle between them steeply acute. *frater*

General vestiture pale green or grey, but never metallic green; elytra without any yellow patch at the base of intervals; elytral vestiture with scales devoid of pedicel; female genitalia with spermatheca having its nodulus and ramus distinct, distal arm never parallel to the proximal arm and angle between them obtuse. 22

22. Elytra with vestiture uniform pale green, without any pollinose, lateral stripe, its longitudinal curvature much convex, deepest near the middle, gradually sloping behind, ratio of length of elytra from its basal margin to the posterior declivity and from its posterior

- genitalia with spermatheca having its nodulus globular, spiculum ventrale with the ratio of length of basal plate to that of shaft 1:3; male genitalia with aedeagus having the length: breadth ratio of median lobe 7:1, tegmen with its dorsal piece 3x as broad as the basal piece. *cretaceus*
- Elytra with an ochreous yellow, lateral stripe on its intervals six and seven, extending inwards at the base and near apex as far as the interval four and with a similar stripe on the prothorax, its longitudinal curvature moderately convex, their apices pointed in male and mucronate in female; female genitalia with spermatheca having nodulus small and notched, spiculum ventrale with the ratio of length of basal plate to that of shaft 1:5; male genitalia with aedeagus having the length: breadth ratio of median lobe 9:1, tegmen with its dorsal piece 8x as broad as basal piece. *anamalairius*
23. General size of the body with length at least 3x or more as the breadth.....24
- General size of the body with length:breadth ratio never more than 3:1.....25
24. Rostrum with its lateral carinae extending posteriorly beyond the anterior margins of eyes, atleast to a distance of 0.25x as the length of an eye; prothorax only 1.01x as broad as long, without any central stria; antennae with funicle segment first only 1.25x as long as the second; male genitalia with aedeagus having its apophyses 0.66x as long as the median lobe, spiculum gastrale with its shaft truncate at apex. *subkraatzi* sp. nov.
- Rostrum with its lateral carinae not extending beyond the anterior margin of eyes; prothorax atleast 1.25x as broad as long, and with a deep, central stria in its posterior two thirds; antennae with funicle segment first atleast 1.43x as long as the second; female genitalia with spiculum ventrale having its basal plate ovate, only 0.2x as long as its shaft and 1.5x as long as broad. *albizziae* sp. nov.
25. Rostrum as long as broad, shallowly impressed dorsally, a juxta marginal carina runs from its apex to just above the eye; prothorax longer than broad and sharply constricted at apex, its greatest breadth almost equal to that of elytra, with a fine central stria which does not reach apex. *kraatzi*
- Rostrum 1.2x as broad as long, deeply impressed dorsally, without any juxta marginal carina; prothorax 1.2x as broad as long, without any constriction at its apex, its greatest breadth never equal to that of elytra, with a deep central stria which is rounded posteriorly and straight anteriorly, restricted to posterior one thirds. *megakraatzi* sp. nov.

4.5 DESCRIPTION/ REDESCRIPTION OF SPECIES

Indomias perroteti (Boheman)

(Figs. 9, 35, 62, 89, 130, 162, 163, 164, 252, 253, 273 and 305)

Description: General colour black, with yellow and white stripes on the prothorax, blackish on the disc, sulphur yellow below, with a broad yellow band ascending the anterior and posterior margins as far as the edge of the disc, the median lateral area with sparse grey vestiture,

elytra with a broad yellow stripe along the extreme edge, but ceasing before the apex, a similar stripe on intervals five and six, encroaching a little on four and seven at the base, and a narrower, white stripe along the suture from the base to the declivity (Fig.305).

Head 1.13x as long as rostrum, its upper surface convex, with very fine shallow punctations. **Rostrum** finely punctate, not impressed dorsally, as broad as long, its anterior margin 0.82x as broad as the posterior margin; central furrow very short, broader towards anterior margin; lateral carinae parallel and distinct running up to one third of eyes; sides narrowed towards anterior margin, where they are parallel; scrobes uniformly broad, rounded anteriorly, rectangular and parallel posteriorly towards the eyes, 0.7x as long as rostrum. **Eyes** oval, dorsal, convex, 2x long as broad. **Antennae** reddish brown; scape gradually clavate; funicle with first and second segments equal, fourth, fifth and sixth equal; club oval, 3x as broad as funicle (Fig. 9).

Prothorax 1.05x as broad as long, its breadth at middle 1.1x as that of posterior margin; sides very slightly rounded and broadly constricted anteriorly; anterior margin 0.78x as broad as the posterior margin, truncate dorsally, acute laterally, posterior margin truncate; finely coriaceous above, with a faint, central stria, from the posterior margin up to a little distance away from the anterior margin. Legs with hind tibial apex without any dense, golden yellow hairs (Fig. 62).

Elytra narrowly ovate in male, broadly ovate in female, with basal margin slightly raised, humeral fold slight and not forming a prominent tubercle; apices separately and sharply mucronate in both the sexes; stria deeply punctatostriate; intervals rather narrow and slightly convex, with short, white, elongate scales on the declivity, which are not erect, posterior declivity distinctly impressed, straight or slightly convex but not sinuate; elytral vestiture with predominant scales circular

or subovate, reddish brown, with 9-10 ridges (Fig.252), less predominant elongate, reddish brown, with a narrow, pedicellate base, apex broadened and rectangular, inner core opaque, with 3 ridges (Fig.253).

Male genitalia

Aedeagus with median lobe having its apex rounded, length: breadth ratio 6.66:1, apophyses 0.75x as long as the median lobe, their apices clefted (Figs.162 and 163). Tegmen with dorsal piece 5x as broad as basal piece; parameres long, slender, their apices rounded, 0.27x as long as manubrium; manubrium slender, uniformly thick, 0.68x as long as median lobe, broadened to a subconical apex (Fig.164). Spiculum gastrale with shaft 1.12x as long as median lobe, thicker at middle, slender towards apex, with apex broad, rectangular and clefted; basal prongs equal, broad, their apices truncate (Fig.130).

Female genitalia

Spermatheca could not be described. Spiculum ventrale with shaft much slender between the base and apex, its apex blunt; basal plate spatulate, apical half conical, its apex broadly rounded, slightly longer than broad (1.16:1); ratio of length of basal plate to that of shaft 1: 3.2 (Fig.89).

Length: Male: 8.42 mm - 8.75 mm; Female: 8.75mm.

Breadth: Male: 2.80 - 2.85 mm; Female: 3.00 mm.

Specimens examined: INDIA: Nilgiris, 3 ♂, VI. 1962, B.V. David, on potato; 1 ♀, with same data as above (NPC).

Distribution: INDIA: Tamil Nadu: Nilgiris.

Taxonomic note: Marshall (1916) states that the faint central stria on prothorax is seen from base to beyond the middle, but it is found only at a little distance from the base and apex, almost approaching very near to apex; elytra narrowly ovate in male, broadly ovate in female.

Indomias hispidus Marshall

(Figs. 5, 32, 58, 84, 115, 147, 148, 149, 218, 219, 261 and 309)

Description : General colour black, intermingled with black and grey vestiture, the latter predominant laterally and often having a coppery reflection (Fig. 309). **Head** longer than rostrum (1.1:1), upper surface fine, even, with scattered, coarse punctations, a short, dumbbell shaped, central furrow is seen on vertex. **Rostrum** shallowly impressed at middle dorsally, broader than long (1:0.8), anterior margin only 0.62x as broad as the posterior margin; central furrow moderately long, very deep, broader towards anterior margin, then getting narrowed, and thereafter slightly broadened before reaching the middle of eyes; lateral carinae distinct; scrobes broader, oriented parallel anteriorly, but narrowed and sharply pointed posteriorly, 0.75x as long as rostrum, space between scrobes 0.83x as broad as that between eyes. **Eyes** dorsal, convex, 2x as long as broad. **Antennae** brown; scape more slender, glabrous; funicle with first segment 1.25x as long as second, broader, third to sixth equal and bead like, seventh broadest; club conical, much broader than funicle segments (Fig. 5).

Prothorax 1.1x as broad as long, its breadth at middle 1.1x as that of posterior margin; sides rounded in front and constricted posteriorly; anterior margin 0.75x as broad as the posterior margin, truncate dorsally and vertical laterally, posterior margin subtruncate; upper surface coarsely punctate, without any stria. Legs with hind tibial apex without any dense, golden yellow hairs (Fig. 58).

Elytra broadly ovate, with basal margin strongly raised, its external angle acute, with a distinct humeral fold, strongly compressed posteriorly; apex sharply mucronate in both the sexes; stria finely punctatostriate; intervals broad and convex, posterior declivity more or less strongly impressed, slopes much more gradually, its outline straight

and not sinuate; apical half with erect, elongate scales; elytral vestiture with predominant scales subcircular to squarish, pink, with patches of granulated areas (Fig. 218), less predominant elongate, brown, broad and rectangular at base, gradually narrowing and smoothly rounded at apex, with ridges (Fig. 219).

Male genitalia

Aedeagus with median lobe very slender, length: breadth ratio 8 : 1, uniformly broad, apex rounded; apophyses short, 0.43x as long as the median lobe (Figs. 147, 148). Tegmen with dorsal piece 4x as broad as the basal piece; parameres long, broadened to a rounded apex; manubrium moderately long, as long as apophyses, slightly bent at the rounded apex (Fig. 149). Spiculum gastrale with shaft slightly shorter than median lobe, 0.93x as long as the median lobe, uniformly thick, apex bent and pointed; basal prongs equal, their apices triangular (Fig. 115).

Female genitalia

Spermatheca could not be described. Spiculum ventrale with shaft elongate, uniformly thick, apex blunt; basal plate 0.2x as long as the shaft, basal half transverse, apical half conical, apex rounded with tuft of hairs, longer than broad (1:1.8) (Fig. 84).

Length: Male: 8.00 mm; Female : 8.52 mm.

Breadth: Male: 2.85 mm; Female 2.70 mm.

Specimens examined: 1 ♂, INDIA: Kerala: Cochin: Mapply Valley, 16-19.IX.1923, Coll. Ramakrishna; 1 ♀, Tamil Nadu: Coimbatore : 1988, without collector's name, on tea.

Associated habitats: Tea

Distribution: INDIA: Kerala: Kochi; Tamil Nadu: Coimbatore.

Indomias anasuryae sp.nov.

(Figs. 25, 49, 75, 94, 107, 245, 246, 275 and 299)

Diagnosis: This species resembles *acutipennis* but can be distinguished by the following characters: Head 1.1x as long as rostrum, central furrow on rostrum broadly rounded anteriorly but narrow and pointed posteriorly, reaching up to the middle of the eyes; scrobes 0.87x as long as the rostrum. Female genitalia with spiculum ventrale having a spatulate basal plate, whose apex is rounded with few distinct hairs, apex of basal plate truncate.

Description: General colour black, with pale or dull green vestiture (Fig. 299). Head 1.1x as long as rostrum, upper surface almost plane, with deep, scattered punctations; vertex convex. **Rostrum** shallowly impressed at the middle dorsally, as long as broad, anterior margin only 0.75x as broad as the posterior margin; central furrow broadly rounded anteriorly, but narrow and pointed posteriorly, reaching up to the middle of eyes; lateral carinae distinct; sides almost straight; scrobes 0.87x as long as rostrum, broad anteriorly, narrow, sharply pointed and convergent posteriorly. **Eyes** dorsolateral and convex. **Antennae** brown; scape gradually thickened; funicle with first segment 1.1x as long as the second, third to fifth equal, sixth and seventh subequal; club broader than funicle, with whorl of hairs on its second, third and fourth joints (Fig. 25).

Prothorax 1.05x as long as broad, its breadth at middle 1.05x as the posterior margin; sides well rounded anteriorly, but straight and parallel posteriorly; anterior margin only 0.75x as broad as the posterior margin, truncate dorsally, acute laterally, posterior margin subtruncate; upper surface with shallow, scattered punctations, their interspaces tuberculate. Legs with hind tibial apex without any dense, golden yellow hairs (Fig. 75).

Elytra ovate, with basal margin strongly raised, its external angle acute, humeral fold prominent, more or less strongly impressed on the declivity, posterior declivity distinctly sinuate; apices rounded; stria shallowly punctate; intervals broad, their upper surface moderately convex; elytral vestiture with predominant scales elongate, yellowish orange, with a small pedicel, apex broadened with 5 ridges (Fig. 246), less predominant circular, yellow, with many broken ridges and a dark, circular, granulated area (Fig. 245).

Female genitalia

Spermatheca with proximal arm swollen, as long as and 3.5x as broad as the distal arm, angle between the arms obtuse; nodulus distinct, bulbous, with a cylindrical projection; ramus cuboidal, only 1.3x as broad as nodulus, its apex blunt; cornu short, bent at apex and pointed (Fig. 107). **Spiculum ventrale** with basal plate 1.5x as long as broad, its apex rounded and with few, distinct hairs, its apex spatulate, sides straight, as if cut vertically, shaft 4x as long as basal plate, uniformly thick with rounded apex (Fig. 94).

Length: Female: 10.00 mm; **Breadth:** Female: 3.13 mm.

Holotype : 1 ♀, INDIA: Kerala: Malabar: Dhony forests, 26. V. 1922, Coll. Ramakrishna (NPC).

Distribution: INDIA: Kerala.

Etymology: This species is named after author's mother Smt. Anasuryamma.

***Indomias subacutipennis* sp.nov.**

(Figs. 13, 40, 66, 121, 168, 169, 170, 230, 231, 266 and 290)

Diagnosis : Closely resembles *acutipennis*, but it can be distinguished by the following characters : Rostrum with central furrow short, broad, and posteriorly pointed; deeply impressed in the middle. Male genitalia with apex of manubrium blunt; ratio of length of dorsal piece (inclusive

of parameres) and manubrium 1 : 1.25; median lobe with its curvature not sharp. Elytra with the outline of posterior declivity sinuate; humeral fold present but not prominent; apices rounded. Prothorax 1.02x as broad as long.

Description

General colour black with pale or dull green vestiture (Fig. 290). **Head** as long as rostrum, upper surface flat, with shallow, confluent punctations. **Rostrum** as long as its breadth at posterior margin; breadth at anterior margin 0.75x as that of posterior margin; deeply impressed at the middle dorsally; central furrow short, broad anteriorly, pointed posteriorly; lateral carinae distinct, running throughout length of rostrum; sides straight, parallel towards anterior margin; scrobes uniformly broad throughout, but pointed near the eyes, scrobes only 0.55x as long as rostrum, space between scrobes as much as the breadth of rostrum at anterior margin. **Eyes** dorsal, oval and less convex. **Antennae** dark or reddish brown; funicle with first segment 1.1x as long as the second, rest of the funicle segments bead like, seventh largest; club conical (Fig. 13).

Prothorax 1.02x as broad as long, its breadth at middle 1.1x as its breadth at posterior margin; sides almost straight, narrowed towards the anterior margin, which is only 0.78x as broad as the posterior margin; anterior margin truncate dorsally, acute laterally, while the posterior margin is truncate; upper surface with coarse punctations, interspaces obscurely granulate, without any central stria. Legs with hind tibial apex without any dense, golden yellow hairs (Fig. 66).

Elytra ovate, with basal margin strongly raised, humeral fold present but not very prominent; more or less strongly impressed on declivity, posterior declivity distinctly sinuate; apices rounded; stria punctatostriate, intervals broad, convex and raised, third, fourth and

fifth impressed on the declivity, short elongate scales seen on declivity; elytral vestiture with predominant scales subcircular to ovate, pinkish with 6-7 ridges, interspaces with granulated areas (Fig. 230), less predominant elongate, their apices broad, inner core opaque, granulated and with 4-5 ridges (Fig. 231).

Male genitalia

Aedeagus with median lobe distinctly elongate, membranous at the middle, length: breadth ratio 10:1, slightly broader at middle but narrowed towards ends, apex narrowly rounded; in profile median lobe arcuate at base; apophyses thin, their apices pointed and hooked, only 0.5x as long as median lobe; transfer apparatus less sclerotized, ejaculatory duct short (Fig. 168 and 169). Tegmen with dorsal piece atleast 4-5x as broad as the basal piece; parameres long, slender, papillate and pointed; manubrium uniformly thick, with a slightly bent and blunt apex, only 0.5x as long as the median lobe (Fig. 170). Spiculum gastrale long, slender, as long as median lobe ; basal prongs subequal, their apices pointed (Fig.121).

Length: Male : 8.97 mm; **Breadth:** Male : 3.30 mm.

Holotype: 1 ♂ , INDIA: Kerala: Malabar: Dhony forests, 26. V.1922. Coll. Ramakrishna. (NPC).

Distribution : INDIA:Kerala.

Etymology : This species is very near to *acutipennis* and agrees with the same in general shape, size and many other characters, and hence it is named *subacutipennis* sp.nov.

Indomias mayarami sp.nov.

(Figs. 18, 50, 76, 95, 126, 171, 172, 173, 247, 248, 276 and 300).

Diagnosis: This species resembles *acutipennis* from which it differs in the following characters: Scrobes uniformly broad, pointed anteriorly and broadly rounded posteriorly, oriented parallel towards eyes.

Prothorax broadest at middle, apices of elytra pointed but not mucronate. Male genitalia with length: breadth ratio of aedeagus 5.5:1. Female genitalia with spiculum ventrale having its basal plate triangular, its apex rounded with 4-5 slender hairs. Elytral vestiture with predominant scales ovate, reddish brown with 5-6 ridges.

Description: General colour black, with pale or dull green vestiture (Fig. 300). Head as long as rostrum, upper surface convex, with shallow and scattered punctations, usually hidden behind vestiture. Rostrum shallowly impressed at the middle dorsally, as long as broad, anterior margin 0.85x as broad as the posterior margin; central furrow broadly rounded anteriorly, but pointed posteriorly; lateral carinae extend up to margin of eyes; scrobes uniformly broad, pointed anteriorly and broadly rounded posteriorly, oriented parallel towards the eyes. Eyes dorsal, conical and moderately convex. Antennae reddish brown; scape abruptly clavate; funicle with first segment 1.16x as long as the second, third and fourth equal, fifth and sixth subequal, sixth bulbous, seventh conical and broadest of all; club cylindrical, broader than funicle (Fig. 18).

Prothorax 1.04x as broad as long, it is broadest at middle and 1.07x as broad as the posterior margin; sides rounded; anterior margin only 0.82x as broad as the posterior margin, truncate dorsally, acute laterally, posterior margin subtruncate, basal lobe slightly emarginate; upper surface with shallow, scattered punctations, interspaces granulate. Legs with hind tibial apex without any dense, golden yellow hairs (Fig. 76).

Elytra ovate, with basal margin strongly raised, its external angle acute, humeral fold present but not projecting, more or less strongly impressed on the declivity, posterior declivity distinctly sinuate; apices pointed but not mucronate; stria shallowly punctate; intervals moderately broad, upper surface convex, much raised; elytral vestiture with

predominant scales ovate, reddish brown, with 5-6 ridges (Fig. 247), less predominant more elongate, base truncate, with pedicel, inner core opaque and granulated, with 3 ridges (Fig. 248).

Female genitalia

Spermatheca could not be described. Spiculum ventrale with shaft 4.8x as long as the basal plate, almost uniformly thick, its apex enlarged and rounded; basal plate triangular, 1.3x as long as broad, its apex rounded, with 4-5 slender hairs (Fig. 95).

Male genitalia

Aedeagus with median lobe elongate but broadened towards apex and much narrowed towards base, in profile base arcuate, apex broadly rounded, membranous at the middle, broadest near its junction with apophyses, length: breadth ratio 5.5:1, apophyses 0.57x as long as the median lobe (Figs. 171 and 172). Tegmen with dorsal piece 5x as broad as the basal piece; parameres long, apices rounded; manubrium short, slender, with a blunt apex, only 0.31x as long as median lobe (Fig. 173). Spiculum gastrale with shaft, elongate, slender, but broadened to a rounded apex, which is bent at right angle, 1.05x as long as the median lobe; basal prongs subequal, their apices pointed (Fig. 126).

Length: Female: 8.09 mm; **Breadth:** Female: 2.70 mm.

Holotype: 1 ♀, INDIA: Kerala: Malabar: Dhony forests, 26.V.1922, Coll. Ramakrishna; **Allotype:** 1 ♂, with same data as holotype; **Paratype:** 1 ♀, with same data as holotype (NPC).

Distribution: INDIA: Kerala.

Etymology: This species is named after Shri Mayaram.

***Indomias acutipennis* Boheman**

(Figs. 7, 36, 60, 85, 100, 117, 153, 154, 155, 220, 262 and 312)

Description: General colour black, with chalky white vestiture, more or less tinged yellow at the sides, which is sparse on disk, but much

denser laterally and beneath (Fig. 312). **Head** as long as rostrum, upper surface finely coriaceous, with scattered, coarse punctations. **Rostrum** shallowly impressed above, as long as broad, anterior margin 0.9x as broad as the posterior margin; central furrow club shaped, rounded at either ends, narrowing posteriorly and extending upto middle of eyes; lateral carinae distinct throughout the length of rostrum; upper surface coarsely punctate; sides straight and parallel; scrobes rounded anteriorly and pointed posteriorly, 0.6x as long as rostrum. **Eyes** dorsolateral, convex, 2x as long as broad. **Antennae** brown; sparsely hairy; scape gradually clavate, funicle with first segment 1.1x as long as the second, third and fourth subequal, fifth and sixth equal; club conical (Fig. 7).

Prothorax 1.1x as broad as long (male), slightly longer than broad (female), broadest at a little distance away from middle towards anterior margin and 1.07x as broad as the posterior margin; sides rounded anteriorly, straight at middle, rather strongly constricted anteriorly; anterior margin only 0.7x as broad as that of posterior margin, subtruncate dorsally and acute laterally, posterior margin truncate, basal lobe slightly emarginate; upper surface finely sculptured, with shallow, confluent punctations, usually hidden by vestiture and without any central stria. Legs with hind tibial apex without any dense, golden yellow hairs (Fig. 60).

Elytra ovate, with basal margin strongly raised, its external angle acute, humeral fold prominent, slightly broader behind middle, strongly impressed on the posterior declivity; apices sharply mucronate in both the sexes; stria finely punctate; intervals broad and convex; elongate scales very short and depressed, more noticeable on the declivity, posterior declivity distinctly sinuate; elytral vestiture with predominant scales oval, brown, with patches of granulated areas (Fig. 220).

← 6621

Male genitalia

Aedeagus with median lobe in profile evenly arcuate at base, broadest at its junction with apophyses, its apex pointed, length: breadth ratio 8.5: 1; apophyses 0.52x as long as median lobe (Figs. 153, 154). Tegmen with dorsal piece 2.5x as broad as the basal piece; parameres short, slender, their apices indistinct; manubrium elongate, slender, 0.52x as long as the median lobe, uniformly thick, with a broadened, subconical apex (Fig. 155). Spiculum gastrale with shaft 1.08x as long as the median lobe, broadest at middle, apex much narrowed, slightly deflected and blunt; basal prongs equal, their apices rounded (Fig. 117).

Female genitalia

Spermatheca with proximal arm 3x as broad and 1.3x as long as the distal arm, subcylindrical, angle between proximal and distal arms obtuse; nodulus bulbous; ramus rectangular, 2x as broad as nodulus; cornu tubular, its apex rounded (Fig. 100). Spiculum ventrale with shaft elongate, uniformly thick, but widened towards the rounded apex; basal plate longer than broad (1.3: 1), spatulate with basal half subtrapezoidal, its apical half subconical, apex blunt and bare, ratio of length of basal plate to that of shaft 1: 4.3 (Fig. 85).

Length: Male: 7 - 8.00 mm; Female: 8 - 8.30 mm.

Breadth: Male: 2.25 - 2.50 mm; Female: 2.75 - 3.25 mm.

Specimens examined: 1 ♂, 2 ♀, INDIA: Kerala: Malabar: Dhony forests, 26.V.1922, Coll. Ramakrishna; 1 ♂, Peermad: VI.1922, Coll. E.B (NPC).

Distribution: INDIA: Kerala

Taxonomic Note: Marshall (1916) states that apical margin of prothorax is obliquely truncate but it is observed to be acutely subtruncate and also the prothorax is broadest at a little distance away from the middle towards anterior margin and not exactly at middle as stated by Marshall (1916).

Indomias maicykuttyae sp. nov.

(Figs. 26,51,77,127,186,187,188,249,277 and 301)

Diagnosis: This species resembles *frater* from which it can be distinguished by the following characters: General colour black with slightly bluish green vestiture, margins of elytra near humeral fold with dense, golden yellow vestiture. Vertex with a minute, circular fovea. Prothorax as long as broad. Antennae with first segment of funicle 1.4x as long as the second. Scrobes squarish anteriorly. Elytral vestiture with obovate reddish brown scales, with clefted base and 10-12 ridges. Male genitalia with apophyses 0.44x as long as median lobe, manubrium with apex broadened and bulbous, shaft of spiculum gastrale 0.88x as long as the median lobe.

Description : General colour black with apple green or slightly bluish green vestiture, more or less shining, margins of elytra especially near humeral fold with dense, golden yellow vestiture (Fig. 301). **Head** 1.05x as long as rostrum, upper surface moderately convex, vertex with a minute, circular fovea. **Rostrum** shallowly impressed at the middle dorsally, as long as broad; anterior margin only 0.85x as broad as the posterior margin; central furrow uniformly broad, distinct; lateral carinae running throughout the length of rostrum; sides narrowed anteriorly, where it is slightly dilated; scrobes broadest at middle, squarish anteriorly, but divergent and pointed posteriorly. **Eyes** dorsal, moderately convex. **Antennae** dark brown; scape gradually clavate; funicle with first segment 1.4x as long as the second, third and fourth equal, fifth and sixth equal; club with distinct rows of dense hairs on its joints (Fig. 26).

Prothorax as long as broad, broadest at middle, 1.09x as broad as the posterior margin; sides rounded; anterior margin only 0.62x as broad as the posterior margin, truncate dorsally and oblique laterally,

posterior margin subtruncate, basal lobe emarginate; upper surface with very shallow, scattered punctations, interspaces obscurely granulate. Legs with hind tibial apex without any dense, golden yellow hairs (Fig. 77).

Elytra ovate, with basal margin strongly raised, its external angle acute, humeral fold prominent and projecting, more or less strongly impressed on the declivity, posterior declivity sinuate; apices rounded; stria with punctations deep, intervals broad, plane and not raised; outline of posterior declivity not distinctly sinuate; elytral vestiture with obovate, reddish brown scales with a clefted base and with 10-12 ridges (Fig. 249).

Male genitalia

Aedeagus with median lobe comparatively slender at middle, broad at base and apex, length: breadth ratio 9:1, apex rounded, broadest at junction between apophyses, apophyses 0.44x as long as median lobe (Figs. 186 and 188). **Tegmen** with dorsal piece 2.5x as broad as the basal piece; parameres short, slender and pointed; manubrium moderately long, slender, 0.5x as long and 0.2x as broad as the median lobe, uniformly thick, with apex much broadened and bulbous (Fig. 187). **Spiculum gastrale** with shaft 0.88x as long as the median lobe, uniformly thick, apex deflected and bluntly rounded; basal prongs subequal, their apices broadly rounded (Fig. 127).

Length: Male: 7.86 mm; **Breadth:** Male: 2.59 mm.

Holotype: 1 ♂, INDIA: Kerala: Pampadumpara, 22.I.1994. Coll. P.M. Mathew, on Cardamom; **Paratype:** 1 ♂, with same data as holotype (NPC).

Distribution : INDIA: Kerala.

Etymology: This species is named after its collector Dr. P. Maicykutty Mathew.

Indomias menoni sp.nov.

(Figs. 23, 47, 74, 91, 106, 124, 180, 181, 182, 241, 242, 272 and
297)

Diagnosis: This species resembles *acutipennis* but can be distinguished by the following characters: Rostrum with anterior margin only 0.54x as broad as the posterior margin; central furrow long, narrow, reaching frons and running up to one third of the eyes. Antennae with first segment of funicle 1.5x as long as the second; club with 3 distinct rows of hairs at its joints. Elytra at posterior declivity distinctly sinuate, their apices separately pointed but not mucronate. Prothorax with upper surface rugose. Male genitalia with dorsal piece of tegmen 5x as broad as the basal piece. Female genitalia with shape of basal plate laminate, spermatheca with its proximal arm 1.1x as long as the distal arm.

Description: General colour black with pale green vestiture (Fig. 297). Head as long as rostrum, upper surface convex, with shallow, scattered punctations, hidden behind vestiture. Rostrum shallowly impressed at the middle dorsally, as long as broad, anterior margin only 0.54x as broad as the posterior margin; central furrow long, narrow, reaching frons and running up to one third of eyes; lateral carinae distinct; sides narrowed anteriorly; scrobes 0.75x as long as the rostrum, broadly rounded at either ends and divergent from eyes. Eyes dorsolateral, convex, 2x as long as broad. Antennae piceous; scape gradually clavate; funicle with first segment 1.5x as long as the second, third the shortest of all, fourth to sixth equal, seventh broadest of all; club with 3 distinct rows of hairs, at its joints (Fig. 23).

Prothorax as broad as long, its breadth at middle 1.1x as that of posterior margin; sides rounded; anterior margin only 0.83x as broad as the posterior margin, truncate dorsally and vertical laterally, posterior margin truncate; upper surface rugose, with shallow, scattered

punctations, interspaces granulate. Legs with hind tibial apex without any dense, golden yellow hairs (Fig. 74).

Elytra broadly ovate, with basal margin strongly raised, its external angle acute, humeral fold present but not projecting; more or less strongly impressed on the declivity, apices slightly pointed but not mucronate; stria shallowly punctate; intervals broad and convex, fourth, fifth and sixth shallowly impressed at the posterior declivity, posterior declivity distinctly sinuate; elytral vestiture with predominant scales curved, but elongate, dark brown with a short pedicel, broadest at apex, with inner core opaque and granulated (Fig. 241), less predominant more elongate, brown with inner core opaque and with 5 ridges (Fig. 242).

Male genitalia

Aedeagus with median lobe elongate, straight, even, in profile not arcuate, apex broadly rounded, length: breadth ratio 1:0.63; apophyses 0.63x as long as median lobe, their apices rounded and dark brown, well sclerotized (Figs. 180 and 182). Tegmen with dorsal piece 5x as broad as the basal piece; parameres short, broad and apices pointed; manubrium elongate, 0.5x as long as median lobe, with its apex enlarged and rounded (Fig. 179). Spiculum gastrale with shaft 1.06x as long as the median lobe, uniformly thick, its apex blunt, 2x as long as manubrium, basal prongs subequal, their apices pointed (Fig. 124).

Female genitalia

Spermatheca with proximal arm 1.1x as long and 3x as broad as the distal arm, angle between proximal and distal arms obtuse; nodulus squarish, with apex rounded; ramus rectangular, 2x as broad as the nodulus, cornu short, narrowed towards apex and pointed (Fig. 106). Spiculum ventrale with shaft uniformly thick, very slender, its apex curved and rounded; basal plate only 0.26x as long as the shaft, laminate,

broadest at base, slightly longer than broad (1.15:1), apex rounded with slender hairs, apical half conical (Fig. 91).

Length: Male: 8.40 mm; **Breadth:** Male: 2.47 mm.

Holotype : 1 ♂, INDIA: Kerala: Malabar: Dhony forests, 26.V.1922. Coll. Ramakrishna; **Allotype**: 1 ♀, with the same data as above (NPC).

Distribution: INDIA: Kerala.

Etymology: This species is named after late Dr. M. G. Ramdas Menon.

Indomias prasinus Boheman

(Figs. 14, 39, 63, 119, 159, 160, 161, 223, 265 and 315)

Description: General colour black, with uniform, dense green or blue green vestiture, sometimes with finely interspersed dark scales; sides and posterior margin of prothorax, and the inflexed margins of the elytra with more or less distinct sulphur yellow powdering, vestiture not or but very slightly metallic (Fig. 315). **Head** as long as rostrum, upper surface convex, with scattered punctations, hidden behind dense vestiture. **Rostrum** deeply impressed at the middle dorsally; 1.1x as broad as long, anterior margin only 0.65x broad as the posterior margin; central furrow very short, broad, forked posteriorly; lateral carinae running throughout the length of rostrum; scrobes narrow and sharply pointed at either ends, much broader and parallel in between. **Eyes** dorsal, moderately convex, 1.7x as long as broad. **Antennae** brown; scape gradually broadened; funicle with first segment 0.85x as long as second, but broader than second, other funicular segments elongate, bead shaped; club with fourth joint invisible and bulbous (Fig. 14).

Prothorax 1.08x as broad as long, its breadth at middle 1.04x as its breadth at posterior margin; sides rounded anteriorly, but straight posteriorly; anterior margin 0.76x as broad as posterior margin, truncate dorsally and vertical laterally, posterior margin subtruncate; upper surface with shallow, confluent punctations, intervals coriaceous or

obscurely granulate; central stria faint, broken but distinct posteriorly; laterally with two, distinct pits, due to impressions near the posterior margin. Legs with hind tibial apex without any dense, golden yellow hairs (Fig. 63).

Elytra narrowly ovate (male) or broader (female), with basal margin only slightly raised; its external angle obtuse, with a distinct, rather prominent humeral fold; apices with distinct, sharp mucros in both the sexes; striae finely punctate, with a shallow impression on the declivity; intervals broad, almost plane, and of even height, third distinctly raised over second, at posterior declivity near apex, elongate scales inconspicuous, declivity not impressed; elytral vestiture with predominant scales obovate, orange red with 10-11 broken ridges and pedicel (Fig. 223).

Male genitalia

Aedeagus with median lobe in profile arcuate at base; apex rounded, length: breadth ratio 7.5: 1, broadest at junction with apophyses; transfer apparatus with a sclerotized pouch at the middle; apophyses slender, 0.66x as long as the median lobe (Figs. 159, 161). Tegmen with dorsal piece 3x as broad as the basal piece, very long, 0.2x as long as the manubrium; parameres moderately long, slender, their apices indistinct; manubrium 0.66x as long as the median lobe, uniformly thick and with a pointed apex (Fig. 160). Spiculum gastrale with shaft 2x as long as manubrium, uniformly thick throughout except at apex, which is slightly narrow, deflected and rounded; basal prongs equal, their apices pointed (Fig. 119).

Length: Male: 7.1 mm; **Breadth:** Male: 2.65 mm.

Specimens examined: 1♂, INDIA: Tamil Nadu: Nilgiris, Coonoor, 6-13.V.1919, Coll. P. S. Nathan (NPC).

Distribution: INDIA: Tamil Nadu : Nilgiris.

Taxonomic note: Marshall (1916) described an infraspecific taxa namely, variety *subcostatus*; except for some minor morphological differences, Marshall confirms that it is indistinguishable based on male genitalia. Furthermore, as the species *prasinus* and its variety *subcostatus* are not geographically isolated it is not considered as a subspecies in the present study.

***Indomias lividus* Marshall**

(Figs. 11, 37, 64, 120, 165, 166, 167, 225, 226, 227, 263 and 316)

Description: General colour black or piceous, with dense, greyish vestiture, varied, with small, vague darker markings or else with brownish vestiture, with a pale greenish reflection or with metallic green vestiture (Fig. 316). **Head** 1.1x as long as rostrum, upper surface convex, with fine, scattered punctations, frons impressed. **Rostrum** deeply impressed at middle dorsally, as broad as long; anterior margin 0.75x as broad as the posterior margin; central furrow short, uniformly broad and rounded at either ends; lateral carinae distinct, reaching up to anterior margin of eye; scrobes much longer, 0.8x as long as rostrum, uniformly broad, smoothly rounded and parallel at either ends. **Eyes** dorsolateral, convex, 2x as long as broad, space between eyes as much as the space between scrobes. **Antennae** reddish brown; scape gradually clavate; funicle with first segment 1.1x as long as second, all funicular segments with whorl of hairs at middle; club densely hairy throughout, its joints invisible due to dense hairs (Fig. 11).

Prothorax 1.04x as long as broad, breadth at middle 1.1x as that of posterior margin; sides more rounded and narrower in male than in the female; anterior margin only 0.83x as broad as the posterior margin, truncate dorsally and acute laterally, posterior margin subtruncate; upper surface with shallow, subconfluent punctations, more or less hidden

behind vestiture, with a faint zig zag stria, with broad depressions at lateral sides, due to impression. Legs with hind tibial apex without any dense, golden yellow hairs (Fig. 64).

Elytra ovate, basal margin slightly raised, humeral fold distinct, having almost the appearance of a true shoulder, so that external basal angle becomes obtuse, posterior declivity not impressed; apices not or scarcely mucronate; stria with comparatively large and deep punctations; intervals not much broader than stria, third and fifth 1.33x as broad as the others and more raised, usually alternate ones slightly raised, elongate scales on the intervals short, recumbent and inconspicuous, except sparsely at apex; elytral vestiture with three types of scales, predominant flat, circular, orange red, with irregular impressions and a hyaline outer core (Fig. 226), less predominant oval, with ridges (Fig. 225), the least predominant round, with ridges starting a little distance away from base (Fig. 227).

Male genitalia

Aedeagus with median lobe slender, its apex rounded, almost uniformly broad throughout; length: breadth ratio 5.33: 1, becomes broadest at its junction with apophyses; apophyses 0.62x as long as the median lobe (Figs. 165, 167). Tegmen with dorsal and basal pieces equally broad; parameres very long, slender, their apices indistinct; manubrium moderately long, 0.62x as long as the median lobe, more or less uniformly broad, with apex slightly deflected and rounded (Fig. 166). Spiculum gastrale 1.25x as long as median lobe and 2x as long as manubrium, broadened towards base, its apex narrowed, deflected and bent; basal prongs almost equal, massive, their apices pointed (Fig. 120).

Length: Male: 9.40 mm; **Breadth:** Male: 3.13 mm.

Specimens examined: 1 ♂, INDIA: Tamil Nadu: Nilgiris, Coll. T. V. Campbell, without date; 1 ♂, Karnataka: Chickaballapura, Coll. T. V. Campbell, without date.

Distribution: INDIA: Karnataka: Chickaballapura; Tamil Nadu: Nilgiris.

Taxonomic note: Marshall (1916) states that intervals are of equal height and only sometimes the alternate ones are raised but it has been seen that alternate intervals are raised and intervals are not of equal height.

***Indomias praeteritus* Marshall**

(Figs. 16, 38, 61, 88, 102, 116, 150, 151, 152, 221, 222, 264, 313
and 314)

Description : General colour black, with glittering, metallic to bluish green vestiture; inflexed sides of prothorax, elytra and base of prothorax yellowish (Fig. 313, 314). **Head** as long as rostrum, upper surface convex, with scattered punctations, hidden behind dense vestiture. **Rostrum** plane dorsally, as long as broad, anterior margin 0.80x as broad as the posterior margin; central furrow short, pushed anteriorly; lateral carinae distinct and parallel; scrobes broader, squarish and fuses with rostrum anteriorly, narrowed, smoothly rounded and parallel towards the eyes. **Eyes** dorsolateral, slightly convex, almost 2x as long as broad, space between eyes as much as the space between scrobes and the breadth of rostrum at anterior margin. **Antennae** piceous; scape abruptly clavate; funicle with first segment only 0.7x as long as the second but stouter, third to fifth bead like, seventh broadest of all funicle segments; club 3x broader than funicle segments and conical (Fig. 16).

Prothorax as long as broad, at middle 1.1x as broad as the posterior margin but narrowed anteriorly; sides rounded; anterior margin only 0.8x as broad as the posterior margin, truncate dorsally and acute laterally, posterior margin subtruncate; upper surface with shallow, confluent punctations, intervals coriaceous or obscurely granulate, central stria faint, runs throughout except at base and apex. Legs with hind tibial apex without any dense, golden yellow hairs (Fig. 61).

Elytra with basal margin strongly raised; its external angle acute, humeral fold much less developed, being practically absent in male, while in female, it does not project beyond the outline of elytra, as seen from above, posterior declivity not impressed; stria shallowly punctate; intervals broad, almost plane, not much raised, third not raised over second, at posterior declivity; apices mucronate in both sexes; elytral vestiture with predominant scales round to obovate, bluish orange, with many ridges (Fig. 222), less predominant oval, bluish orange with bifurcated ridges (Fig. 221).

Male genitalia

Aedeagus with median lobe in profile not arcuate, apex rounded, broadest at middle; apex with patches of sclerotized areas, length: breadth ratio 7: 1; apophyses long, slender, 0.66x as long as median lobe (Figs. 150 and 151). Tegmen with dorsal piece 5x as broad as basal piece, shorter, 0.11x as long as the manubrium; parameres very long, 0.33x as long as manubrium, finger shaped, their apices pointed; manubrium elongate, 0.64x as long as median lobe, very slender, 0.1x as broad as the median lobe, with a slightly deflected, conical apex (Fig. 152). Spiculum gastrale with shaft 1.1x as long as median lobe, 0.1x as broad as the median lobe, uniformly thick, with apex deflected, broadened and rounded; basal prongs subequal (Fig. 116).

Female genitalia

Spermatheca with proximal arm 1.2x as long as and 4x as broad as the distal arm; nodulus 1.4x as broad as ramus, swollen, conical, ramus cylindrical; cornu slender, uniformly thick throughout, apex rounded and bent parallel to the proximal arm (Fig. 102). Spiculum ventrale with shaft narrow at base, uniformly thick at middle, its apex bent, broadened and rounded; basal plate conical, much longer than

broad (1.6:1), its apex rounded with tuft of slender hairs, ratio of length of basal plate to that of shaft 1:4 (Fig. 88).

Length: Male: 7.00-7.25 mm; **Breadth:** Male: 2.5-2.65 mm.

Specimens examined: 2 ♀, INDIA: Tamil Nadu: Yercaud, Shevaroyas, 4500 ft, 23.IV-4.V.1913, Coll., Fletcher, Y.R.

Distribution: INDIA: Tamil Nadu: Yercaud.

***Indomias subdecipiens* sp.nov.**

(Figs. 24, 48, 67, 125, 183, 184, 185, 243, 244, 274 and 298)

Diagnosis: This species resembles *decipiens* but can be distinguished by the following characters: Rostrum deeply impressed at the middle dorsally, central furrow broadest anteriorly and narrowed posteriorly. Elytra less convex longitudinally and slopes gradually behind. Male genitalia with aedeagus having its apophyses only 0.42x as long as the median lobe, tegmen with manubrium 0.5x as long as the median lobe, spiculum gastrale with shaft 1.05x as long as median lobe and its apex clefted.

Description: General colour black with pale green vestiture (Fig.298).

Head as long as rostrum, upper surface moderately convex, with shallow, scattered punctations, hidden behind vestiture. **Rostrum** deeply impressed at the middle, as long as broad in male and 1.25x as long as broad in female; anterior margin 0.85x as broad as the posterior margin, central furrow broadest anteriorly, but narrowed posteriorly, lateral carinae distinct, reaching up to middle of eyes; sides narrowed from posterior to anterior margin; scrobes narrowed and pointed anteriorly, broadened and divergent posteriorly. **Eyes** dorsal, circular and moderately convex. **Antennae** piceous; scape gradually thickened; funicle with first segment 1.14x as long as the second, third and fourth equal, fifth to seventh equal and bead like; club broader than the funicle segments, with hairs in rows, throughout its outer margin (Fig. 24).

Prothorax 1.06x as broad as long, at middle 1.1x as broad as the posterior margin; sides rounded; anterior margin only 0.8x as broad as the posterior margin, truncate dorsally and vertical laterally, while posterior margin subtruncate; sides rounded; upper surface rugosely punctate, their interspaces granulate. Legs with hind tibial apex without any dense, golden yellow hairs (Fig. 67).

Elytra ovate, with basal margin strongly raised, its external angle acute, humeral fold prominent, not at all impressed on the declivity; apices rounded in male, pointed but not mucronate in female; stria shallowly punctate; intervals convex, much raised; elytral vestiture with predominant scales squarish, reddish brown, with 9-11 ridges (Fig. 243), less predominant more elongate, brown with a rounded base and gradually broadened apex, their inner core opaque and granulated, with 4 ridges (Fig. 244).

Male genitalia

Aedeagus with median lobe in profile arcuate at base, its apex rounded, length: breadth ratio 6:1, apophyses 0.42x as long as median lobe (Figs. 183 and 184). **Tegmen** with dorsal piece 3x as broad as the basal piece; parameres moderately long and their apices pointed; manubrium 0.52x as long as median lobe, very slender, its apex broadened and rounded (Fig. 185). **Spiculum gastrale** with shaft 2x as long as manubrium, uniformly slender, its apex clefted, basal prongs subequal, their apices broadly rounded (Fig. 125).

Length: Male: 7.78 - 8.5 mm; Female: 9.14 mm.

Breadth: Male: 2.50 - 3.20 mm; Female: 2.70 mm.

Holotype: 1 ♂, INDIA: Kerala: Malabar: Dhony forests, 26.V.1922, Coll. Ramakrishna; **Allotype:** 1 ♀, with same data as above; **Paratype:** 1 ♂, with same data as above (NPC).

Distribution: INDIA: Kerala.

Etymology: This species resembles *decipiens* in general shape and size, hence the name *subdecipiens* sp.nov.

Indomias ramakrishnani sp.nov.

(Figs. 6, 45, 72, 122, 174, 175, 176, 237, 238, 270 and 295)

Diagnosis: This species resembles *cretaceus* but can be distinguished based on the following characters: Shape more elongate, length: breadth ratio of whole body 3.2:1. Rostrum deeply impressed at the middle dorsally, central furrow rounded anteriorly and pointed posteriorly. Antennae with first funicle segment 1.5x as long as the second. Elytra with intervals three, four, five and six slightly impressed at the posterior declivity and humeral fold not prominent, their apices rounded.

Description: General colour black with pale or dull green vestiture (Fig. 295). Head as long as rostrum, upper surface flat, with deep, scattered punctations. Rostrum deeply impressed at the middle dorsally; as long as broad, anterior margin 0.88x as broad as the posterior margin; central furrow rounded anteriorly and pointed posteriorly, located more towards the anterior margin; lateral carinae distinct, running throughout the length of rostrum; sides straight; scrobes uniformly broad, parallel anteriorly and smoothly rounded at either ends. Eyes dorsolateral, convex, 2x as long as broad. Antennae piceous; scape abruptly clavate; funicle with its first segment 1.5x as long as the second, third to fifth conical, sixth longer and broader at apex; club transverse (Fig. 6).

Prothorax 1.09x as broad as long, its breadth at middle 1.1x as broad as the posterior margin; sides rounded at the middle and towards the anterior margin, but straight towards the posterior margin; anterior margin 0.68x as broad as the posterior margin, truncate dorsally and vertical laterally, posterior margin subtruncate, basal lobe slightly emarginate; upper surface rugosely punctate and interspaces perfectly

tuberculate. Legs with hind tibial apex without any dense, golden yellow hairs (Fig. 72).

Elytra narrowly ovate, with basal margin strongly raised, its external angle acute, humeral fold small and not projecting; not at all impressed on the declivity, apices rounded; stria deeply punctate, intervals broad, convex and raised, intervals three, four, five and six slightly impressed on the declivity; elytral vestiture with predominant scales circular, reddish brown, with patches of granulated areas (Fig. 237), less predominant, elongate, brown, with much broader and triangular base, apex smoothly rounded, narrowed and bent, with 2 ridges (Fig. 238).

Male genitalia

Aedeagus with median lobe tubular; in profile arcuate at base, apex sharply pointed, length: breadth ratio 9.5:1, gradually broadened from base to apex, broadest at its junction with apophyses; apophyses 0.68x as long as median lobe (Figs. 174 and 176). **Tegmen** with dorsal piece 3x as broad as basal piece; parameres long, narrowed to a sharply pointed apex; manubrium moderately long, 0.42x as long as median lobe, uniformly thick, its apex enlarged and rounded (Fig. 175). **Spiculum gastrale**, with shaft 2.5x as long as manubrium, uniformly thick, its apex bent at right angles, enlarged and rounded; basal prongs subequal, their apices smoothly pointed (Fig. 122).

Length: Male: 8.15 mm; **Breadth:** Male: 2.53 mm.

Holotype : 1 ♂, INDIA: Kerala: Malabar: Dhony forests, 26.V.1922, Coll. Ramakrishna (NPC).

Distribution: INDIA: Kerala.

Etymology: This species is named in honour of late Dr. T. V. Ramakrishna Ayyar, the collector of this specimen.

Indomias mucronatus sp.nov.

(Figs. 21, 44, 71, 87, 235, 236, 269 and 294)

Diagnosis: This species resembles *cretaceus* but can be distinguished by the following characters: Rostrum deeply impressed, central furrow club shaped, ending in a narrow, faint line, before reaching vertex. Elytra with its longitudinal curvature less convex, gradually sloping behind, humeral fold not prominent, their apices mucronate, intervals four, five and six deeply impressed at the posterior declivity. Antennae with funicle having its first segment 1.5x as long as the second.

Description: General colour black with dull green vestiture (Figs 294). Head as long as rostrum, upper surface convex, with deep, scattered punctations. Rostrum deeply impressed at middle dorsally, as broad as long, anterior margin 0.9x as broad as its posterior margin; central furrow club shaped, ending in a narrow, faint line, before reaching vertex; lateral carinae distinct; sides straight; scrobes narrowed at the middle and pointed at either ends, space between scrobes as much as the length of scrobe. Eyes dorsal, convex, 2x as long as broad. Antennae dark brown; scape abruptly clavate; funicle with its first segment 1.5x as long as the second, broader than second (Fig. 21).

Prothorax 1.02x as broad as long, its breadth at middle 1.1x broad as the posterior margin; sides rounded; anterior margin only 0.87x as broad as the posterior margin, truncate dorsally, acute laterally, posterior margin truncate; upper surface with coarse, scattered punctations, their interspaces granulate, without any stria. Legs with hind tibial apex without any dense, golden yellow hairs (Fig. 71).

Elytra ovate, with basal margin strongly raised, its external angle acute, humeral fold present, but not prominent; not at all impressed on declivity, apices mucronate; stria punctate, intervals uniformly broad, surface convex and raised, intervals four, five and six deeply impressed

in the posterior declivity; elytral vestiture with predominant scales, curved, elongate, reddish brown, with a short pedicel, their inner core opaque and with 2-3 ridges (Fig. 235), less predominant more elongate, broadened towards apex and with 3 ridges (Fig. 236).

Female genitalia

Spermatheca could not be described. Spiculum ventrale with shaft 4.2x as long as the basal plate, more or less uniformly thick, its apex slightly deflected and clubbed; basal plate spatulate, broadest at the basal half, slightly longer than broad (1.12:1), its apex bluntly rounded with a tuft of short hairs (Fig. 87).

Length: Female: 8.92 mm; **Breadth:** Female: 3.19 mm.

Holotype: 1 ♀, INDIA: Kerala: Malabar: Dhony forests, 26.V.1922. Coll. Ramakrishna (NPC).

Distribution: INDIA: Kerala.

Etymology: This species is named based on its distinct character of mucronate nature of apex of elytra.

***Indomias satyanarayanai* sp.nov.**

(Figs.22,46,73,123,177,178,179,239,240,271 and 296)

Diagnosis: This species resembles *cretaceus* but can be distinguished by the following characters: Rostrum deeply impressed at the middle dorsally, central furrow short, broad, oval, with either ends rounded. Prothorax as long as broad, upper surface shallowly punctate. Antennae with funicle having its first segment 1.3x as long as the second. Elytra with humeral fold not projecting, intervals fourth, fifth and sixth with an impression at the posterior declivity. Male genitalia with shaft of spiculum ventrale 1.2x as long as median lobe, apex of manubrium rounded and capitate, apophyses 0.77x as long as median lobe.

Description : **General colour** black with pale grey or black vestiture (Fig. 296). **Head** only 0.8x as long as rostrum, upper surface convex,

with shallow, scattered punctations. **Rostrum** deeply impressed at the middle dorsally, 1.05x as long as broad, its breadth at anterior margin 0.73x as that of posterior margin; central furrow short, broad, oval with either ends rounded; lateral carinae distinct throughout rostrum; sides narrowed towards anterior margin; scrobes uniformly broad, rounded at either ends and broadest towards eyes. **Eyes** dorsal and convex. **Antennae** reddish brown; scape abruptly clavate; funicle having its first segment 1.3x as long as the second, third and fourth subequal, fifth and sixth equal, seventh broadest; club conical and hairy (Fig. 22).

Prothorax as long as broad, its breadth at middle 1.1x as broad as the posterior margin; sides rounded; anterior margin only 0.86x as broad as the posterior margin, truncate dorsally and acute laterally, posterior margin subtruncate; upper surface shallowly punctate and interspaces obscurely granulate. Legs with hind tibial apex without any dense, golden yellow hairs (Fig. 73).

Elytra broadly ovate, with basal margin strongly raised, its external angle acute, humeral fold present but not projecting; not at all impressed on the declivity, apices separately pointed but not truly mucronate; stria shallowly punctate; intervals broad, convex and raised, fourth, fifth and sixth with an impression at the posterior declivity; elytral vestiture with predominant scales subrectangular to subovate, yellow, with 9-10 ridges (Fig.239), less predominant, more elongate, brown, broadened towards apex, with 3 ridges (Fig.240).

Male genitalia

Aedeagus with median lobe membranous at middle, in profile arcuate at base, its apex pointed, length: breadth ratio 9: 1; apophyses 0.77x as long as median lobe, their apices truncate (Figs.177 and 178). **Tegmen** with dorsal piece 7x as broad as the basal piece; parameres long, pointed at their apices; manubrium gradually thickened towards

the rounded apex, 0.5x as long as the shaft of spiculum gastrale (Fig.179). Spiculum gastrale uniformly thickened, narrowed towards either ends, its apex bent at acute angle and rectangular; basal prongs subequal, their apices rounded, each prong with a wavy base (Fig.123).

Length: Male: 8.55 mm; **Breadth:** Male: 2.73 mm.

Holotype : 1♂ , INDIA: Tamil Nadu: Thadiankudisai, 29. IX. 1987, Coll. Kailash, on shrubs (NPC).

Distribution: INDIA: Tamil Nadu.

Etymology: This species is named on the author's father Shri Satyanarayana.

***Indomias marshalli* sp.nov.**

(Figs. 20, 43, 70, 86, 105, 233, 234, 268 and 293)

Diagnosis : This species resembles *decipiens* but can be distinguished by the following characters: Rostrum shallowly impressed. Elytra in its longitudinal curvature gradually sloping behind. Head with nine distinct rows of elongate, curved scales. Antennae with funicle having its first segment 1.5x as long as the second. Prothorax 1.1x as broad as long. Elytra with the humeral fold not prominent, their apices rounded.

Description: General colour black with pale green vestiture (Fig. 293).

Head slightly shorter than rostrum (1:1.1), upper surface convex, with deep, scattered punctations. **Rostrum** shallowly impressed at the middle dorsally, as long as broad, breadth at anterior margin 0.75x as that of posterior margin; central furrow moderately long, uniformly thick; lateral carinae distinct; with nine distinct rows of elongate, curved scales; sides rounded, slightly narrowed towards the anterior margin where it is dilated; scrobes 0.6x as long as rostrum, bent anteriorly but broadly rounded and convergent posteriorly, space between scrobes as much as the breadth of rostrum at anterior margin. **Eyes** dorsolateral and convex. **Antennae** brown; scape gradually thickened; funicle with its first

segment 1.5x as long as the second, third to sixth bead shaped, seventh slightly longer than other segments; club with its first segment transverse (Fig. 20).

Prothorax 1.1x as broad as long, its breadth at middle almost equal to that of posterior margin; sides straight at middle and towards the posterior margin, but rounded towards the anterior margin; anterior margin only 0.66x as broad as the posterior margin, truncate dorsally, vertical laterally, posterior margin truncate, basal lobe emarginate; upper surface with scattered, deep punctations, without any stria. Legs with hind tibial apex without any dense, golden yellow hairs (Fig. 70).

Elytra ovate, with basal margin strongly raised, its external angle perpendicular or acute, humeral fold present but not prominent, not at all impressed on the declivity; apices rounded; stria deeply punctate, intervals of equal breadth, convex and raised; upper surface less convex, deeper near base and middle, gradually sloping behind; elytral vestiture with predominant scales elongate, reddish brown with a truncate base, rounded apex and with 4 ridges (Fig.234), less predominant conspicuous, subcircular, with a broad, squarish base and with nine ridges (Fig.233).

Female genitalia

Spermatheca with proximal arm 2.5x as broad as the distal arm, angle between the arms obtuse; nodulus round, apex pointed; ramus cuboidal, 2.5x as broad as the nodulus; cornu tubular with apex narrowed, deflected and pointed (Fig.105). **Spiculum ventrale** with its shaft 4.5x as long as the basal plate, at apex broadly rounded; basal plate laminate, slightly longer than broad (1.2: 1), apex flat and bare, apical half subconical, basal half trapezoidal (Fig.86).

Length: Female: 9.46 mm; **Breadth :** Female : 2.93 mm.

Holotype: 1 ♀, INDIA: Kerala: Malabar: Dhony forests, 26.V.1922. Coll. Ramakrishna (NPC).

Distribution: INDIA: Kerala.

Etymology: This species is named in honour of late Sir Guy.A.K. Marshall.

Indomias beelsoni Marshall

(Figs. 8, 34, 57, 114, 144, 145, 146, 217, 260 and 311)

Description : General colour black, head and rostrum with thin bluish grey vestiture; prothorax with vestiture sparse, dull blue dorsally, sides entirely clothed with dense, metallic green vestiture; elytra with disk, as far as the fourth stria, covered mainly with black vestiture, interspersed with green scales, which are sometimes denser along the suture, beyond fourth stria, sides clothed with dense, pale green vestiture, almost to the margin, inner edge of green area being very irregular; the lower surface with dense, greyish green vestiture (Fig. 311).

Head 0.87x as long as rostrum, upper surface convex, with coarse punctations, usually confluent longitudinally, with a faint, broad, transparent impression behind the eyes; vertex with a median fovea and rarely with a median stria. **Rostrum** shallowly impressed at middle, 1.1x as long as broad, anterior margin 0.68x as broad as the posterior margin; central furrow broad and rounded anteriorly, narrowed and pointed posteriorly; lateral carinae run throughout entire length of rostrum and parallel throughout; sides straight and parallel posteriorly; scrobes broader and rounded anteriorly and narrow, sharply pointed and parallel to eyes posteriorly. **Eyes** dorsal and convex, space between eyes as much as the space between scrobes. **Antennae** piceous; scape gradually clavate; funicle with first segment 1.33x as long as second, third to sixth bead like and equal; club much broader than funicle segments and conical (Fig. 8).

Prothorax 1.07x as broad as long, broadest at about middle, where it is 1.1x as broad as the posterior margin; sides gently rounded,

narrowed anteriorly; anterior margin only 0.77x as broad as the posterior margin, truncate dorsally and oblique laterally, posterior margin subtruncate with its basal lobe emarginate; upper surface with coarse, confluent punctations, interspaces finely and sparsely punctate, without any dorsal stria or impressions, elongate scales very short, flattened and recumbent. Legs with hind tibial apex without any dense, golden yellow hairs (Fig. 57).

Elytra narrowly ovate (male) or slightly broader (female), basal margin strongly raised, its external angle acute, humeral fold not very prominent, posterior declivity not impressed; striae deeply punctate; intervals slightly convex and of even height, excepting first, which is somewhat raised at apex, flattened elongate scales short, recumbent and inconspicuous at the basal half, longer and more curved behind; elytral vestiture with predominant scales subcircular, light brown, with surface irregularly impressed (Fig. 217).

Male genitalia

Aedeagus with median lobe slender; in profile slightly arcuate, apex rounded, ejaculatory duct distinct; length: breadth ratio 8.5: 1; apophyses 0.41x as long as median lobe (Figs. 145 and 146). **Tegmen** with dorsal piece 3x as broad as the basal piece and very long, as long as manubrium; parameres short, uniformly broad, apices indistinct; manubrium slender, very short, only 0.17x as long as median lobe, with apex blunt (Fig. 144). **Spiculum gastrale** with shaft 0.94x as long as manubrium, uniformly broad, with apex broadened and smoothly rounded; basal prongs subequal, their apices pointed (Fig. 114).

Length: Male : 7.5 - 8.85 mm; **Breadth:** Male : 3.00 - 3.5 mm.

Specimens examined: 1 ♂, INDIA: Tamil Nadu: Nilambur, 15.VIII.1925, Coll. C.F.C. Beeson; 1 ♂, Aravalllicava, 21.VIII.1925, Coll. S. N. Chatterjee (NPC).

Associated habitat: Teak.

Economic importance: This species feeds on the leaves of young teak and in some cases, defoliate the trees (Marshall, 1921).

Indomias decipiens Marshall

(Figs.3,29,55,82,98,112,138,139,140,210,211,257and 307)

Description : General colour black, with dull brown to sand grey vestiture (Fig. 307). **Head** 1.1x as long as rostrum, upper surface convex, with scattered deep punctations; frons 2x as broad as the length of eye. **Rostrum** plane dorsally, as long as broad, anterior margin 0.83x as broad as the posterior margin; central furrow club shaped, narrowed posteriorly; lateral carinae distinct; sides straight and narrowing towards the anterior margin; scrobes uniformly broad, oriented in a semicircular fashion up to the anterior margin of rostrum, then becoming parallel towards the eyes, space between scrobes 1.1x as that between the eyes. **Eyes** dorsolateral, moderately convex and circular, space between the eyes as much as the breadth of rostrum at posterior margin. **Antennae** dark brown; scape gradually broadened; funicle with first segment 1.1x as long as the second, third and fourth subequal, fifth rounded; club broad, conical (Fig. 3).

Prothorax as long as broad in male, slightly broader than long in female (1 : 0.9), its breadth at middle 1.1x as that of posterior margin; sides rounded anteriorly but constricted behind, gradually narrowing towards the anterior margin which is only 0.7x as broad as the breadth at middle; anterior margin 0.77x as broad as that of posterior margin, truncate dorsally and oblique laterally, posterior margin subtruncate; upper surface with coarse, confluent punctations, interspaces granulate. Legs with hind tibial apex without any dense, golden yellow hairs (Fig. 55).

Elytra narrowly ovate in male, broadly ovate in female, basal margin strongly raised, its external angle acute, with humeral fold slightly prominent, posterior declivity not impressed; apices in female each with a distinct, short mucro, but in males rounded; stria deeply punctate; upper surface less convex, almost flat, deepest near the base, then gradually sloping backwards and becoming abruptly steeper behind; ratio of length of elytra from basal margin to posterior declivity and from the posterior declivity to the apex 4:1; intervals less convex; second and third intervals 2x as broad as the first and fifth; elytral vestiture with predominant scales ovate to conical, flat, reddish brown, with 8-9 broken ridges (Figs.210 and 211). Venter with setae on the first two ventrites longer and finer when compared to those of *cretaceus*.

Male genitalia

Aedeagus with median lobe slender, slightly arcuate in profile, broadest at its junction with apophyses, length: breadth 9:1; transfer apparatus massive, transparent, less sclerotized; apophyses 0.44x as long as the median lobe; apex of median lobe bluntly rounded (Figs. 138 and 140). Tegmen with dorsal piece 5x as broad as basal piece; parameres short, broad, apices smoothly rounded; manubrium short, uniformly thick, 0.33x as long as median lobe, it is bent towards apex in triangular fashion at 45 °angle, with its apex, swollen and rounded (Fig.139). Spiculum gastrale with shaft moderately long, 0.66x as long as the median lobe, apex bent, narrowed and blunt (Fig.112).

Female genitalia

Spermatheca with proximal and distal arms subequal, proximal arm swollen, 2.5x as broad as distal arm; angle between proximal and distal arms acute; nodulus circular and smoothly rounded; ramus at least 3x as nodulus, rectangular; cornu slightly bent inwards at apex and pointed (Fig.98). Spiculum ventrale with shaft broader at middle,

narrowed at base, apex broadened and circular; basal plate laminate, longer than broad (3:2), with apex bluntly rounded and bare; ratio of length of basal plate to that of shaft 1:4 (Fig.82).

Length: Male : 7.35 mm; Female: 7.55 mm.

Breadth: Male: 2.3 mm; Female: 2.7 mm.

Specimens examined: 1♂, without locality, date and collector's name; 1♀: INDIA: Karnataka: Bangalore, 26.VIII.1913, Coll. T.B.F., on Mulberry; 1♀ (paratype) Tamil Nadu: Nilgiris, without date, Coll. H.L. Andrewes; 1♂: Coimbatore, 18.VIII.1912, Coll. T.V.R.; Kerala: Pampadumpara, 22.I.1994, Coll. P.M. Mathew on Cardamom.

Distribution: INDIA: Karnataka: Bangalore; Kerala: Pampadumpara; Tamil Nadu: Coimbatore; Nilgiris.

Associated habitats: Mulberry, cardamom.

Taxonomic note : This species exhibits sexual dimorphism. In females, prothorax is slightly broader than long (1 : 0.9), as compared to males, where it is as long as broad. Similarly, the apices of elytra in females are with distinct, short mucro, while in males they are rounded. Males are shorter.

Economic importance: Reported to be causing damage to young cinchona trees (Marshall,1916).

Indomias yercaudensis sp.nov.

(Figs. 17, 52, 78, 128, 189, 190, 191, 228, 229, 279 and 302)

Diagnosis: This species resembles *lividus* from which it can be distinguished by the following characters: Rostrum plane dorsally. Elytra with basal margin strongly raised, with an impression at the base of intervals five and six, intervals three and five not broader than the others. Prothorax with the central stria uniformly broad, rounded at either ends and running upto the posterior two thirds. General body size with length: breadth ratio 2.8:1.

Description: General colour black with metallic green or bluish green vestiture, prothorax and elytra interspersed with metallic blue scales (Fig. 302). Head as long as rostrum, upper surface flat or even, with shallow, confluent punctations, usually hidden behind vestiture. Rostrum plane dorsally, as long as broad, anterior margin 0.83x as broad as the posterior margin; central furrow short, broad; lateral carinae distinct; sides straight; scrobes 2x broad as breadth at posterior margin and squarish anteriorly but narrow and convergent posteriorly. Eyes dorsolateral, slightly or moderately convex, length: breadth ratio 2.66:1. Antennae dark brown; scape abruptly clavate; funicle with first segment 1.16x as long as the second, third and fourth subequal, fifth and sixth equal and bead like; club conical (Fig. 17).

Prothorax as long as broad, its breadth at middle 1.2x as broad as the posterior margin; sides rounded; anterior margin 0.9x as broad as the posterior margin, truncate dorsally and acute laterally, posterior margin truncate; upper surface with shallow confluent punctations at the middle, lateral areas rugosely punctate. Legs with hind tibial apex without any dense, golden yellow hairs (Fig. 78).

Elytra broadly ovate, with basal margin strongly raised, its external angle acute or perpendicular, humeral fold present and projecting, posterior declivity not impressed, with an impression at the base of intervals five and six; apices rounded; stria shallowly punctate, hidden behind vestiture; intervals broad, plane and not much raised; elytral vestiture with predominant scales circular, orange, with ridges (Fig. 228), less predominant more elongate, orange, with ridges incomplete (Fig. 229).

Male genitalia

Aedeagus with median lobe much slender, in profile narrowly arcuate at the base, but apex pointed, length: breadth ratio 10:1,

apophyses 0.85x as long as the median lobe, their apices rounded; endophallus duct with a sclerotized patch and a distinct, transfer apparatus (Figs. 189 and 191). Tegmen with dorsal piece 3x as broad as the basal piece; parameres short, broad, thumb shaped; manubrium slender, uniformly thick, only 0.64x as long as the median lobe, with apex deflected and truncate (Fig. 190). Spiculum gastrale with shaft very slender, only 0.25x as broad as the median lobe, 1.1x as long as median lobe, apex pointed; basal prongs equal, their apices rounded (Fig. 128).

Length: Male: 7.41 mm; **Breadth:** Male: 2.45 mm.

Holotype: 1 ♂, INDIA: Tamil Nadu: Salem: Yercaud 7-15.V.1919. Coll. Isaac (NPC).

Distribution: INDIA: Tamil Nadu.

Etymology: This species is named after the locality Yercaud, from where it was collected.

Indomias frater Marshall

(Figs. 10, 33, 59, 83, 99, 113, 141, 142, 143, 212, 213, 214, 258 and 306)

Description: **General colour** black, covered with dense, uniform, metallic green or bluish green vestiture, inflexed margins of prothorax and elytra with yellow powdery patches; elytra with an elongate, yellow patch at the base of intervals four and five, another similar smaller patch at the apex of these intervals (Fig. 306). **Head** as long as rostrum, upper surface moderately convex, with fine, scattered punctations and without any central stria. **Rostrum** plane dorsally, tranverse, 1.2x as broad as long, breadth at anterior margin only 0.64x as that of posterior margin; central furrow very short, broad and pushed towards anterior margin; lateral carinae distinct; sides straight, narrowing gradually towards anterior margin; scrobes uniformly broad, narrow, much longer, almost 0.9x as long as rostrum, extending from anterior margin of rostrum

to the anterior margin of prothorax, rounded anteriorly and pointed posteriorly towards eyes, space between scrobes 0.78x as much as the space between eyes. Eyes entirely lateral, broadly oval, moderately convex and prominent, 0.5x as long as rostrum; space between eyes as much as the breadth of rostrum at its posterior margin. Antennae dark brown; scape abruptly clavate; funicle with first and second segments equal, third and fourth equal, fifth and sixth subequal; club conical, with only last two segments hairy (Fig. 10).

Prothorax as long as broad, its breadth at middle 1.1x as broad as the posterior margin; sides rounded throughout, broadest at about middle, then gradually narrowing towards anterior margin; lateral margins inflexed; anterior margin only 0.67x as the breadth at middle and 0.72x as broad as the posterior margin, truncate dorsally, acute laterally, posterior margin truncate, basal lobe emarginate; upper surface with shallow, confluent punctations, interspaces coriaceous, without any central stria. Legs with hind tibial apex without any dense, golden yellow hairs (Fig. 59).

Elytra with basal margin strongly raised, its external angle perpendicular or acute, humeral fold prominent and projecting; longitudinal curvature moderately convex; apices almost rounded in male and slightly mucronate in female; stria finely punctatostriate; intervals even and plane, interval three not higher than two on its declivity, which bears no impression, elongate scales small but distinct; elytral vestiture with predominant scales circular to oval, flat, reddish orange to reddish blue, their inner areas granulated, and base with a pedicel (Figs. 212 and 213), less predominant elongate, club shaped, with a rounded pedicel at base, with 3 ridges (Fig. 214).

Male genitalia

Aedeagus with median lobe slender, broadest at middle, length : breadth ratio 8:1, in profile median lobe scarcely arcuate, its apex narrow and bluntly pointed; transfer apparatus less sclerotized, ejaculatory duct very long (Figs.141 and 142). Tegmen with dorsal piece 7x as broad as basal piece, dorsal piece very long, 0.44x as long as the manubrium; parameres long, slender, their apices rounded; manubrium 0.5x as long as the median lobe, and as long as tegmen its apex broadened and spatulate (Fig.143). Spiculum gastrale elongate, as long as median lobe, uniformly thick, its apex blunt; basal prongs subequal, triangular and pointed (Fig.113).

Female genitalia

Spermatheca with proximal arm triangular, relatively much swollen, 4x as broad as the distal arm, as long as cornu; angle between two arms steeply acute, distal arm almost parallel to the proximal, without any distinction between nodulus and ramus; cornu long, bent, close towards proximal arm. (Fig.99). Spiculum ventrale with shaft slender, uniformly thick, its apex blunt; basal plate spatulate, 1.19x as long as broad, 0.25x as long as the shaft, apical half triangular, with a rounded apex and with 4-5 short stout hairs (Fig.83).

Length: Male: 5.00-8.00 mm; Female: 6.80- 7.40 mm.

Breadth: Male: 2.00-2.66 mm; Female: 2.45- 2.80 mm.

Specimens examined: 2 ♂, 3 ♀, INDIA: Tamil Nadu: Yercaud: Shevaroy: 4500 ft, 23. IV-4.V.1913, Coll. Fletcher, on coffee; Karnataka: Coorg: Pollibetta, IX. 1903, without collector's name; 2 specimens, 1 paratype, Tamil Nadu: Shevaroy: 4000 ft, 24.VIII.1907, Coll. C.W.M., on coffee; Paiyur: Coll. G. Lund, without date; 5 specimens, Tamil Nadu: Yercaud, Shevaroy, 4500 ft, 21.IV to 4.V.1913, Coll. Fletcher.

Associated habitat: Coffee.

Distribution: INDIA: Karnataka: Coorg; Tamil Nadu: Nilgiris; Salem; Yercaud.

Indomias cretaceus Marshall

(Figs. 4, 31, 56, 81, 97, 111, 135, 136, 137, 209, 256 and 310)

Description : General colour black with uniform, chalky white or pale green vestiture, without any pollinose lateral stripe on elytra (Fig. 310).

Head convex, as long as rostrum, with scattered, deep punctations; frons as broad as the rostrum at anterior margin. **Rostrum** transverse, plane dorsally, 1.1x as broad as long, anterior margin 0.87x as broad as posterior margin; central furrow uniformly broad throughout, distinct up to anterior margin; lateral carinae distinct; scrobes broadest at middle, narrowed and pointed anteriorly, rounded posteriorly, space between scrobes as much as the space between eyes. **Eyes** oval and dorsolateral. **Antennae** reddish brown; scape gradually broadened; funicle with first segment 1.1x as long as second, third and fourth equal and bead like, fifth and sixth equal; club conical, entire surface densely hairy (Fig. 4).

Prothorax 1.1x as broad as long, its breadth at middle 1.1x as that of posterior margin; sides rounded throughout and strongly narrowed anteriorly; anterior margin 0.87x as that of posterior margin, truncate dorsally and oblique laterally, posterior margin subtruncate; upper surface with coarse, confluent punctations and interspaces granulate. Legs with hind tibial apex without any dense, golden yellow hairs (Fig. 56).

Elytra ovate, with basal margin strongly raised, its external angle acute, the humeral fold prominent, not impressed on the declivity, external basal angle acute; apices rounded in male, separately pointed but not truly mucronate in female; stria deeply punctatostriate; intervals slightly convex, with short, elongate scales; dorsal outline much convex, deepest near the middle and gradually sloping behind; ratio of length from basal

margin to posterior declivity and from posterior declivity to apex 0.9 : 1; elytral vestiture with predominant scales reddish, almost ovate, with 6-7 ridges (Fig. 209). Venter with elongate scales on the first two ventrites short and flattened, when compared to those of *decipiens*.

Male genitalia

Aedeagus with median lobe, short, broad, broadest at junction with apophyses, apex pointed, length: breadth ratio 5.8: 1, apophyses short, only 0.5x as long as median lobe, apices broadly rounded (Figs. 135 and 136). Tegmen with dorsal piece 3x as broad as the basal piece; parameres very short, their apices pointed; manubrium moderately long, 0.57x as long as the median lobe, it is bent throughout its length, apex bluntly rounded (Fig. 137). Spiculum gastrale with shaft as long as median lobe, slender at middle, broad at either ends, apex bent acutely and rectangular; basal prongs subequal, apices rounded (Fig. 111).

Female genitalia

Spermatheca with proximal arm swollen, 3x as broad and 0.64x as long as the distal arm, angle between the arms obtuse; nodulus globular, ramus cuboidal, 3.4x as broad as nodulus; cornu narrowing towards smoothly rounded apex (Fig. 97). Spiculum ventrale with shaft moderately long, uniformly thick, its apex bluntly rounded; basal plate 0.66x as long as shaft spatulate, longer than broad (1 : 0.7), with basal half rectangular, apical half subconical, apex blunt with tuft of hairs (Fig. 81).

Length: Male : 6-6.5 mm; Female : 8.5 - 9.5 mm.

Breadth: Male : 2.5 - 3.0 mm; Female : 3.25 - 3.60 mm.

Specimens examined : 2 ♂, INDIA: Tamil Nadu: Gudalur: Nilgiris: 3500 ft, 1949, without collector's name; 1 ♀, Karnataka: Bangalore: 26.VIII.1913, Coll. T.B. F., on mulberry; Nilgiris, without date and collector's name; 1 ♂, Coimbatore; Bailur forest, 23-28.XI.1913, Coll.

Ramakrishna; Nilgiris: Adderley: 3000 ft, 26.IV.1915, Coll. G.R. Dutt; Karnataka: Bangalore, 24.VI.1908, Coll. T.V.R.; Karnataka: Bangalore: VI.1906, Coll. T.V.R.; Kerala: Malabar: Dhony forests: 26.V.1922, Coll. Ramakrishna; 6 specimens, Karnataka: Bangalore: PDBC, 3.VII.1998, Coll. J. Poorani, on redgram; 6 specimens, Karnataka: Bangalore: PDBC, 25.V.1998, Coll. J. Poorani, on rose; Tamil Nadu: Thadiyankudisai, 24.VII.1999, Coll. S. Suresh, on coffee; 3 specimens, Karnataka: Bangalore: PDBC, 25.V.1998, Coll. J. Poorani, on radish.

Distribution: INDIA: Karnataka: Tamil Nadu

Associated habitats: coffee, radish, rose, redgram, mulberry.

Taxonomic note: This species exhibits sexual dimorphism in size, females are more robust than males. Marshall (1916) stated that apical margin of prothorax is vertically truncate laterally, but it has been found that it is obliquely truncate.

Economic importance: It is reported to be a vector of sandal spike disease in sandal (Hart and Rengaswamy, 1926; Anonymous, 1932, 1933). It was reported feeding on coffee (Ayyar, 1922), mulberry (Wadhi and Batra, 1964) and on *Rawolfia seperpentina* plantations (Pratap Singh, 1964).

Indomias anamalainus Marshall

(Figs.12,30,65,90,101,118,156,157,158,215,216,259 and 308)

Description: General colour black, with thin, grey or bluish grey vestiture; prothorax with an ochreous yellow, lateral stripe; elytra with a similar stripe on the intervals six and seven, extending inwards at the base and near the apex as far as interval four, and with ochreous vestiture along the margin (Fig. 308). **Head** as long as rostrum, upper surface moderately convex, finely punctate; frons with a central stria, which fuses with central furrow of rostrum and extending a little on to vertex. **Rostrum** plane dorsally, as long as broad, anterior margin only 0.8x as

broad as the posterior margin; central furrow longer, broadest anteriorly and getting narrower posteriorly; lateral carinae distinct, parallel posteriorly; sides straight; scrobes narrow, uniformly thick, 0.8x as long as rostrum and almost touching either ends. Eyes dorsolateral, strongly convex, space between eyes 0.88x as the space between scrobes and as much as the breadth of rostrum at posterior margin. **Antennae** piceous; scape abruptly clavate; funicle with first segment as long as but little broader than second, third and fourth equal and broader than fifth and sixth, which are subequal, seventh triangular; club slightly broader and conical (Fig. 12).

Prothorax 1.1x as broad as long, its breadth at middle 1.2x as the posterior margin; sides smoothly rounded; anterior margin 0.9x as broad as the posterior margin, truncate dorsally and acute laterally, posterior margin subtruncate; upper surface more coarsely punctate. Legs with second tarsal segment without any trace of vestiture in the form of scales. Legs with hind tibial apex without any dense, golden yellow hairs (Fig. 65).

Elytra broadly (female) or narrowly ovate (male), with basal margin strongly raised, its external angle acute, humeral fold prominent and projecting, posterior declivity not impressed; apices mucronate (female) or pointed and not mucronate (male); longitudinal curvature moderately convex, deepest near middle and gradually sloping behind; stria deeply punctate; intervals broad, convex, moderately raised; elongate scales on the discal area much smaller; elytral vestiture with two types of scales, found in almost equal proportions. First type perfectly round, brown and with inner core granulated (Fig. 215); second type elongate, their apices broader, with 3 ridges (Fig. 216).

Male genitalia

Aedeagus with median lobe broadest at middle and at its junction with apophyses, length: breadth ratio 9:1; in profile apex pointed; transfer apparatus massive and conical; apophyses 0.57x as long as the median lobe (Figs. 156 and 157). Tegmen with dorsal piece 8x as broad as the basal piece; parameres short, tubular, their apices poorly defined; manubrium uniformly thick, 0.5x as long as the median lobe, longer than tegmen, 1.2x as long as tegmen, its apex slightly bent and rounded (Fig. 158). Spiculum gastrale with its shaft 1.1x as long as median lobe, uniformly thick but narrowed towards bluntly rounded apex; basal prongs triangular, subequal, their apices rounded (Fig. 118).

Female genitalia

Spermatheca with proximal arm bulbous, 3x as broad as the distal arm, 1.33x as long as cornu, angle between proximal and distal arms obtuse; nodulus short, notched and continuous with apex of proximal arm; ramus 3x as broad as nodulus, more or less rectangular; cornu 0.33x as broad as proximal arm, slightly narrowed and rounded at apex (Fig. 101). Spiculum ventrale with its shaft elongate, 5x as long as basal plate, uniformly thick, its apex bluntly pointed; basal plate laminate, with a short, pedicellate base, longer than broad (1:0.6), apical half subconical, apex rounded and fringed with many, thick hairs (Fig. 90).

Length: Male: 7.4 - 7.85 mm; Female: 10.63 mm.

Breadth: Male : 2.85 mm; Female: 3.99 mm.

Specimens examined : 1♂, INDIA: Tamil Nadu: Anamalais: Mount Stuart, 7.XII.1917, Coll. Y. R. Rao; 1♀, Kodaikanal, 5000 ft, 17.I.1917, Coll. Royal; 1♀, Tamil Nadu: Pulney hill, 4500 ft, 10-11.V.1917, Coll. P. S. Nathan (NPC).

Distribution: INDIA: Tamil Nadu; Anamalais; Kodaikanal; Palani hills.

Indomias subkraatzi sp.nov.

(Figs. 27, 53, 79, 129, 195, 196, 197, 250, 251, 278 and 303)

Diagnosis: This species resembles *kraatzi* but distinguished by the following characters: Rostrum 1.1x as broad as long, central furrow broad and almost fused with anterior margin but narrowed and pointed posteriorly. Antennae with club distinct i.e., segments narrowing and telescoped from base to apex. Prothorax 1.01x as broad as long. Male genitalia with apex of manubrium enlarged, conical, notched; spiculum gastrale with shaft having its apex truncate and horn like. Length: breadth ratio of general body size either equal to or more than 3:1.

Description: General colour black with pale or dull green vestiture (Fig. 303). Head as long as rostrum, upper surface moderately convex, with deep, scattered punctations, hidden behind vestiture. **Rostrum** shallowly impressed, 1.1x as broad as long, anterior margin only 0.75x as broad as the posterior margin; central furrow broad and almost fused with anterior margin, but narrowed and pointed posteriorly; lateral carinae complete and seen throughout the length of rostrum, extending beyond anterior margin of eyes atleast up to 0.25x as the length of eye; scrobes broader and broadly rounded anteriorly but much narrowed, sharply pointed and converging posteriorly. **Eyes** dorsal, moderately convex and cylindrical. **Antennae** dark brown; scape abruptly clavate; funicle with first segment 1.25x as long as the second, third and fourth equal, fifth and sixth subequal; club distinct due to the segments narrowing, and getting telescoped from base to apex (Fig. 27).

Prothorax 1.01x as broad as long, its breadth at middle 1.1x as broad as the posterior margin, sides rounded; anterior margin only 0.87x as broad as the posterior margin, truncate dorsally and acute laterally, posterior margin truncate; sides rounded; upper surface shallowly punctate, interspaces granulate. **Legs** with hind tibial apex having well developed, dense, golden yellow, short hairs (Fig. 79).

Elytra with basal margin strongly raised, its external angle acute, humeral fold present but not projecting; apices rounded; stria deeply punctate; intervals broad, convex; elytral vestiture with predominant scales subovate, reddish brown, with 8-10 ridges (Fig. 250), less predominant elongate, brown, with a short pedicel, inner core opaque, granulated, with 4-5 ridges (Fig. 251)..

Male genitalia

Aedeagus with median lobe slender, broadest at junction with apophyses, length: breadth ratio 6:1, membranous at middle; in profile arcuate at base, its apex blunt, apophyses 0.66x as long as the median lobe (Figs. 195 and 197). **Tegmen** with dorsal piece 5x as broad as the basal piece; parameres long, papillate, their apices rounded; manubrium 0.5x as long as the median lobe, uniformly thick, with an enlarged, notched, conical apex (Fig. 196). **Spiculum gastrale** with shaft as long as median lobe, uniformly thick, its apex truncate, horn like; basal prongs equal, their apices truncate and pointed (Fig. 129).

Length: Male: 9.03 mm; **Breadth:** Male: 2.85 mm.

Holotype: 1 ♂, INDIA: Kerala: Malabar: Dhony forests, 26, V.1922, Coll. Ramakrishna (NPC).

Distribution: INDIA: Kerala.

Etymology: This species resembles *kraatzi* in its golden yellow hairs at the hind tibial apex and, hence the name *subkraatzi* sp.nov.

Indomias albizziae sp.nov.

(Figs.15,41,68,92,103,224,267and 291)

Diagnosis: This species is related to *kraatzi* and *megakraatzi* sp.nov., from which it is distinguished by the following characters: Prothorax 1.25x broad as long, its greatest width is lesser than the greatest width of elytra. Fore legs with apex of femur never black and wrinkled. Length: breadth ratio of its general body size equal to or more than 3:1. Female

genitalia with spiculum ventrale having its basal plate ovate, spermatheca with its proximal arm as long as the distal arm.

Description : General colour black, with dull green or apple green vestiture; sides of prothorax and elytra with metallic green vestiture, rarely interspersed with reddish tinged scales (Fig. 291). **Head** as long as rostrum, upper surface moderately convex, finely coriaceous, with shallow confluent punctations; vertex impressed. **Rostrum** shallowly impressed at the middle dorsally, 1.1x as broad as long, breadth at anterior margin 0.77x as that of posterior margin; central furrow uniformly broad throughout, reaching the middle of eyes; lateral carinae do not extend beyond the anterior margin of eyes; sides narrowed towards anterior margin, but almost parallel; scrobes narrowed towards anterior margin of rostrum, uniformly broad, 0.6x as long as rostrum, smoothly rounded posteriorly. **Eyes** almost lateral, circular, moderately convex. **Antennae** piceous; scape very slender; with first funicle segment 1.43x as long as second, thick and broad (Fig. 15).

Prothorax subcylindrical, 1.25x as broad as long, its breadth at middle only 1.02x as the breadth at posterior margin; sides rounded at the front and constricted behind; anterior margin 0.75x as broad as the posterior margin, truncate dorsally, vertical laterally; posterior margin truncate, its basal lobe emarginate; upper surface rugosely punctate, interspaces obscurely granulate, central stria deep, found at the posterior two thirds. **Legs** with hind tibial apex having well developed, dense golden yellow hairs (Fig. 68).

Elytra broadly ovate, with basal margin slightly raised, humeral fold present but not prominent; apices slightly mucronate; stria finely punctate, intervals broad, almost plane, second and third impressed at the posterior declivity, elongate scales inconspicuous; elytral vestiture with broadly ovate scales, having patches of granulated areas (Fig. 224).

Female genitalia

Spermatheca with proximal arm subequal to distal arm, as long as and 2x as broad as the cornu, angle between them obtuse; nodulus triangular, with apex pointed; ramus almost cuboidal, 2x as broad as nodulus; cornu long, tubular, its apex bent and bluntly rounded (Fig. 103). Spiculum ventrale with shaft thickened towards apex, otherwise slender; basal plate ovate, 1.5x as long as broad, only 0.2x as long as the shaft, its apex rounded with 5-6 short, stout hairs (Fig. 92).

Length: Female: 9.54 mm; **Breadth:** Female: 3.24 mm.

Holotype : 1 ♀, INDIA: without locality and collector name, forest campus, 8.IV.1994, on *Albizzia lebbeck* (NPC).

Distribution: INDIA.

Etymology: It is named after the host *Albizzia lebbeck* on which it was found.

Indomias megakraatzi sp.nov.

(Figs. 19, 42, 69, 93, 104, 232 and 292)

Diagnosis: This species resembles *kraatzi* and *albizziae* sp.nov., but can be distinguished based on the following characters: Rostrum with lateral carinae short, not extending beyond the anterior margin of eyes. Prothorax with central stria rounded posteriorly and straight anteriorly, and it is restricted only to the posterior one thirds, its maximum width lesser than that of elytra. Length: breadth ratio of whole body never more than 3 : 1. Female genitalia with spiculum ventrale, having its apical half of basal plate perfectly conical, spermatheca with proximal arm 1.5x as long as cornu. Rostrum with its anterior margin 0.93x as broad as the posterior margin.

Description: General colour black, with pale or apple green vestiture; sides of head, prothorax and elytra with shining, metallic green vestiture (Fig.292). Head as long as rostrum, upper surface moderately convex, with shallow, scattered punctations; vertex shallowly impressed.

Rostrum strongly impressed at the middle dorsally, 1.2x as broad as long, anterior margin 0.93x as broad as the posterior margin, central furrow uniformly broad, slightly narrowed towards the posterior margin, reaching the middle of eyes, lateral carinae running throughout the rostrum, without any juxta marginal carina from apes to above the eye; sides narrowed and parallel towards the anterior margin; scrobes uniformly broad, smoothly rounded and bent anteriorly, but smoothly pointed, narrowed and divergent towards the eyes, space between scrobes as much as the length of rostrum. **Eyes** dorsolateral and convex. **Antennae** reddish brown; scape gradually clavate; funicle with first segment 1.6x as long as the second and also broader than the second (Fig.19).

Prothorax 1.2x as broad as long, its breadth at middle almost equal to that of posterior margin, broadest at the posterior margin; sides slightly rounded at the middle, well rounded at the anterior margin, and straight towards the posterior margin; anterior margin only 0.67x as broad as the posterior margin, truncate dorsally, acute laterally, while the posterior margin is subtruncate; upper surface coarsely punctate, with a deep, central stria restricted to posterior one thirds, rounded towards the posterior margin and straight towards the anterior margin. Legs with hind tibial apex having well developed, dense golden yellow hairs (Fig.69).

Elytra broadly ovate, with basal margin slightly raised, humeral fold present, but not prominent; apices slightly mucronate; stria finely punctate, intervals broad, plane, not raised, intervals second and third shallowly impressed at the posterior declivity, with short, recumbent elongate scales; elytral vestiture with subovate, yellow scales, with patches of granulated areas (Fig. 232).

Female genitalia

Spermatheca with proximal arm 1.5x as long and 2.5x as broad

as the distal arm, angle between two arms obtuse; nodulus conical and apex rounded; ramus cylindrical and almost as broad as the nodulus; cornu with apex narrowed and bluntly rounded (Fig. 104). Spiculum ventrale with shaft broadest at middle, bent at the rounded apex; basal plate longer than broad (1.6: 1), with its apex rounded, and with slender hairs; apical half of basal plate perfectly conical, shaft 4.25x as long as the basal plate (Fig. 93).

Length: Female: 10.91 mm; **Breadth:** Female: 3.99 mm.

Holotype : 1 ♀, INDIA: without place and collector name, forest campus, 8.IV.1994, on *Albizzia lebbbeck* (NPC).

Distribution : INDIA.

Etymology: This species resembles *kraatzi* in the nature of dense, yellow hairs on its hind tibial apex, but it is larger in size, hence named *megakraatzi* sp.nov.

***Sympiezomias subserratipes* sp.nov.**

(Figs. 28, 54, 80, 131, 198, 199, 200, 254, 255, 280 and 304)

Diagnosis: This species resembles *serratipes* from which it is distinguished by the following characters: Prothorax with upper surface having shallow, confluent punctations. Elytra with basal margin slightly raised; intervals broad and convex, first and second less raised, third to sixth much raised. Male genitalia with aedeagus having its apophyses considerably longer i.e., 1.07x as long as the median lobe and tegmen with, manubrium 1.6x as long as the median lobe.

Description: General colour black with pale grey vestiture (Fig.304).

Head as long as rostrum, upper surface convex, with shallow, confluent punctations; frons with a central furrow which ascends nearly to the vertex. **Rostrum** shallowly impressed at the middle dorsally, 1.09x as long as broad, anterior margin as broad as the posterior margin; central furrow very long, broad anteriorly, narrowed and pointed posteriorly, reaching up to the lower margin of eyes; lateral carinae short, but distinct,

confined to middle and posterior aspects; scrobes uniformly broad at the middle, narrowed at either ends, sharply pointed and convergent towards the eyes. Eyes dorsolateral and convex. Antennae reddish brown; scape gradually clavate; funicle with first segment 1.2x as long as second, third to fifth equal, sixth shortest of all; club conical, slightly broader than funicle, sparsely hairy (Fig. 28).

Prothorax 1.1x as long as broad, at middle 1.18x as broad as the posterior margin; sides rounded; anterior margin only 0.83x as broad as the posterior margin, truncate dorsally and vertical laterally, posterior margin truncate; upper surface with shallow, confluent punctations; central stria uniformly broad and runs throughout the length (Fig. 80).

Elytra narrowly ovate, with basal margin slightly raised, humeral fold absent; apices rounded; stria shallowly punctate; intervals broad and convex, first and second less raised, from third to sixth much raised; dorsal outline rather flat, posterior declivity steep and not impressed; elongate scales seen all over the surface; elytral vestiture with predominant scales circular, brown with patches of circular, granulated areas and a large, rounded patch (Fig. 254), less predominant more elongate, conical, brown, its pedicel broad, apex gradually widened, with 3 ridges (Fig. 255).

Male genitalia

Aedeagus with median lobe short, curved, membranous at the middle, slender, only 0.14x as broad as at middle, in its profile apex rounded, broadest at its junction with apophyses, length: breadth ratio 4:1, apophyses 1.07x as long as median lobe, much slender, 0.28x as broad as median lobe (Figs. 198 and 200). Tegmen with dorsal piece 3x as broad as the basal piece; parameres long, 0.2x as long as manubrium, moderately thick, their apices rounded; manubrium 1.6x as long as the median lobe, uniformly thick, its apex deflected and rounded with a cleft (Fig. 199). Spiculum gastrale with shaft 1.4x as long as the

median lobe, much thicker, 1.7x as broad as the manubrium, apex very broad, deflected and irregularly rounded; basal prongs equal, their apices truncate (Fig. 131).

Length: Male: 9.00 mm; **Breadth:** Male: 2.39 mm.

Holotype: 1 ♂, INDIA: Himachal Pradesh: Kullu, 5.VI.1987. Coll. V.R.S. Rao, on grass, weeds (NPC).

Distribution: INDIA: Himachal Pradesh.

Etymology: This species resembles *serratipes* and hence the name *subserratipes* sp.nov.

II. Molecular Systematics

Cuticular hydrocarbon analysis:

Cuticular hydrocarbon analytical studies were conducted to explore the possibility of using as a diagnostic tool for identifying the species, in nine species of *Indomias*, namely *cretaceus*, *prasinus*, *praeteritus*, *decipiens*, *anamalainus*, *lividus*, *frater*, *acutipennis* and *beesoni*.

The results of the cuticular hydrocarbons analysis reveal that all the nine species of *Indomias*, studied in the present case are characterized by similar hydrocarbon profiles of binary composition of n-decane (C₁₀) and an unidentified compound. However, it was found that the species differ significantly in the amount of hydrocarbon deposited on their body, which was ranging from 13.3 in *anamalainus* to 34.1 mg/ specimen in *cretaceus*. Expressed in the ratio of relative composition of C₁₀ hydrocarbon to unidentified compound, it ranged from 2.1:1 in *frater* and *decipiens* to 20:1 in *beesoni* as tabulated in Table.6. It is possible that these differences may originate from the ecology and evolutionary mechanisms in which these have evolved.

The present study shows, that cuticular hydrocarbon profile can be of use in studying phylogenetic relationships, though not as species markers.

Table 6. Cuticular hydrocarbon chemical profile of species of *Indomias* Marshall

S.N.	Species	Cuticular hydrocarbon content (mg/insect)	Comparative						Ratio of C_{10}/U_1
			C_{10}			U_1			
			Rt	KI	%	Rt	KI	%	
1.	<i>cretaceus</i>	34.1	1.67	1005	72	2.13	1028	28	8:3
2.	<i>prasinus</i>	24.3	1.57	1000	87	2.11	1024	10	8.6:1
3.	<i>praeteritus</i>	22.5	1.67	1005	84	2.17	1030	15	5.6:1
4.	<i>deciens</i>	19.4	1.66	1004	68	2.13	1028	32	2.1:1
5.	<i>anamalainus</i>	13.3	1.69	1006	92	2.20	1031	7	13:1
6.	<i>lividus</i>	28.0	1.69	1006	72	2.17	1032	28	2.5:1
7.	<i>frater</i>	23.3	1.68	1005	67	2.15	1029	32	2.1:1
8.	<i>acutipennis</i>	12.9	1.72	1007	62	2.19	1031	37	1.7:1
9.	<i>beesoni</i>	25.1	1.67	1006	94	2.20	1032	5	20:1

5. DISCUSSION

For the sake of convenience and clarity, the results of the present study on the genus *Indomias* are discussed under following headings namely, the concept of the genus, status of *Indomias* vis-a-vis other closely allied genera, key to the species, infrasubspecific categories; taxonomic characters and zoogeographical distribution.

5.1 THE CONCEPT OF THE GENUS

The genus *Indomias* which was originally considered under *Sympiezomias* had its origin through Marshall (1941), who redefined its key characters and distinguished it from its very close relatives. The genus as it stands now, is distinct from its relatives namely, *Sympiezomias* and *Burmotragus* in possessing "scutellum distinct, elytra with a humeral fold, hind tibiae never denticulate, epistome quite undefined, mentum with only two setae; intercoxal process of venter narrower, arcuate or angulate, suture between ventrites first and second distinct throughout, ventrite second 1.5-2x as long as the third and fourth together". These characters are an extension of what formed the genus *Sympiezomias* (Faust, 1887 and Marshall, 1916). The analysis of these characters in the present study fully support this concept of genus given by Marshall (1941) as extended from Marshall (1916), except for the following discrepancies. Marshall (1916) states that rostrum is always longer than head and about as long as broad. But, the findings of present study show that the rostrum is sometimes shorter than head, and also it is broader than long, in few species. Hence, it would be appropriate to redefine rostrum as either longer or shorter than head and as long as broad or longer than broad or broader than long. Marshall's (1916) description also states that posterior margin of prothorax is always truncate but it has been observed in the present study that in few species it is subtruncate.

The genus *Indomias* was earlier classified under division Adelogathi, subfamily Brachyderinae (Marshall, 1916), tribe Amomphini Reitter 1913 (Gunther and Zumpt, 1933) and in the subtribe Piazomiina of Tanymecini (Emden, 1936). However, these are to be considered in the light of Thompson (1992), who proposed a revised classification of family Curculionidae. Accordingly, *Indomias* falls under the Brachyderini inclusive subfamily Entiminae, because of its possessing characters such as mandibles with well developed deciduous processes and gonatoceros male genitalia (i.e. median lobe in the form of a rigid, stout cylinder and tegmen with dorsal piece reduced to a pair of asetose lobes or parameres). The present study confirms these characters in *Indomias* and approves the placement of *Indomias* under the tribe Tanymecini (Alonzo-Zarazaga and Lyal, 1999) of the subfamily Entiminae of Thompson (1992).

5.2 STATUS OF *Indomias* VIS-A-VIS OTHER CLOSELY ALLIED GENERA

The genera, namely *Sympiezomias*, *Burmotragus*, *Geotragus*, *Lepropus* and *Brachyaspistes* are the ones closely related to *Indomias* sharing many taxonomic characters. The members of *Sympiezomias*, closely resemble *Indomias* in general shape and colour, but can be distinguished by the internal denticulation of hind tibia at the apical half, mentum with four to six setae, elytra without any humeral fold, ventrite second much longer than third and fourth together only in the middle, male genitalia with apophyses 1.07x as long as median lobe, and spiculum gastrale 1.7x as broad as the manubrium (Figs 131, 198, 200). The extent of zoogeographical isolation seen in the distribution of these two genera (Marshall, 1941) is also corroborated in the present study. On the contrary, in case of the genus *Sympiezomias* there are anomalies arising with regard to the zoogeographical distribution. This

genus is known so far exclusively from Chinese and other far eastern parts of Asia, except for *cupreovirens* described from Natal in South Africa (Marshall, 1918). The present study adds one more species to this exception, by way of discovery of the new species *S. subserratipes* from Himachal Pradesh, India. All these conclude that there is a need to explore the faunal diversity of this genus and find out the missing links in their zoogeography, which is beyond the scope of the present study.

Burmotragus is another genus closely allied to *Indomias* (Fig. 317), but it is differentiated based on its funicle with its first two joints being equal, ventrite second not or only slightly longer than third and fourth together, elytra without any humeral fold and scutellum distinct. Its male genitalic studies undertaken now brings out the following characteristics namely, the apex of median lobe much broader, spiculum gastrale with basal prongs having a massive base and a more elongate apex, and manubrium 0.7x as long as the median lobe (Figs. 132, 203, 204, 205). These significant differences, added to their geographical isolation, from that of *Indomias*, strongly support its distinction as a genus by Marshall (1941).

Geotragus is yet another genus closely allied to *Indomias* (Fig. 318), in having basal margin of their elytra elevated and ventrite second longer than third and fourth together. The shape of prothorax and curvature of scrobes also add to their similarity. Nevertheless, it is distinct by its mesosternal episternum being much smaller than epimeron, metasternal episternum distinct only in the basal half and fusing posteriorly with metasternum, absence of humeral fold in the elytra and the scutellum being invisible. In addition to these, their genitalia are quite different, as observed in the present study, especially in their much deflected nature of parameres, spermatheca with proximal and distal

arms equal, spiculum ventrale having its basal plate much longer than broad, its sides straight and base with a pedicel (1.66:1) (Figs. 133, 134, 192, 193, 194, 206, 207, 208).

Two other genera *Lepropus* and *Brachyaspistes* resemble the larger members of *Indomias* in their general shape and size, ventrite second longer than third and fourth, and distinct scutellum. But, *Lepropus* is easily distinguished by its mentum with always more than four setae, shaft of spiculum ventrale 1.5-2.5x as long as basal plate, presence of C_{14} - C_{20} hydrocarbons in more quantities, in addition to elytra with well developed shoulders (Poorani and Ramamurthy, 1997; Ramamurthy *et al.*, 1998). These distinguishing characters have been corroborated in the present study.

Brachyaspistes differs from *Indomias* in the following characters, prothorax always with a median furrow, posterior margin always bisinuate, tibial apex without inner flange, elytral vestiture with flat scales never ridged, presence of C_{14} - C_{20} hydrocarbons in traces and C_{22} - C_{24} and C_{28} in great proportions (Poorani and Ramamurthy, 1997; Ramamurthy *et al.*, 1998). Though, it resembles *Indomias* in the nature of spiculum ventrale with its shaft 3-5x as long as its basal plate, mentum usually with two setae, well developed elytral shoulders make *Brachyaspistes* a genus distinct from *Indomias*.

5.3 KEY TO THE SPECIES

Marshall (1916) had provided a key to the species of the erstwhile *Sympiezomias*, and in the present study this key has been improved by augmenting it with additional characters, and suiting it to diagnose the 27 species so far known from the genus. This key incorporates additional characters, explored in the present study, namely, elytral vestiture, female and male genitalia, in addition to bringing out the following anomalies.

- i. The species like *serratipes* of *Sympiezomias* and *similis* and *metallescens* of *Burmotragus* have been dropped.
- ii. The species *lividus* occurring at two places is appropriately placed now.

5.4 INFRASUBSPECIFIC CATEGORIES IN *Indomias*

Hitherto only one infrasubspecific category is known i.e., *Indomias prasinus* var. *subcostatus* Marshall (1916). With the knowledge gained in the present study and analysing the characters involved in the establishment of the species level taxa and considering the relevant rules of ICZN, it is concluded that *prasinus* var. *subcostatus* is only a variant. This does not deserve to be considered a subspecies as no variations exist in their male genitalia and their geographical distribution.

5.5 TAXONOMIC CHARACTERS

Structure of elytral vestiture, male and female genitalia and molecular characters like cuticular hydrocarbons, are the taxonomic characters included in the present study. In addition, the existing taxonomic characters have been supplemented with ratios of morphometrics to increase their authenticity. The character of structure of elytral vestiture is found to be species specific and helps in identifying many species (*frater*, *beesoni* and *praeteritus*) and provides supporting evidence as an additional character for description of new species *mayarami* sp.nov., and *menoni* sp.nov. (Figs. 247, 248, 241, 242).

The study of female genitalia, especially the spermatheca is useful in identifying species (*frater* and *anamalainus*); the shape of basal plate is of utmost value in differentiating some closely resembling species (*albizziae* sp.nov., *megakraatzi* sp.nov. *mayarami* sp.nov. and *acutipennis*). Likewise, in male genitalia, the tegmen especially the comparative breadth of dorsal piece and basal piece, length of manubrium in comparison to length of median lobe, length of shaft of spiculum

gastrale in comparison to that of median lobe, and shape of its apex are useful diagnostic characters in not only identifying many species, but also aid separating some related genera. Study undertaken on the cuticular hydrocarbons has shown that hydrocarbons of C_{10} are the most abundant, characteristic of all the species, denoting its exclusiveness to the genus *Indomias*. These studies which explored only the qualitative nature of the hydrocarbons have indicated their potential in evaluating the similarity between species and their monophyletic nature. These had also corroborated the earlier such findings on weevils and other insects (Castner and Nation, 1984; Bartelt *et al.*, 1986; Howard, 1987; Ramamurthy *et al.*, 1998).

5.6 ZOOGEOGRAPHICAL DISTRIBUTION

Marshall (1941) stated the range of distribution of *Sympiezomias* as exclusive to Myanmar, China and Japan, and he also stated that it does not occur in the peninsular India and Sri Lanka. However, occurrence of *cupreovirens* in South Africa (Marshall, 1918) and *subserratipes* sp.nov., in Himachal Pradesh, India are exceptions. These exceptions suggest that more species may be brought to light from these regions if explored suitably, and these will enable objective understanding of its zoogeographical distribution.

The zoogeographical distribution of *Indomias* as reported by Marshall (1941) continues to be valid even after the present study. It is restricted to the high attitude regions of South India especially Nilgiris, Anamalais, Kodaikanal, Yercaud, and localities like Bangalore and Coorg, mainly associated with the habitats of coffee, tea, teak, cinchona and mulberry plantations. *Burmotragus* is predominantly Myanmar in its distribution, except for a single species of *similis* which is distributed in the North East India.

6. SUMMARY

Members of the tribe Tanymecini of the subfamily Entiminae are one of the very large, diversely represented group of Curculionidae in India, compared to other geographic regions of the world. Amongst the diverse genera representing of this tribe in India, genus *Indomias* Marshall is important, as it is exclusively Indo-Sri Lankan in distribution. In total, 14 species had been reported before the advent of present study, of which 13 species are exclusively Indian. Some of these species are injurious to cultivated crops like tea, coffee, mulberry, cinchona and sandalwood.

Marshall's (1916) is the only contribution on the systematics of this genus. Hence, the present study on the biosystematics of *Indomias* and its congeneric relatives from the Orient. This study was undertaken with the objectives of a) to make observations on the fauna of *Indomias* and related genera and to prepare a checklist of known species, b) to revise the hitherto described species of the genus *Indomias* and to describe the new ones encountered, if any, c) to determine the status of this genus vis-a-vis its relatives in the subfamily Entiminae, d) to formulate keys and modify the existing ones to facilitate easy identification, e) to compare *Indomias* with its closely related genera and to find out the validity of the classification given by Marshall, and f) to explore the possibility of using molecular techniques in studying the genus, its species and infraspecific population, wherever necessary. The following significant findings accrued from the study based on many specimens, including paratypes.

1. All the 28 species known so far have been taxonomically explored.
2. Fourteen new species are established and described in detail.

3. The descriptions of all the species are supplemented with additional taxonomic characters of elytral vestiture, genitalia, and authenticated by incorporating morphometrics in terms of ratios.
4. Female and male genitalia of 16 and 18 species respectively, are described and illustrated.
5. Literature available on host range, economic importance and distribution of the genus is consolidated.
6. Marshall's (1916) key to the species is modified by strengthening it with more precise and authentic characters and consistent terminology to remove the anomalies in the key.
7. Marshall's (1941) concept of the genus and separation of the three congeneric genera is thoroughly examined and major details have been corroborated.
8. The status of this genus vis-a-vis its close relatives in the subfamily Entiminae namely, *Burmotragus*, *Sympiezomias*, *Geotragus*, *Lepropus* and *Brachyaspistes* has been examined. The distinction of the genus *Indomias* has been authenticated and the concept of the genus validated.
9. Infrasubspecific category occurring in the species *prasinus* had been critically examined from the taxonomic view point and conclusions drawn.
10. Cuticular hydrocarbon studies were undertaken on many species by employing the GC. It has been concluded that C₁₀ hydrocarbons are exclusive to these and thereby indicating their monophyletic nature.
11. An annotated checklist of the species diversity of *Indomias*, *Burmotragus* and *Sympiezomias* has been prepared. A total of 24, 5, and 28 species have been catalogued under *Sympiezomias*, *Burmotragus* and *Indomias* respectively.

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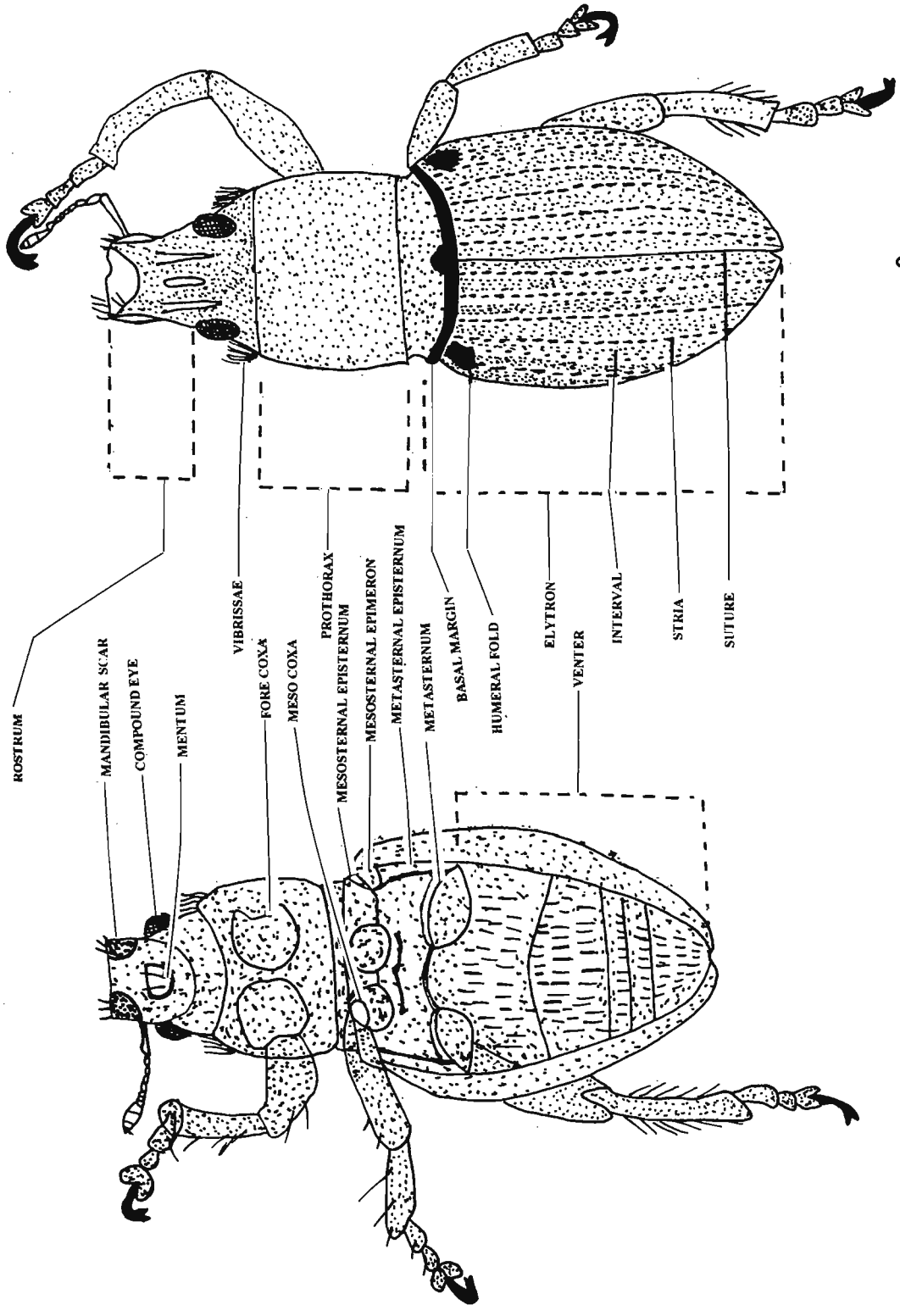
* As cited in Col. Cat. 1933.

** As cited in Alonzo-Zarazaga and Lyal, 1999.

T-6621

Figs. 1,2. *Indomias cretaceus* (Faust)

- 1. ventral view,**
- 2. dorsal view.**



ROSTRUM

MANDIBULAR SCAR

COMPOUND EYE

MENTUM

VIBRISSAE

FORE COXA

MESO COXA

PROTHORAX

MESOSTERNAL EPISTERNUM

MESOSTERNAL EPIMERON

METASTERNAL EPISTERNUM

METASTERNUM

BASAL MARGIN

HUMERAL FOLD

ELYTRON

VENTER

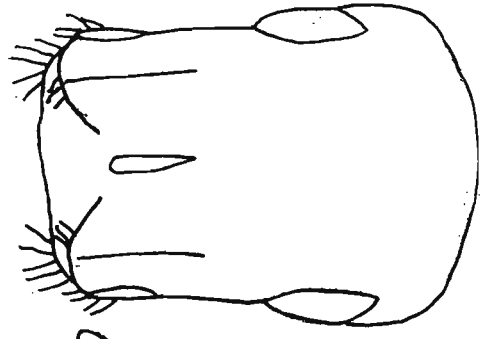
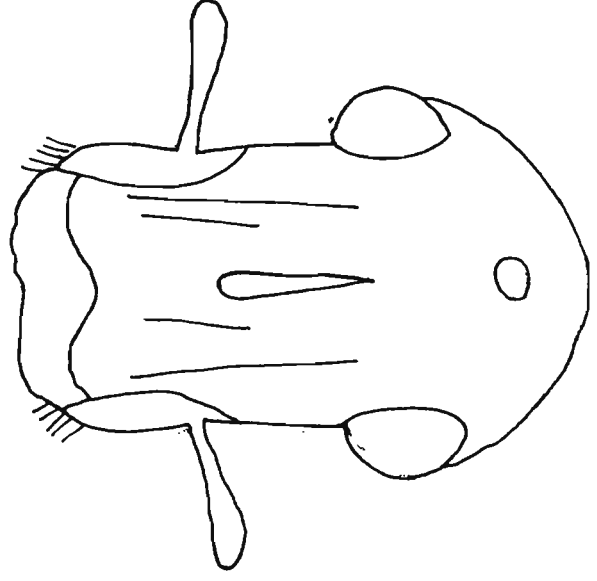
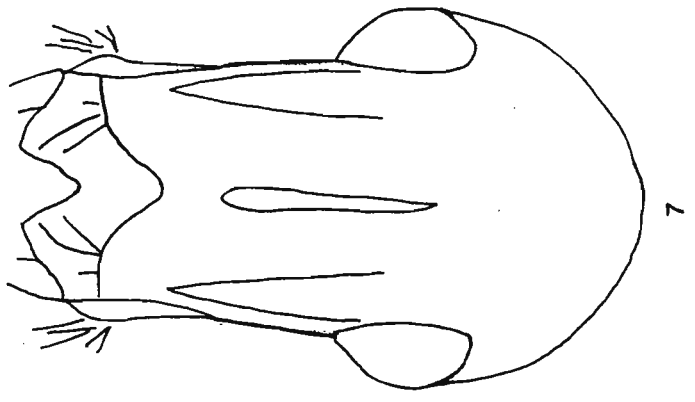
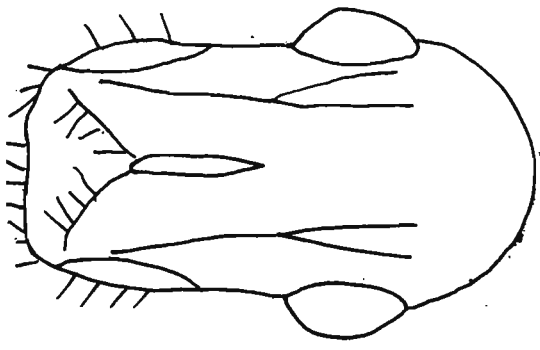
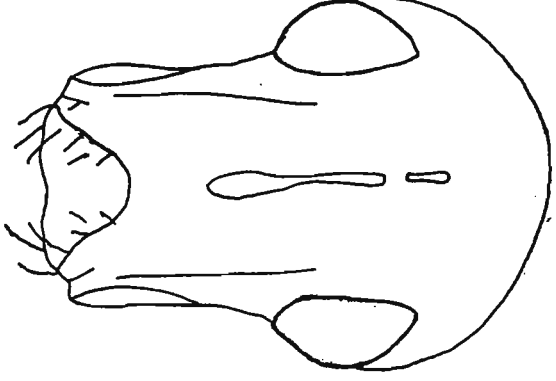
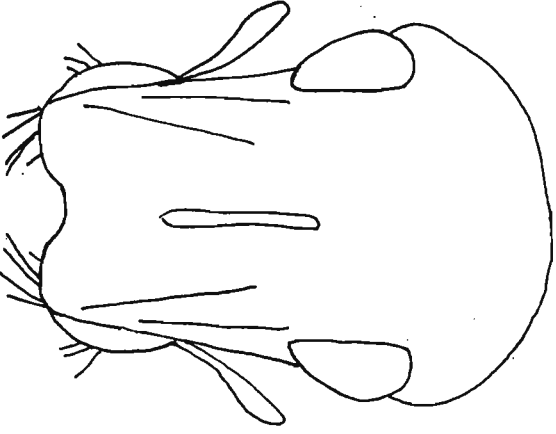
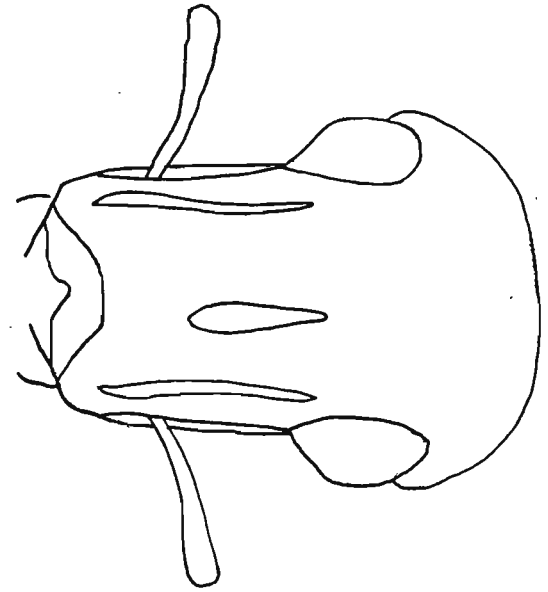
INTERVAL

STRIA

SUTURE

Figs.3-10. Head, dorsal view :

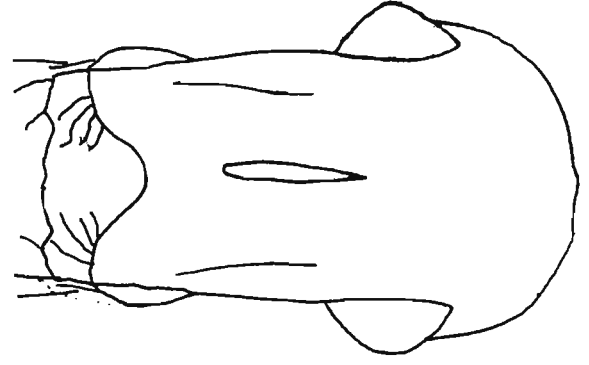
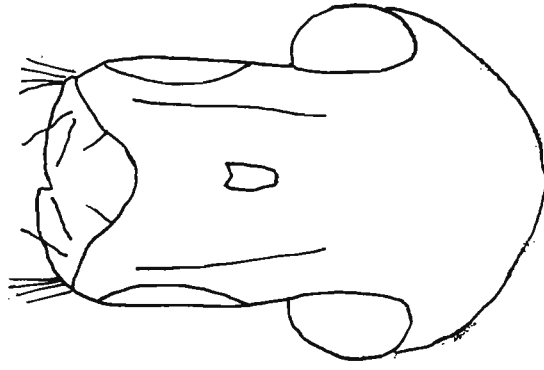
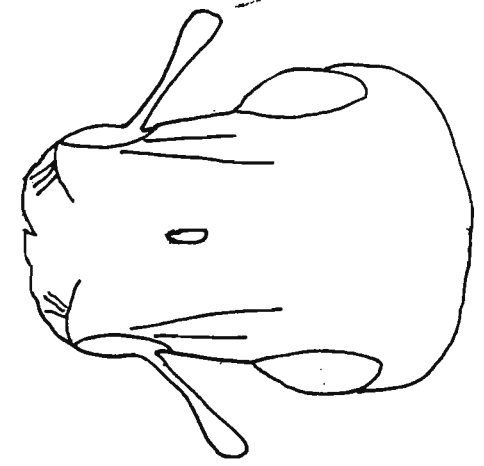
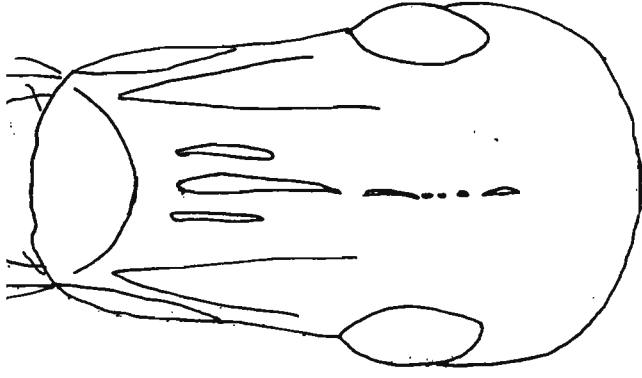
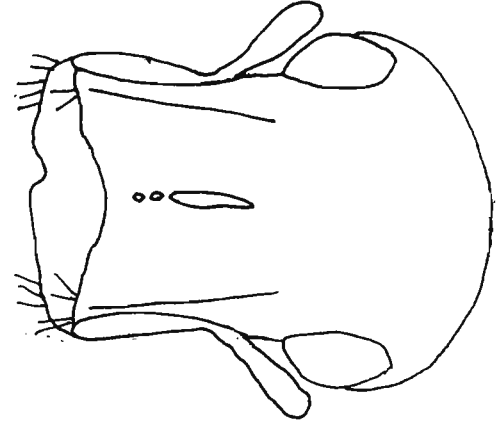
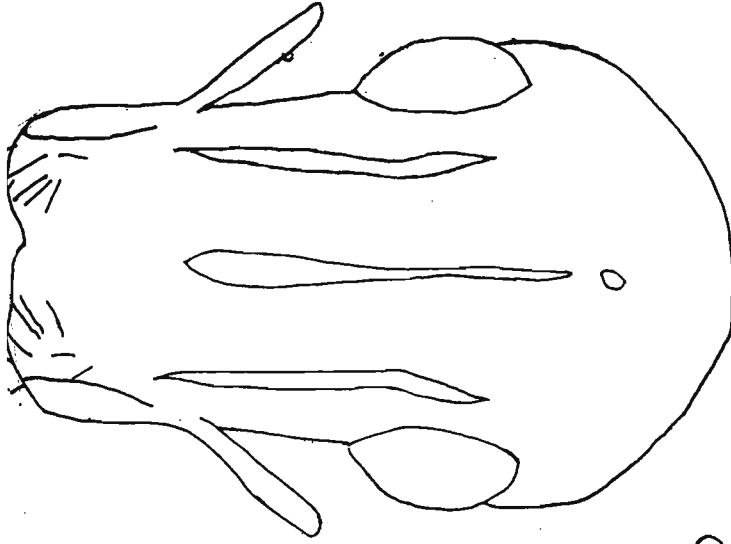
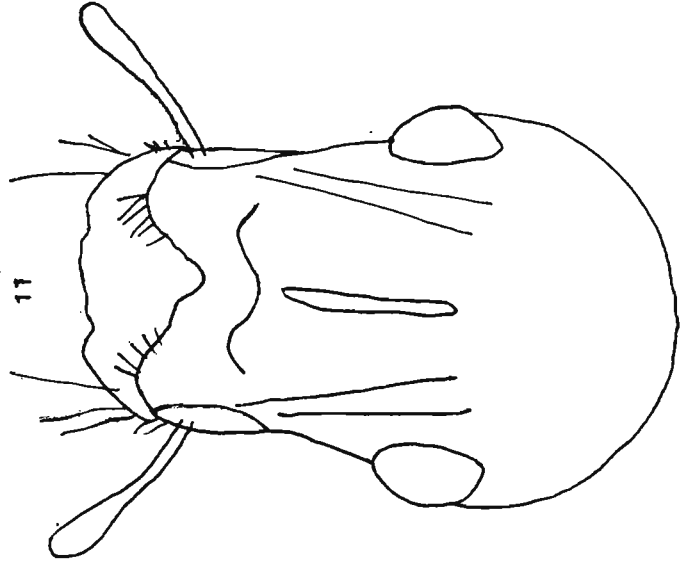
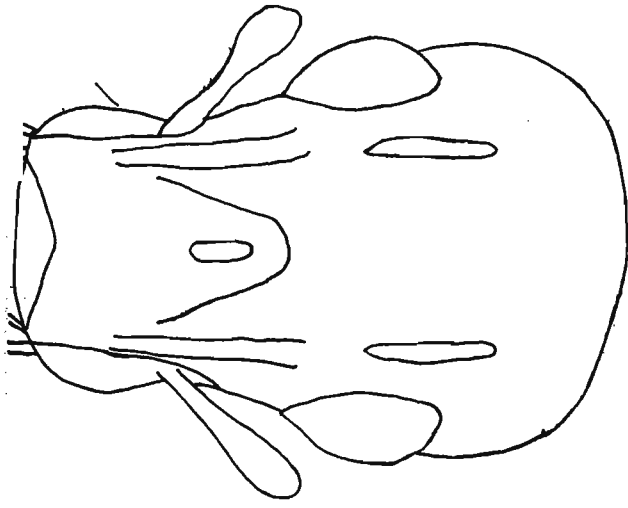
- 3. *decipiens*,**
- 4. *cretaceus*,**
- 5. *hispidus*,**
- 6. *ramakrishnani* sp.nov.,**
- 7. *acutipennis*,**
- 8. *beesoni*,**
- 9. *perroteti*,**
- 10. *frater*.**



1 mm

Figs.11-18. Head, dorsal view :

11. *lividus*, 12. *anamalainus*,
13. *subacutipennis* sp.nov.,
14. *prasinus*,
15. *albizziae* sp. nov.,
16. *praeteritus*,
17. *yercaudensis* sp.nov.,
18. *mayarami* sp.nov.



11

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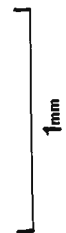
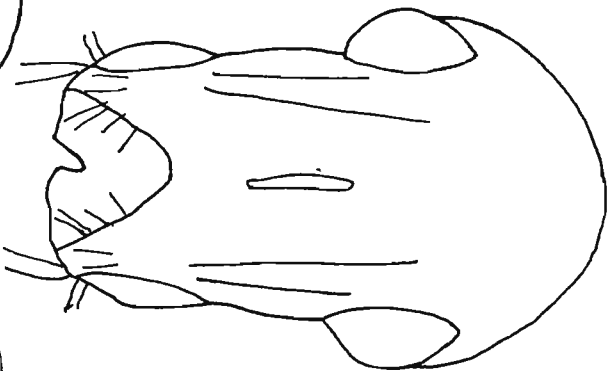
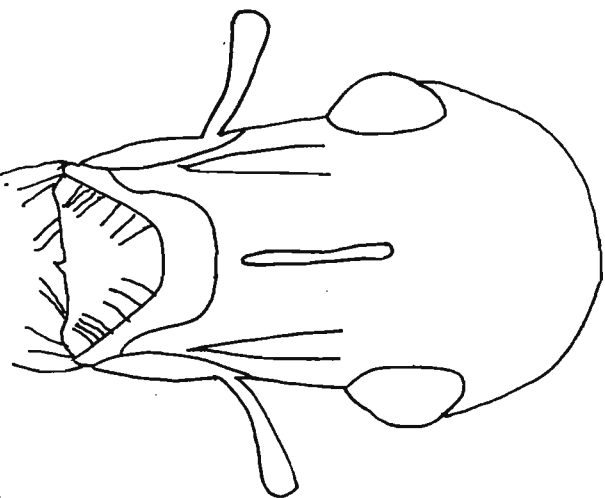
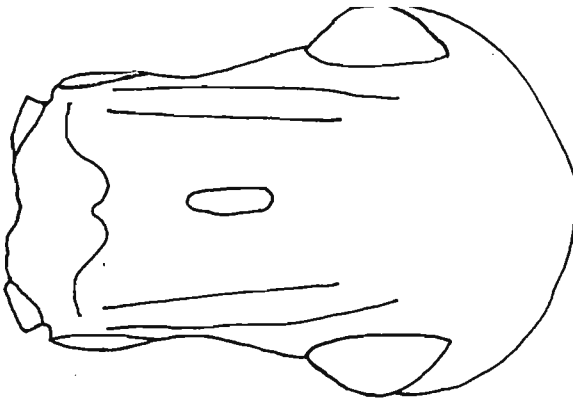
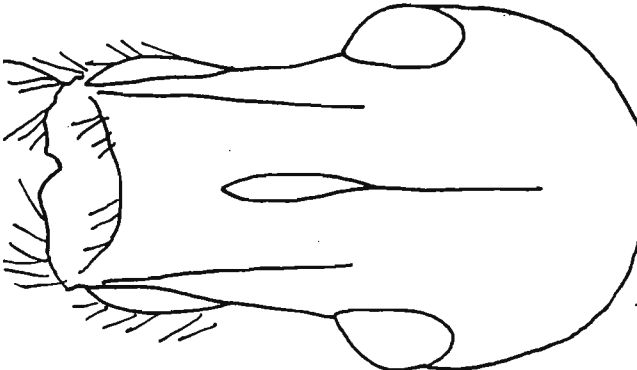
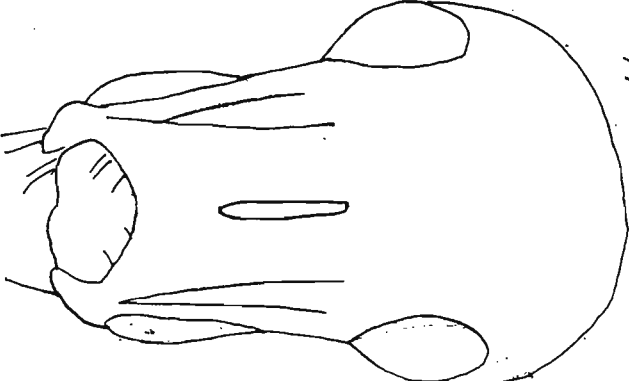
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17

18

Figs. 19-24. Head, dorsal view :

19. *megakraatzi* sp.nov.,
20. *marshalli* sp.nov.,
21. *mucronatus* sp. nov.,
22. *satyanarayanai* sp.nov.,
23. *menoni* sp.nov.,
24. *subdecepiens* sp.nov.



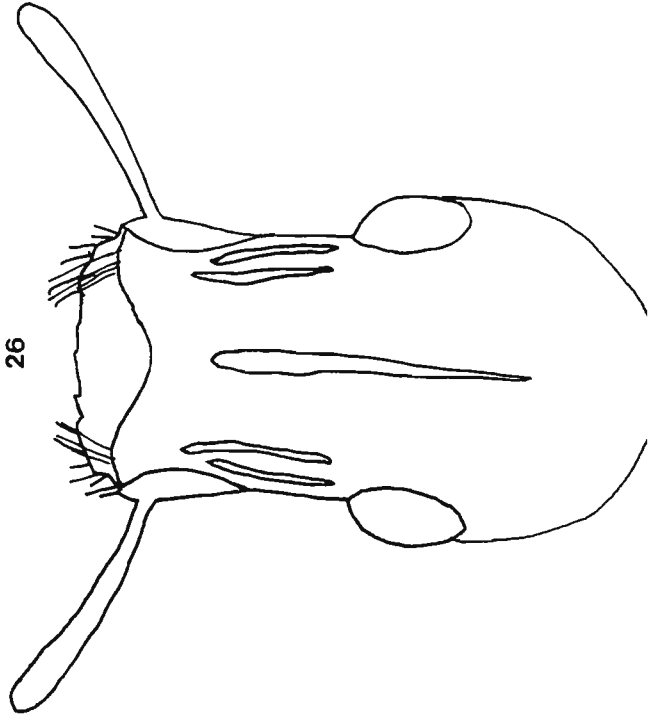
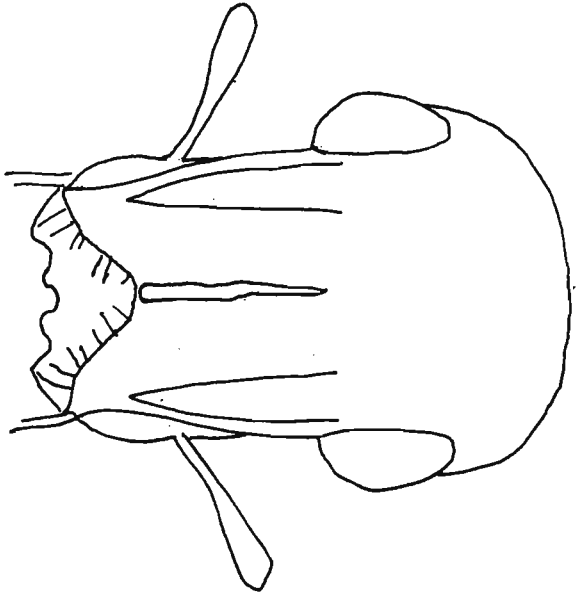
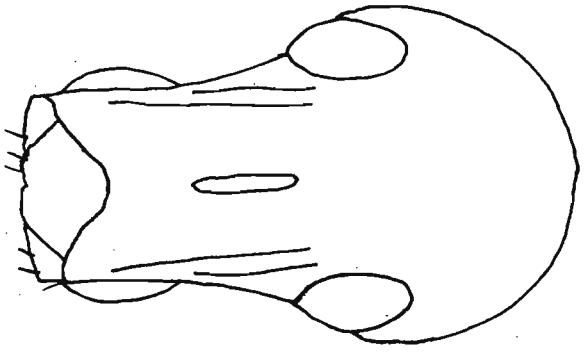
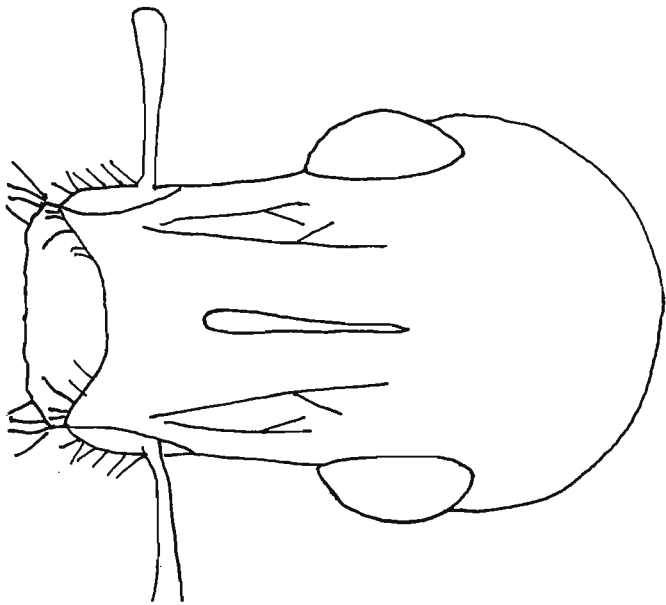
Figs. 25-28. Head, dorsal view :

25. *anasuryae* sp.nov.,

26. *maicykuttyae* sp.nov.,

27. *subkraatzi* sp.nov.,

28. *Sympiezomias subserratipes* sp.nov.



Figs. 29-38. Head, lateral view :

29. *decipiens*,

30. *anamalainus*,

31. *cretaceus*,

32. *hispidus*,

33. *frater*,

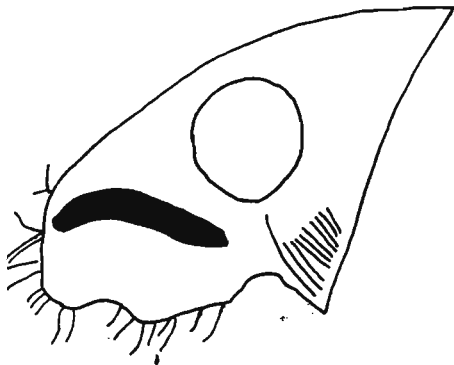
34. *beesoni*,

35. *perroteti*,

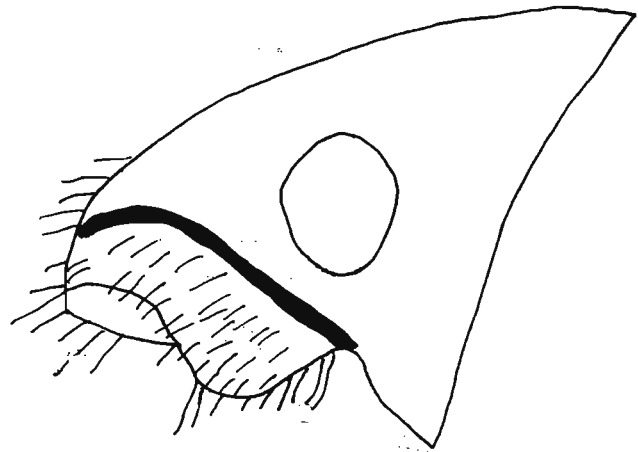
36. *acutipennis*,

37. *lividus*,

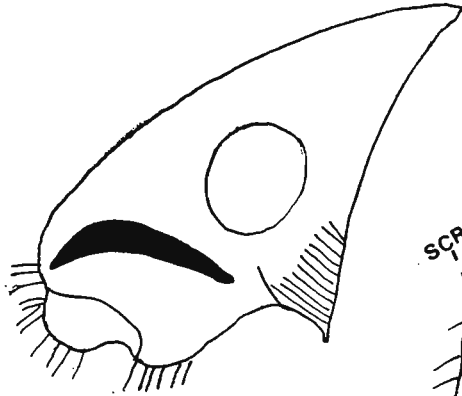
38. *praeteritus*.



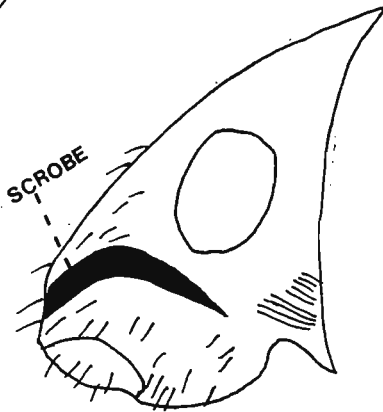
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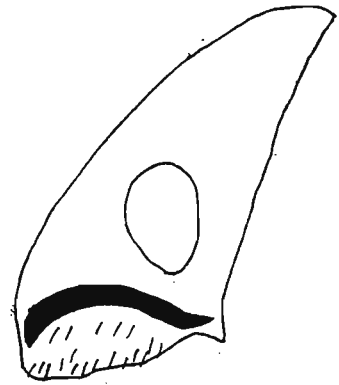


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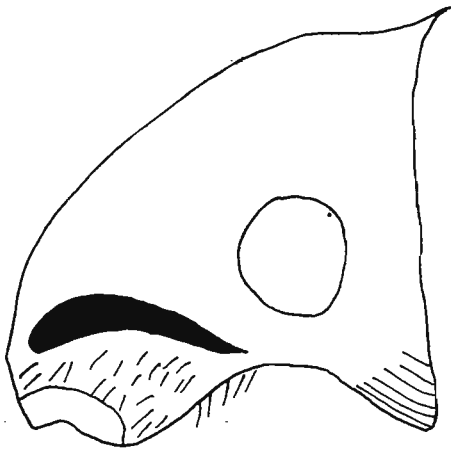


SCROBE

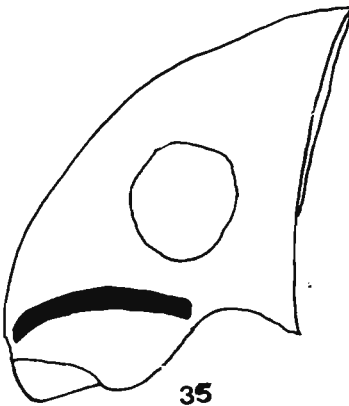
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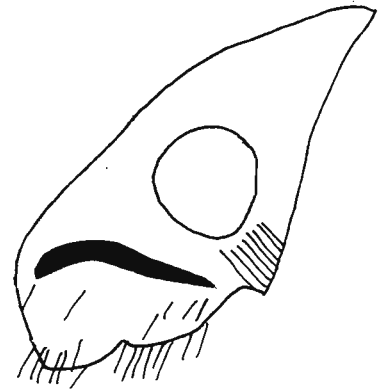
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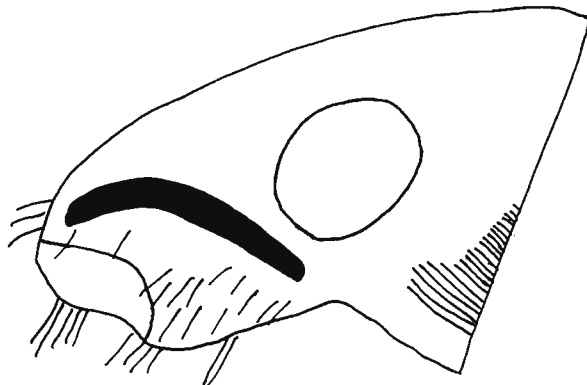
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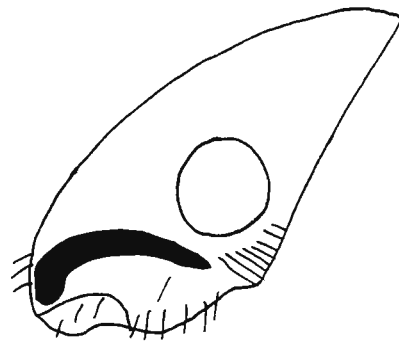
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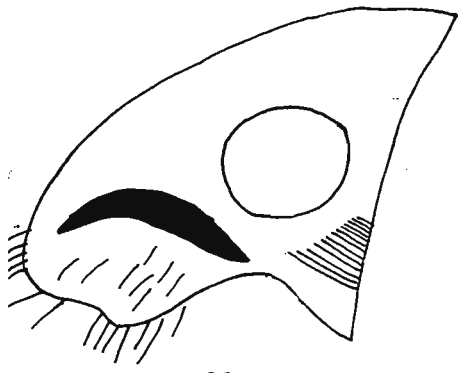


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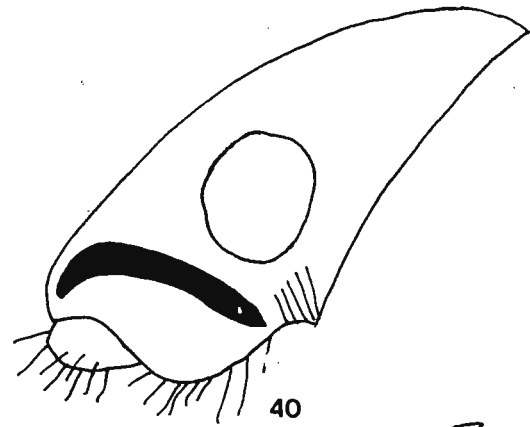


Figs. 39-46. Head, lateral view :

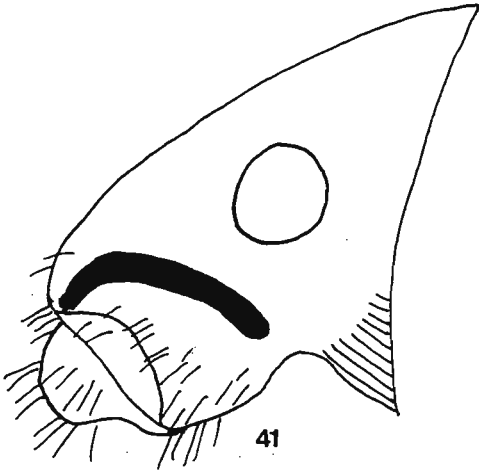
39. *prasinus*,
40. *subacutipennis* sp.nov.,
41. *albizziae* sp.nov.,
42. *megakraatzi* sp.nov.,
43. *marshalli* sp.nov.,
44. *mucronatus* sp.nov.,
45. *ramakrishnani* sp.nov.,
46. *satyanarayanai* sp.nov.



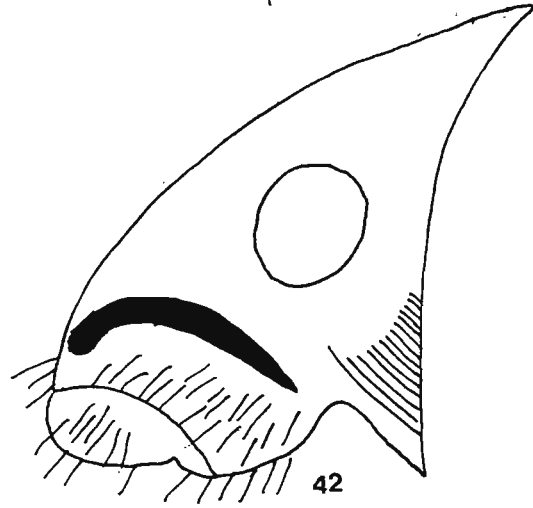
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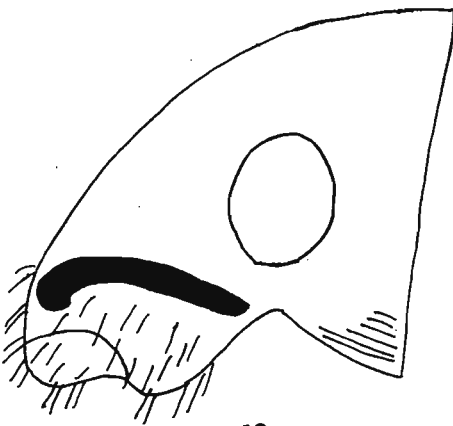
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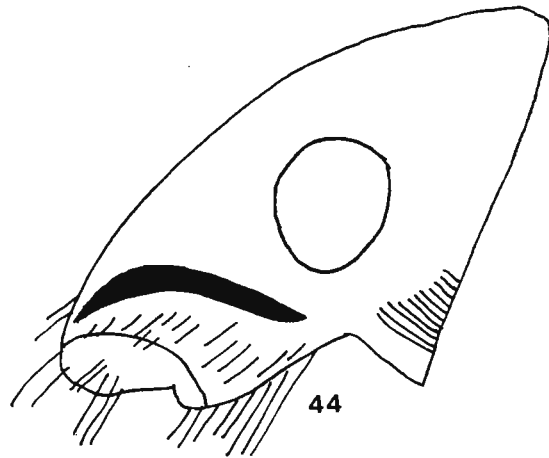
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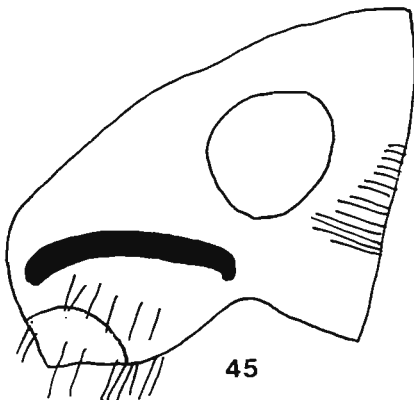
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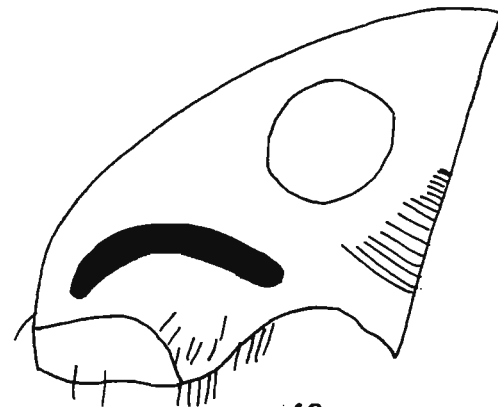
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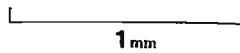
44



45



46



1mm

Figs. 47-54. Head, lateral view :

47. *menoni* sp.nov.,

48. *subdeciens* sp.nov.,

49. *anasuryae* sp.nov.,

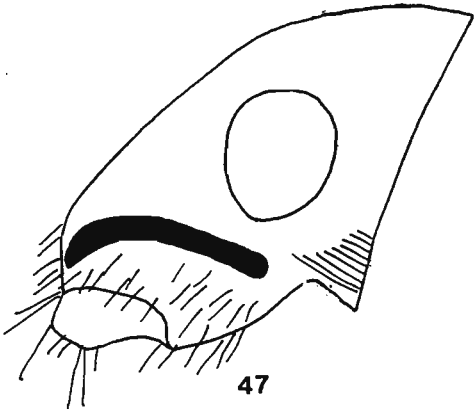
50. *mayarami* sp.nov.,

51. *maicykuttyae* sp.nov.,

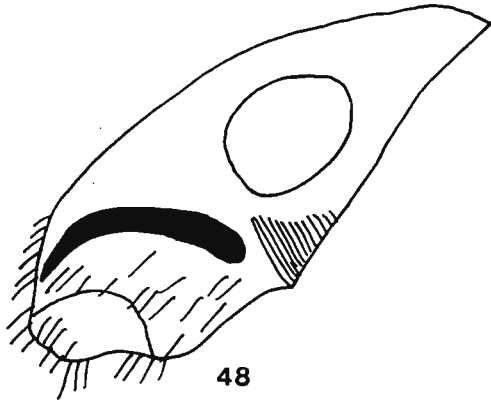
52. *yercaudensis* sp.nov.,

53. *subkraatzi* sp.nov.,

54. *Sympiezomias subserratipes* sp.nov.



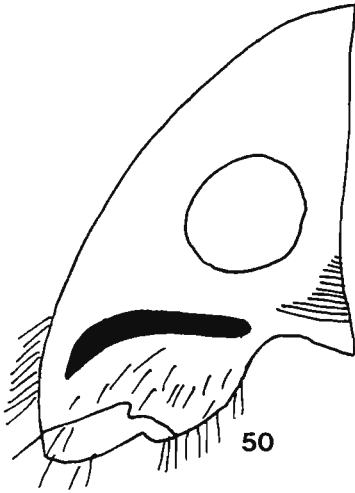
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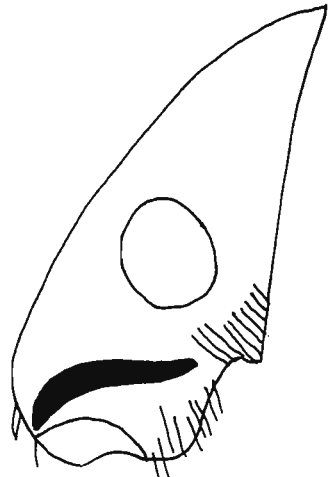
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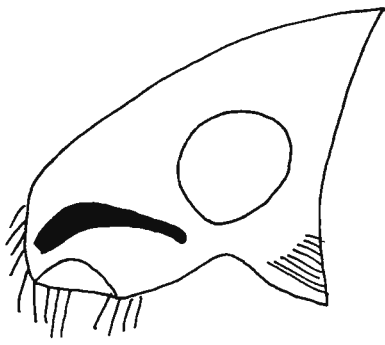
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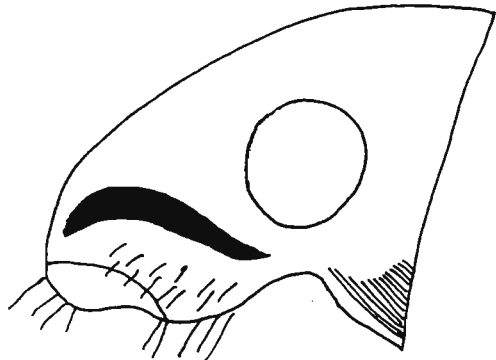
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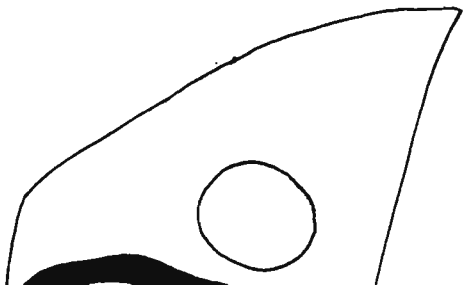
51



52

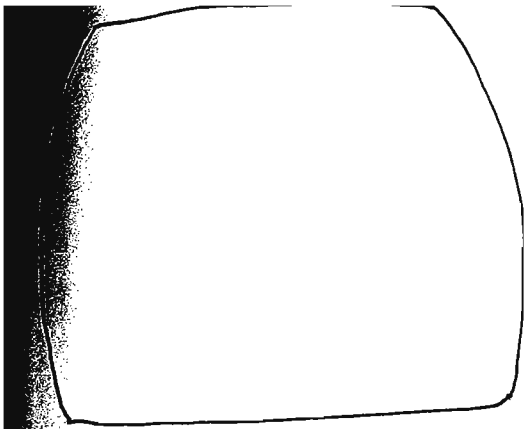


53

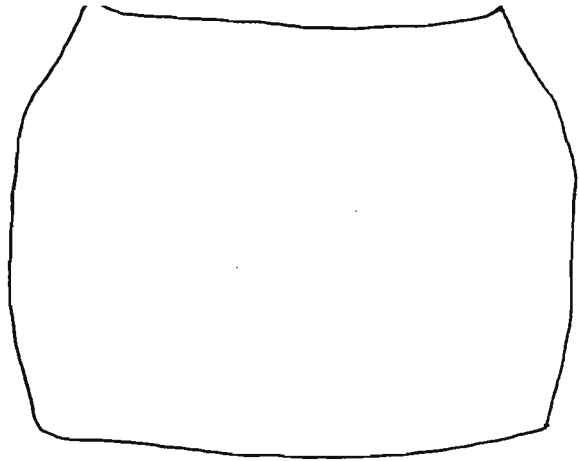


Figs. 55-62. Prothorax, dorsal view :

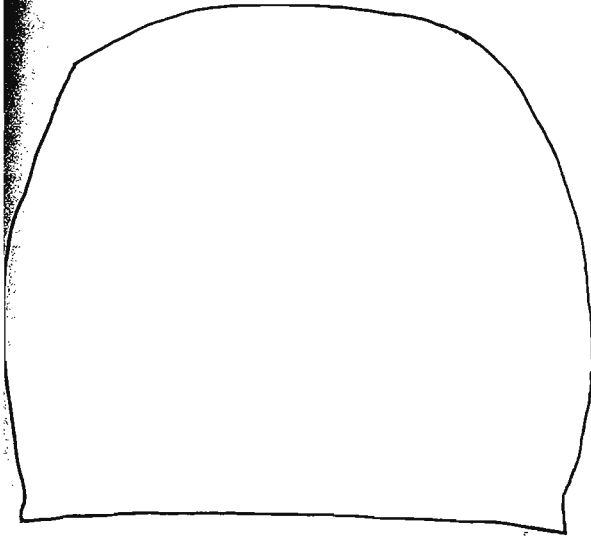
- 55. *decipiens*,**
- 56. *cretaceus*,**
- 57. *beesoni*,**
- 58. *hispidus*,**
- 59. *frater*,**
- 60. *acutipennis*,**
- 61. *praeteritus*,**
- 62. *perroteti*.**



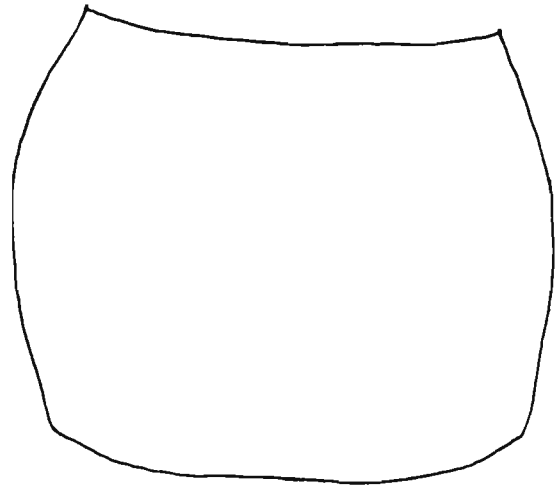
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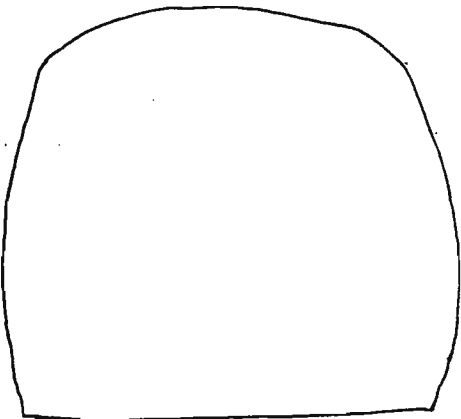
56



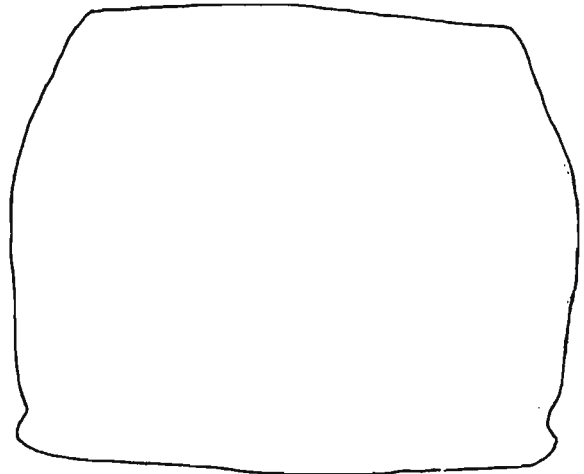
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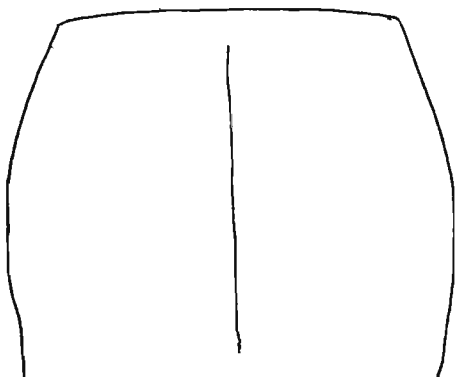
58



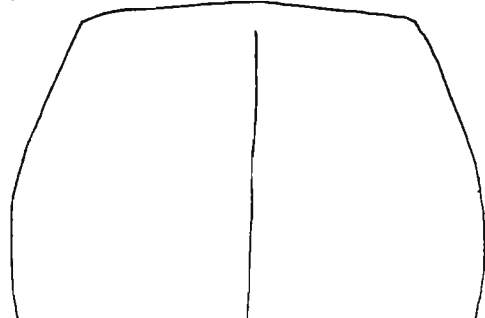
59



60

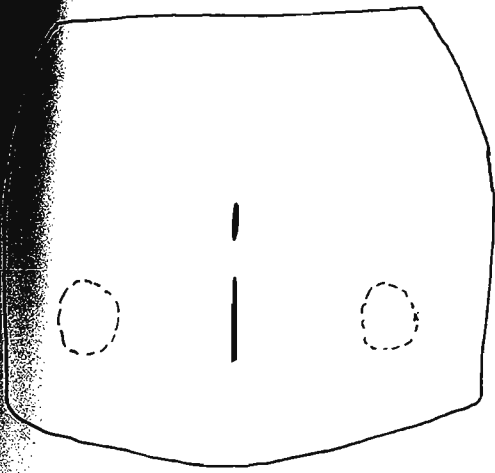


1mm

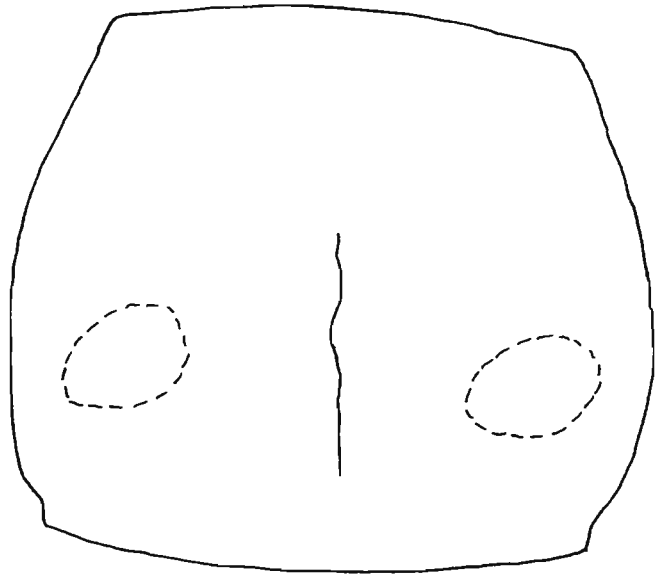


Figs. 63-68. Prothorax, dorsal view :

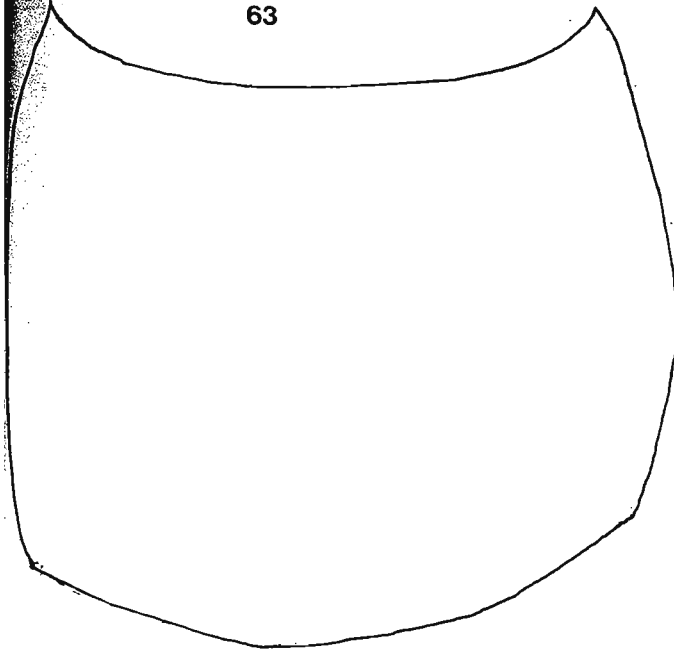
- 63. *prasinus*,**
- 64. *lividus*,**
- 65. *subacutipennis* sp.nov.,**
- 66. *anamalainus*,**
- 67. *subdecipiens* sp.nov.,**
- 68. *albizziae* sp.nov.**



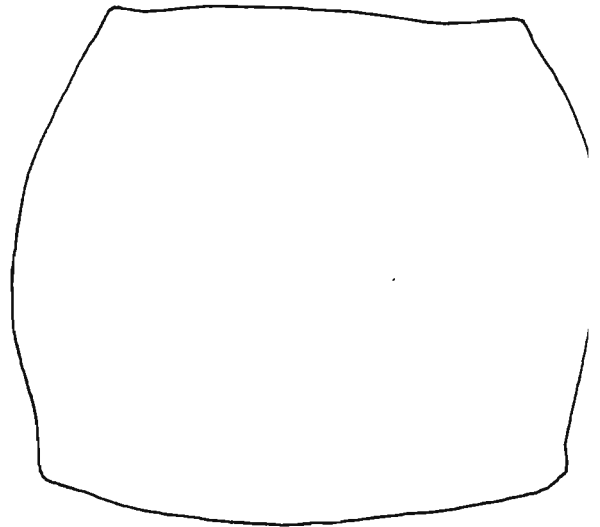
63



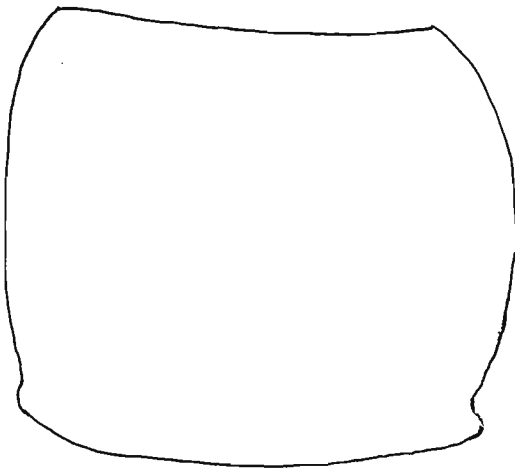
64



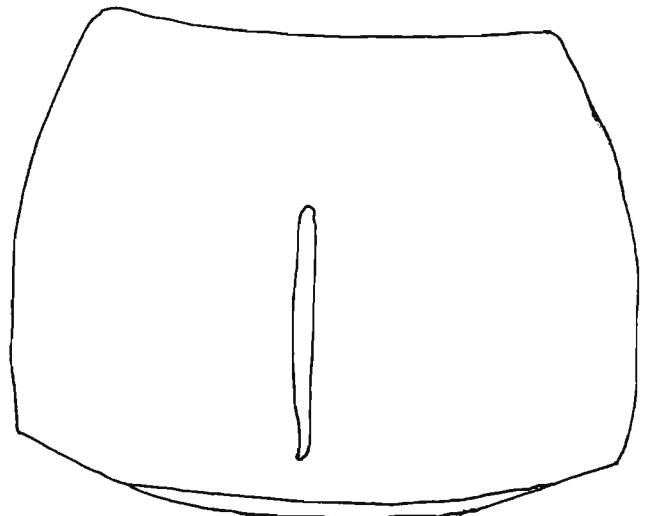
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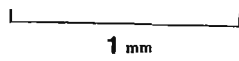
66



67



68



Figs. 69-74. Prothorax, dorsal view :

69. *megakraatzi* sp.nov.,

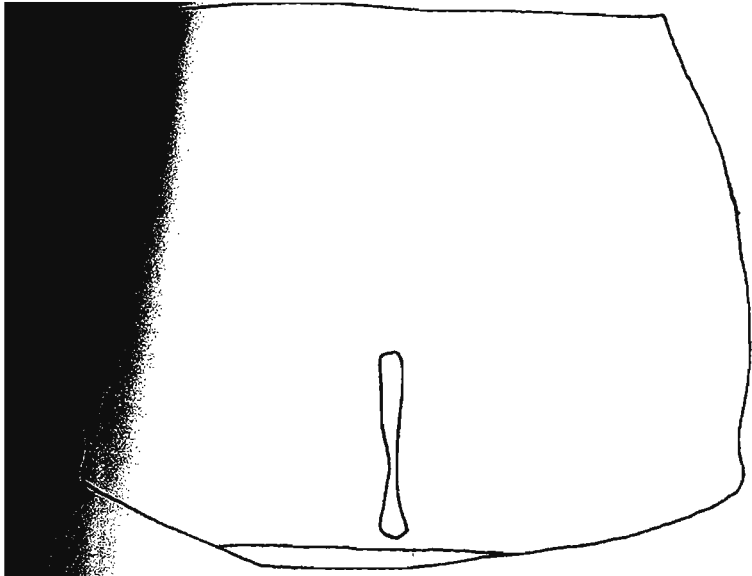
70. *marshalli* sp.nov.,

71. *mucronatus* sp.nov.,

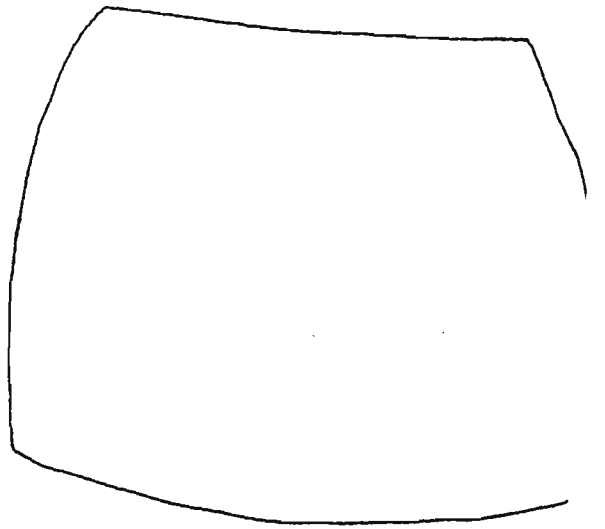
72. *ramakrishnani* sp.nov.,

73. *satyanarayanai* sp.nov.,

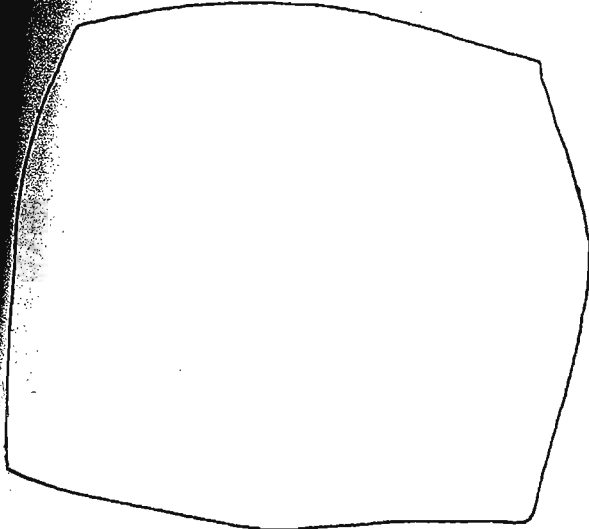
74. *menoni* sp.nov.



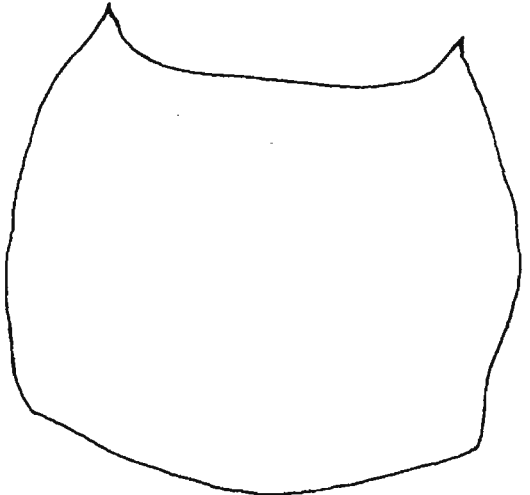
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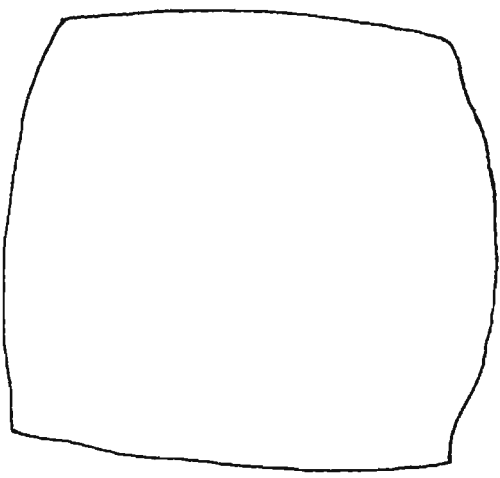
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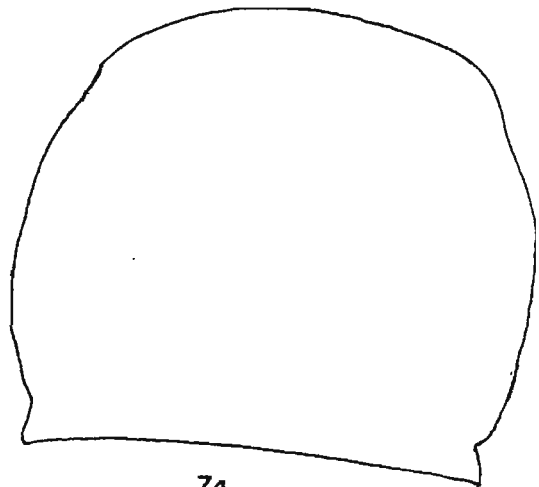
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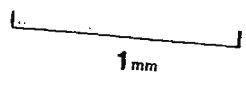
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73

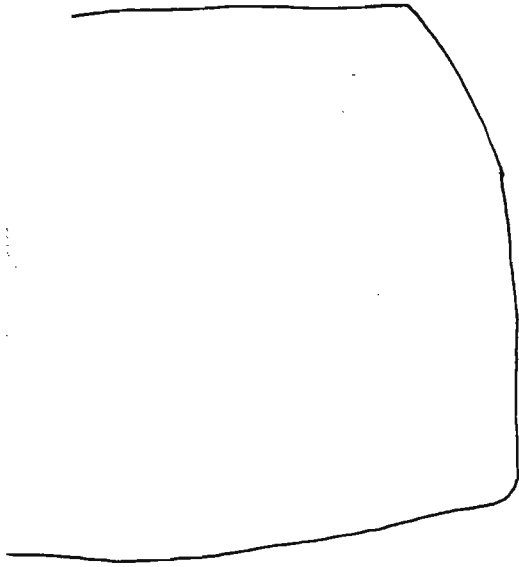


74

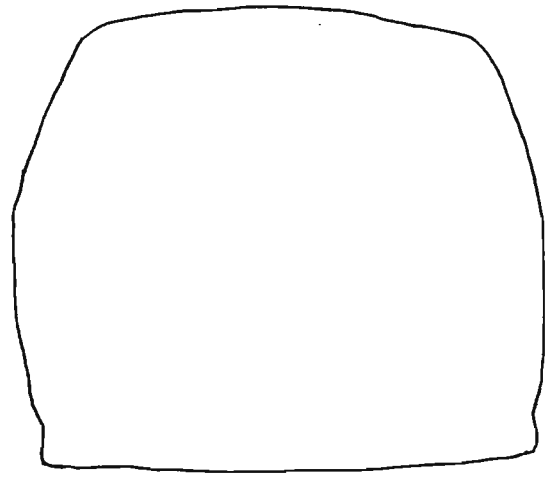


Figs. 75-80. Prothorax, dorsal view :

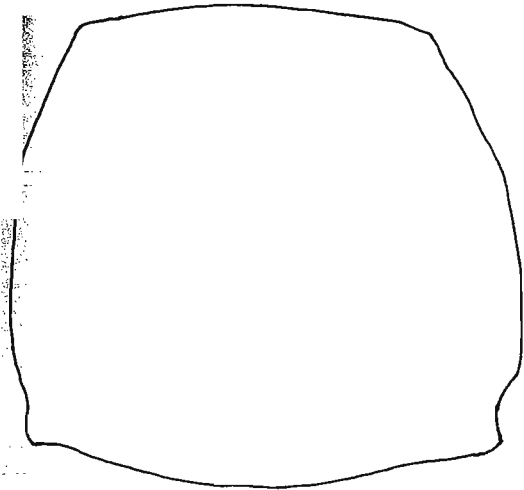
- 75. *anasuryae* sp.nov.,**
- 76. *mayarami* sp.nov.,**
- 77. *maicykuttyae* sp.nov.,**
- 78. *yercaudensis* sp.nov.,**
- 79. *subkraatzi* sp.nov.,**
- 80. *Sympiezomias subserratipes* sp.nov.**



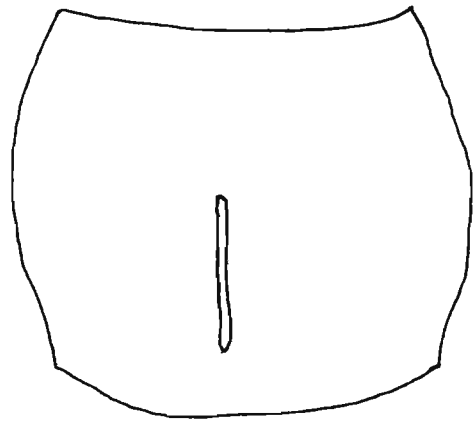
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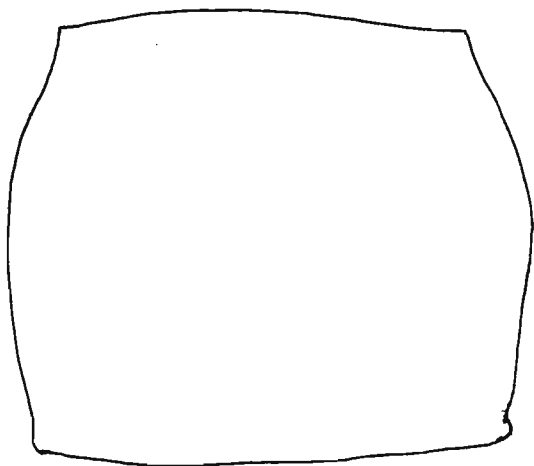
76



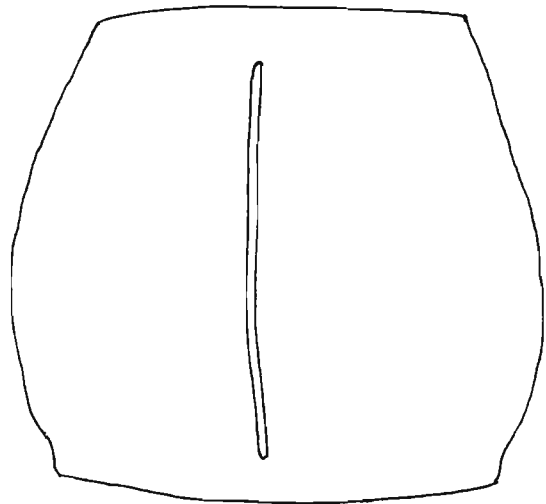
77



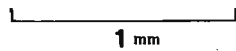
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79

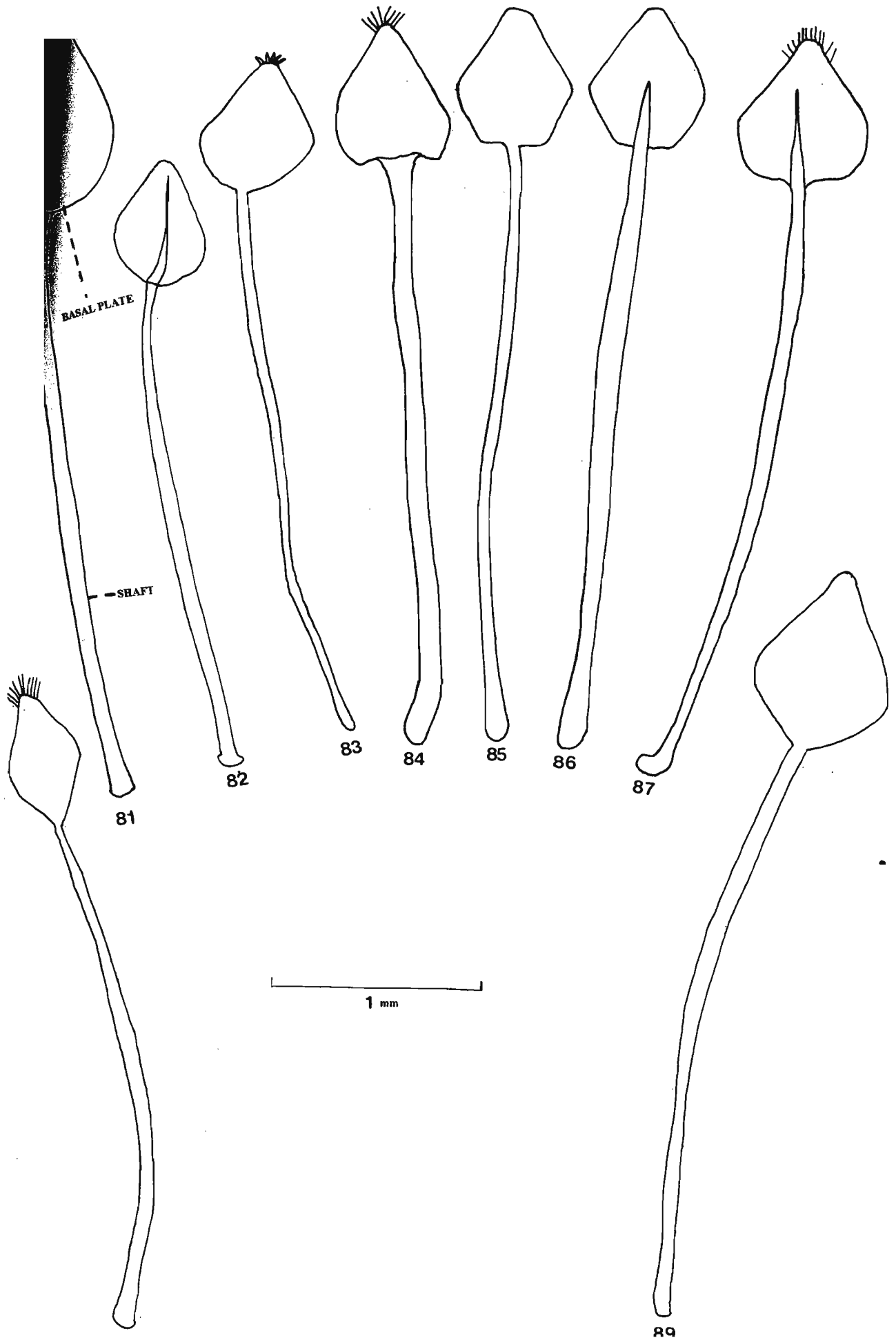


80



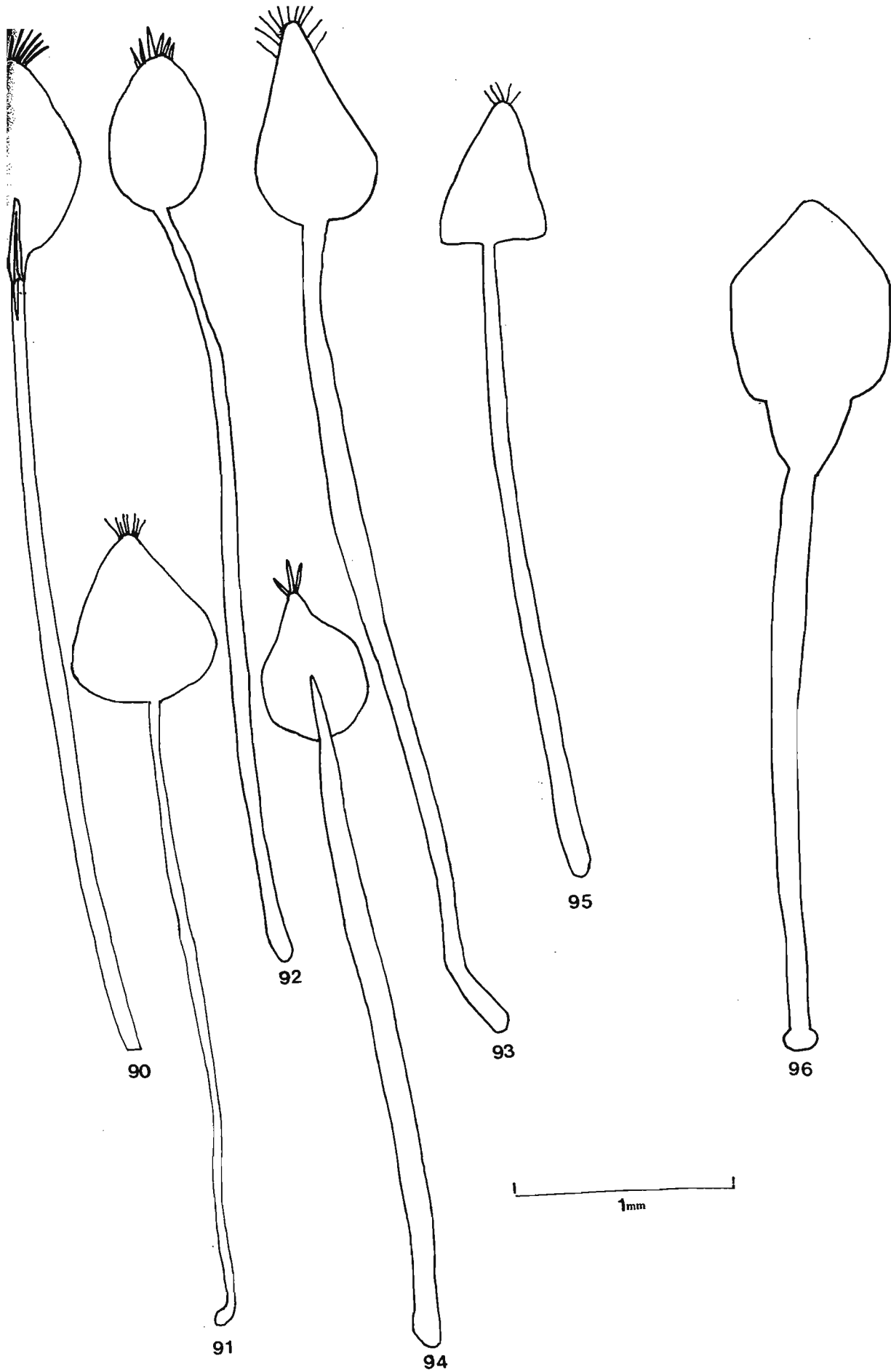
Figs. 81-89. Female genitalia, spiculum ventrale of :

- 81. *cretaceus*,
- 82. *decipiens*,
- 83. *frater*,
- 84. *hispidus*,
- 85. *acutipennis*,
- 86. *marshalli* sp.nov.,
- 87. *mucronatus* sp.nov.,
- 88. *praeteritus*,
- 89. *perroteti*.



Figs. 90-96. Female genitalia, spiculum ventrale of :

90. *anamalainus*,
91. *menoni* sp.nov.,
92. *albizziae* sp.nov.,
93. *megakraatzi* sp.nov.,
94. *anasuryae* sp.nov.,
95. *mayarami* sp.nov.,
96. *Geotragus subfasciatus* sp.nov.

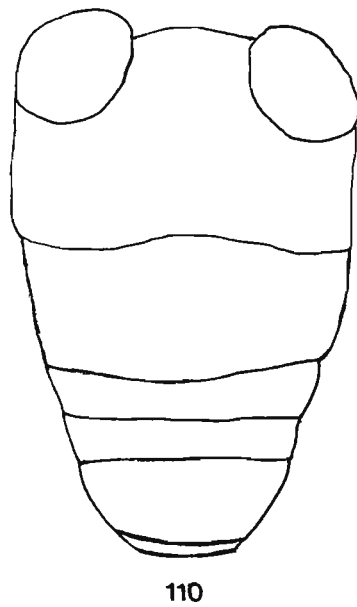
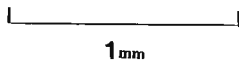
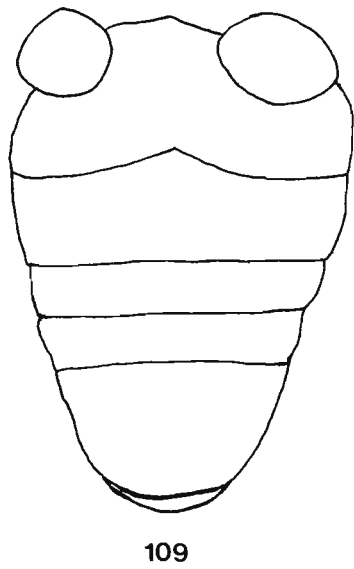
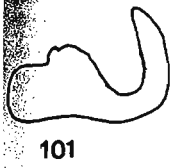
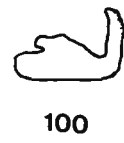
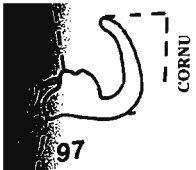


Figs. 97-108. Female genitalia, Spermatheca of :

- 97. *cretaceus*,
- 98. *decipiens*,
- 99. *frater*,
- 100. *acutipennis*,
- 101. *anamalainus*,
- 102. *praeteritus*,
- 103. *albizziae* sp.nov.,
- 104. *megakraatzi* sp.nov.,
- 105. *marshalli* sp.nov.,
- 106. *menoni* sp.nov.,
- 107. *anasuryae* sp.nov.,
- 108. *Geotragus subfasciatus*.

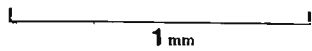
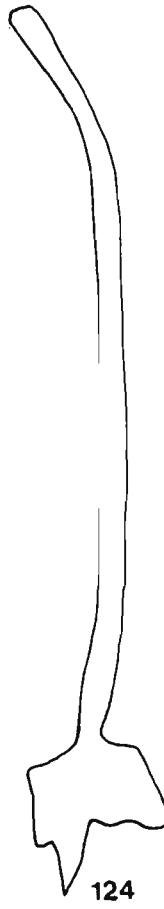
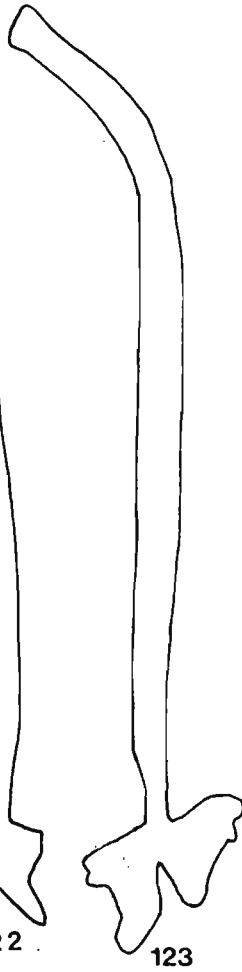
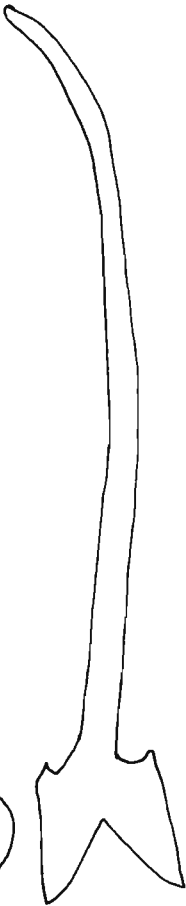
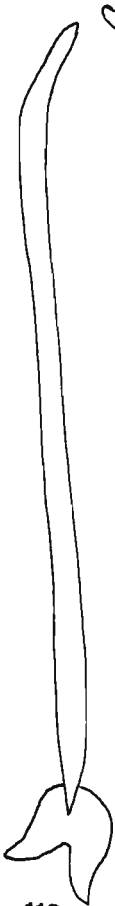
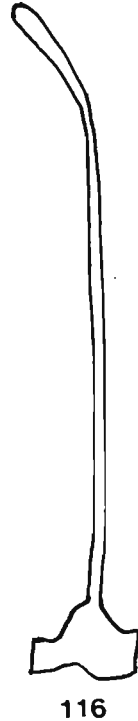
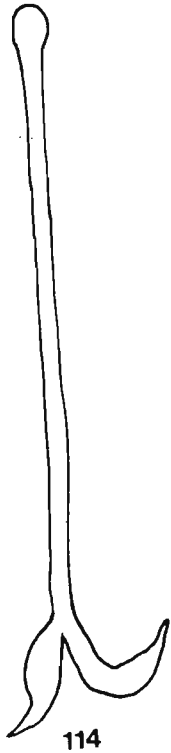
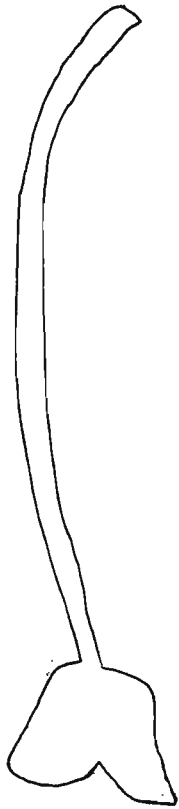
Figs. 109-110. Venter of :

- 109. *Sympiezomias* Faust,
- 110. *Indomias* Marshall.



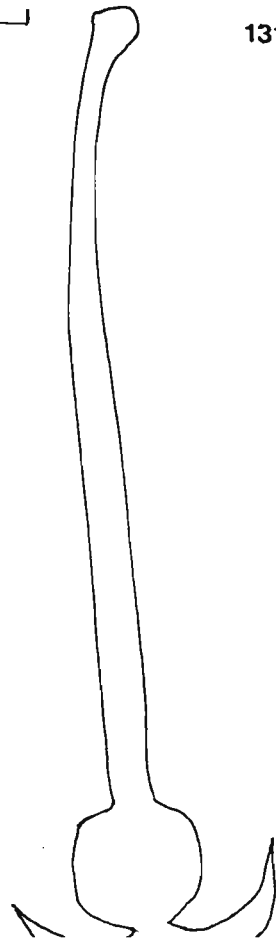
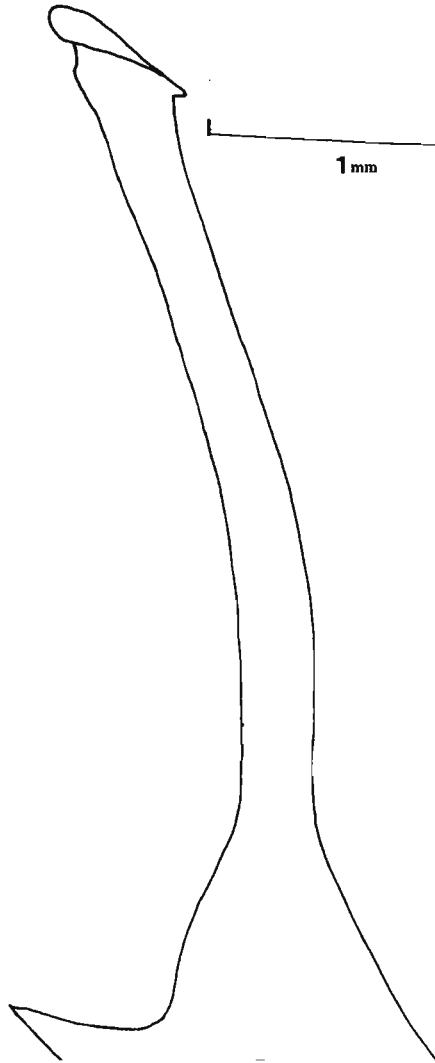
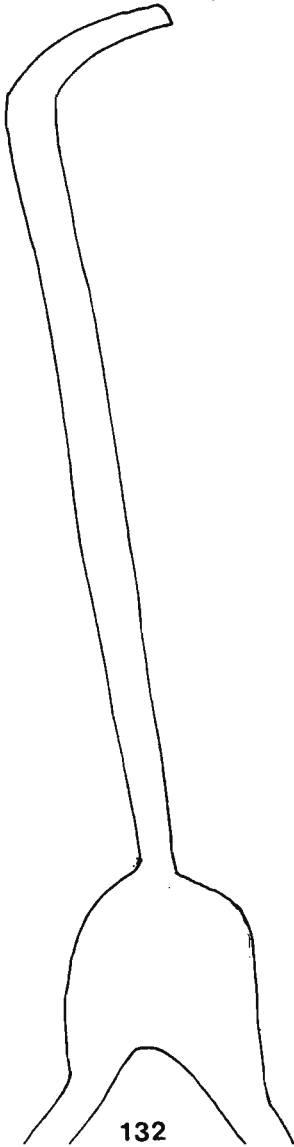
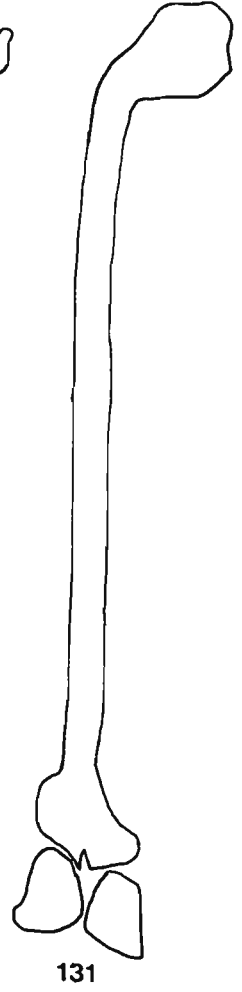
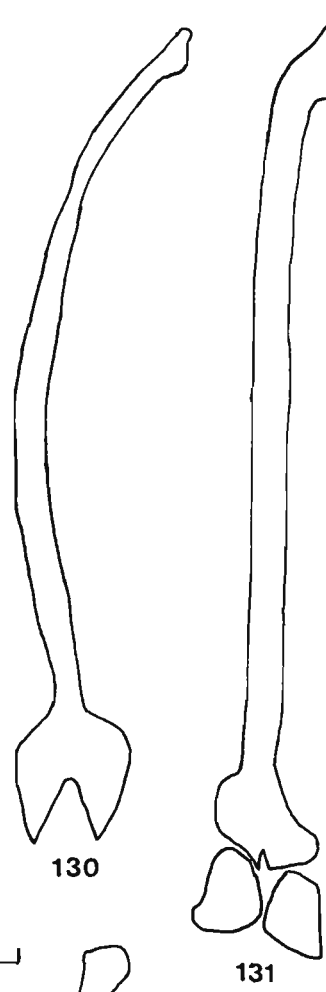
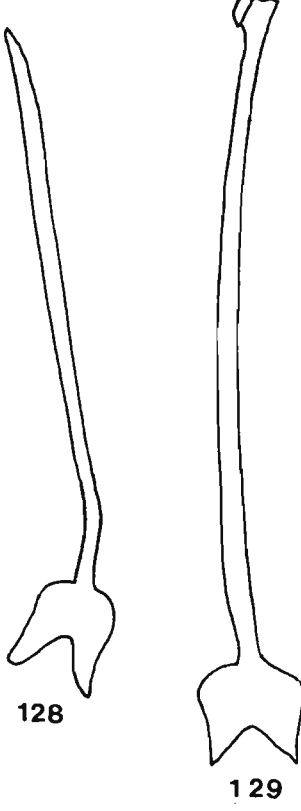
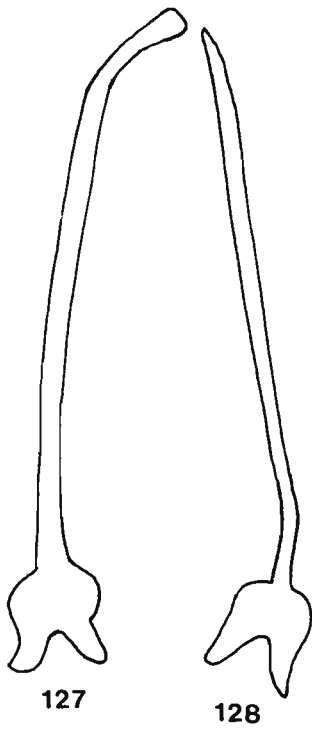
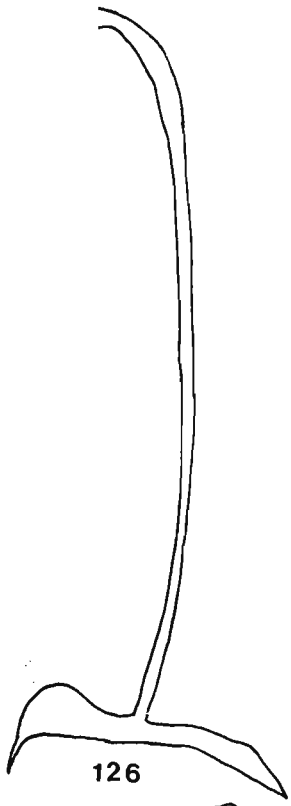
Figs. 111-125. Male genitalia, spiculum gastrale of :

- 111. *cretaceus*,
- 112. *decipiens*,
- 113. *frater*,
- 114. *beesoni*,
- 115. *hispidus*,
- 116. *praeteritus*,
- 117. *acutipennis*,
- 118. *anamalainus*,
- 119. *prasinus*,
- 120. *lividus*,
- 121. *subacutipennis* sp.nov.,
- 122. *ramakrishnani* sp.nov.,
- 123. *satyanarayanai* sp.nov.,
- 124. *menoni* sp.nov.,
- 125. *subdecipiens* sp.nov.



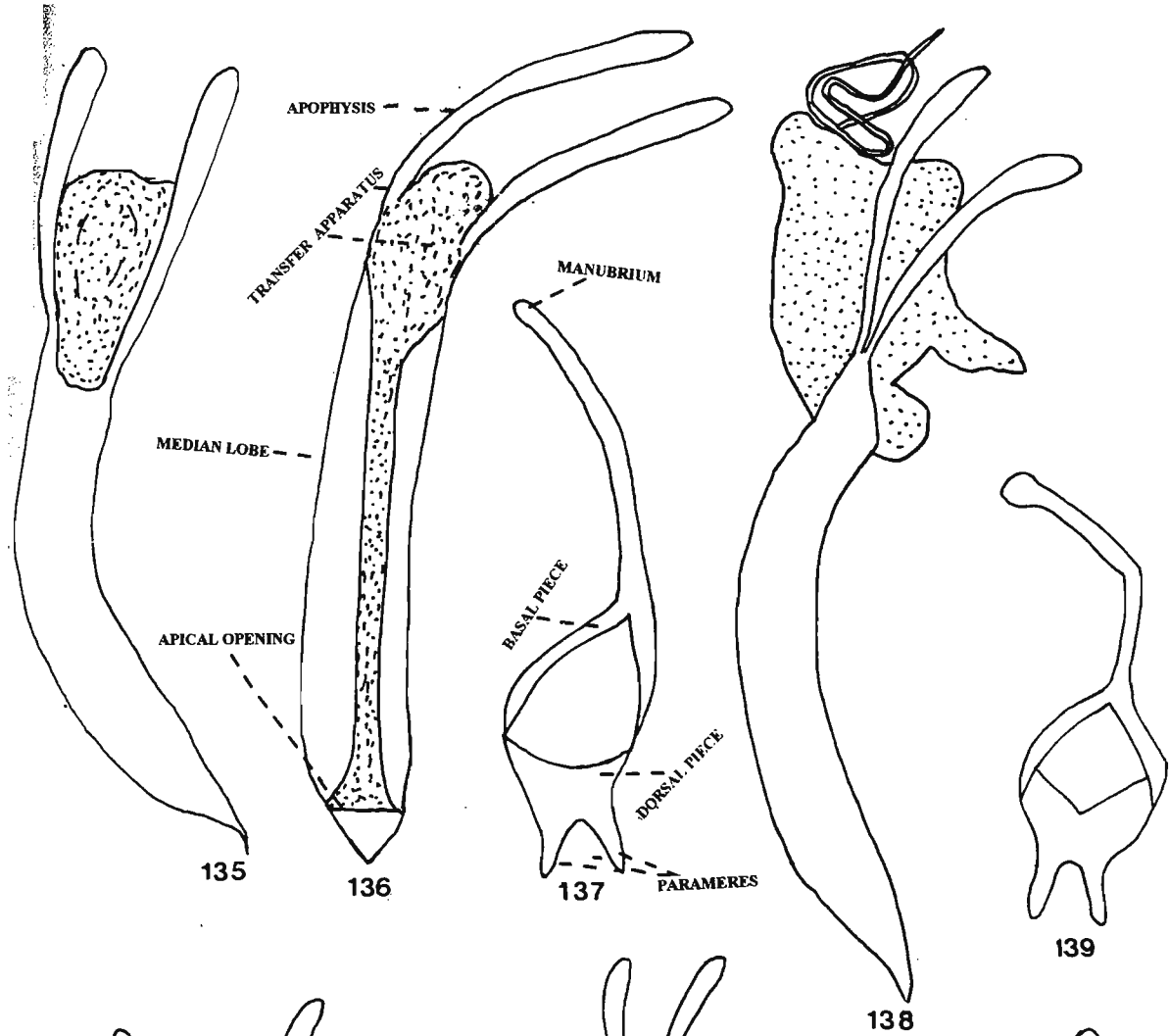
Figs. 126-134. Male genitalia, spiculum gastrale of :

- 126. *mayarami* sp.nov.,
- 127. *maicykuttyae* sp.nov.,
- 128. *yercaudensis* sp.nov.,
- 129. *subkraatzi* sp.nov.,
- 130. *perroteti*,
- 131. *Sympiezomias subserratipes* sp.nov.
- 132. *Burmotragus similis*,
- 133. *Geotragus subfasciatus*,
- 134. *Geotragus himalayanus*.



**Figs. 135-143. Male genitalia, median lobe- ventral and dorsal views
and tegmen , of :**

135-137. *cretaceus*,
138-140. *decipiens*,
141- 143. *frater*.



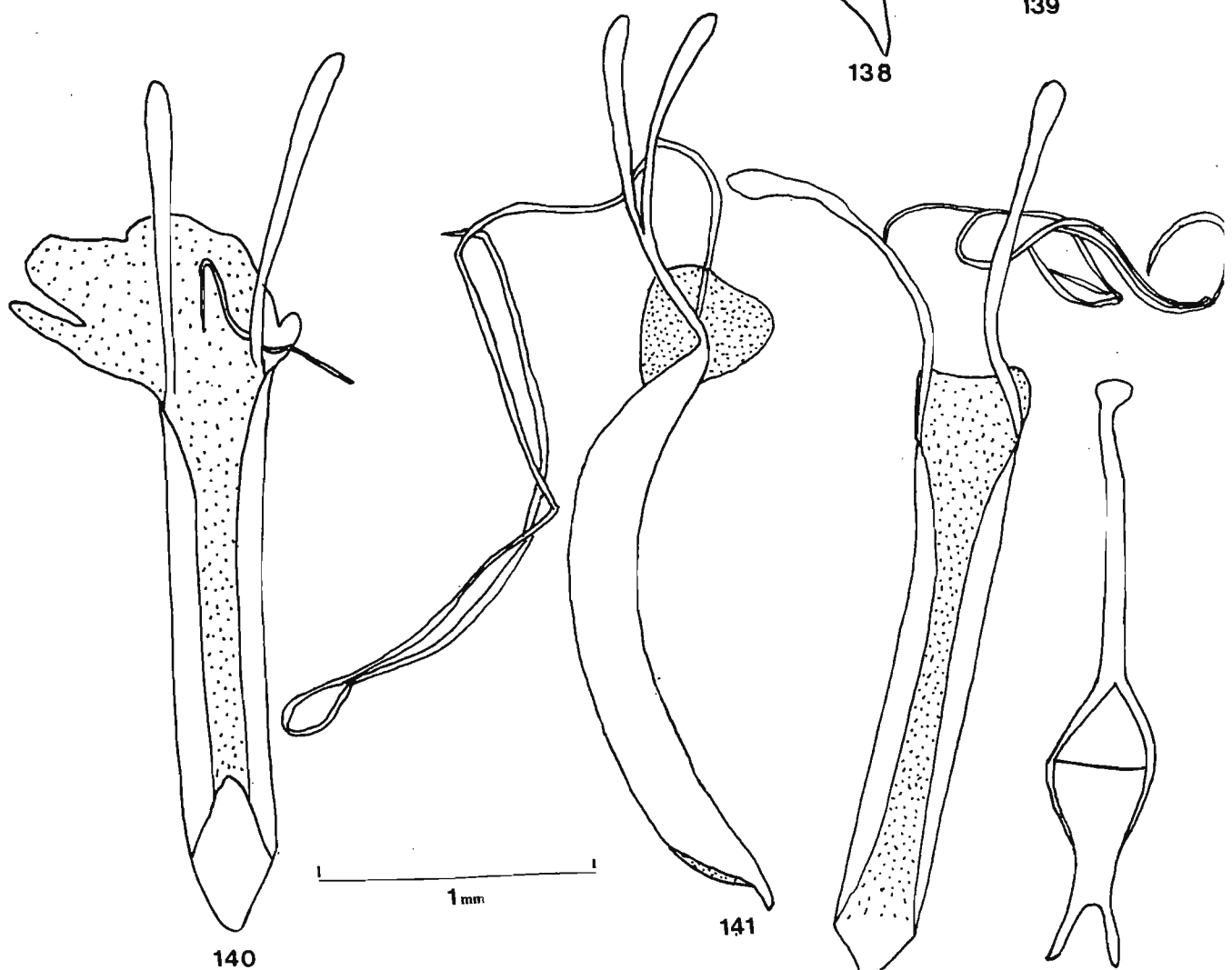
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136

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139



140

141

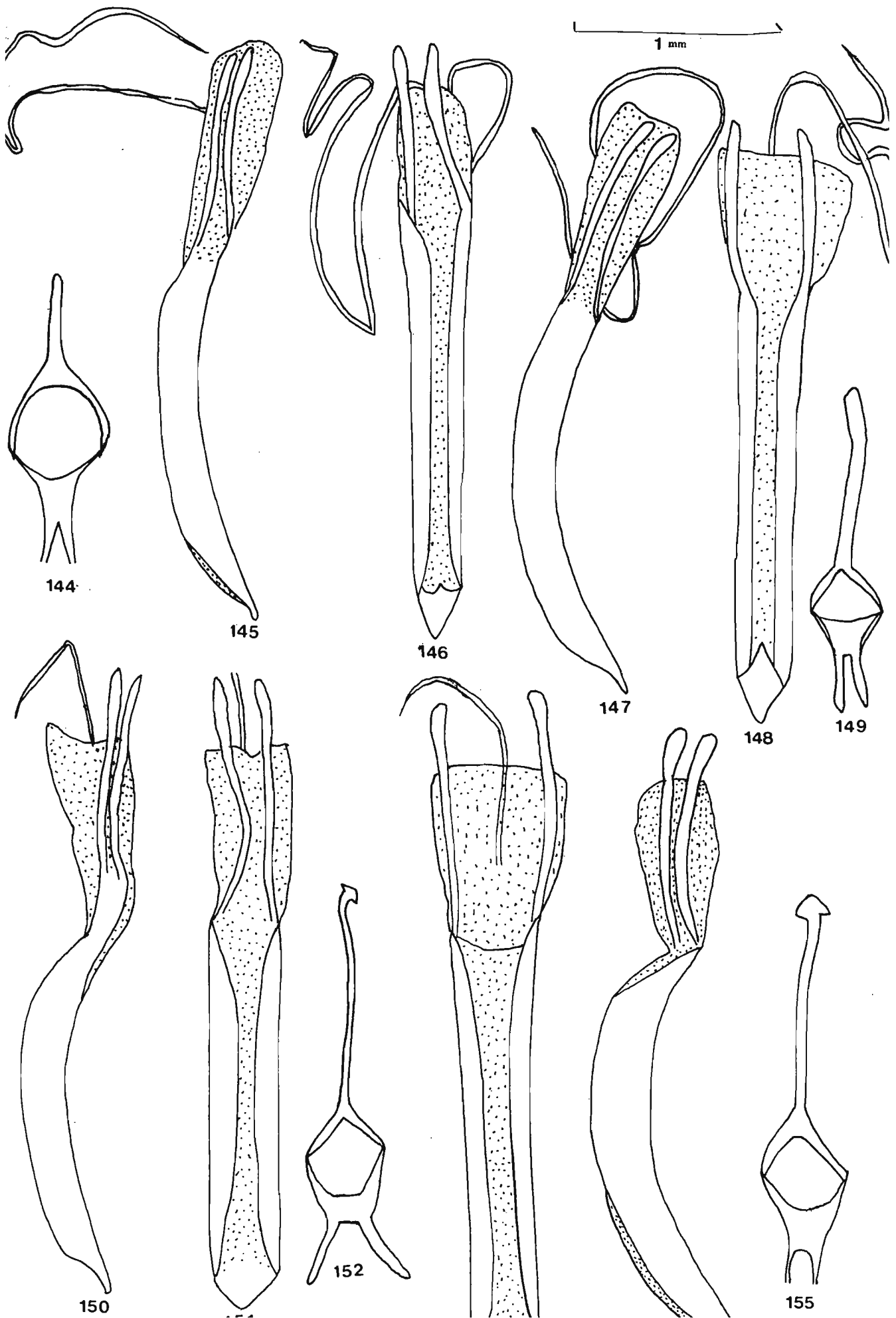
**Figs. 144-155. Male genitalia, median lobe- ventral and dorsal views
and tegmen , of :**

144-146. *beesoni*,

147-149. *hispidus*,

150-152. *praeteritus*,

153-155. *acutipennis*.

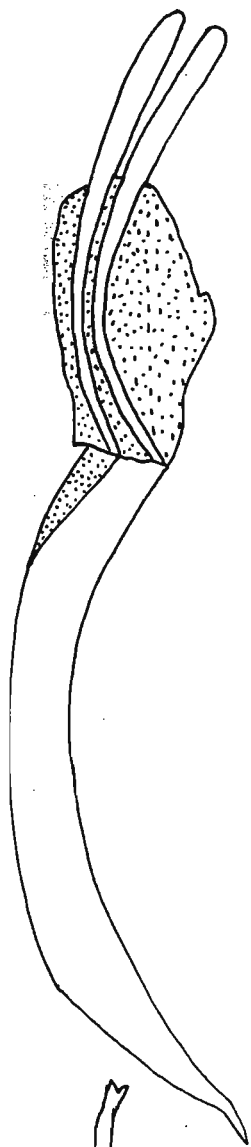


**Figs. 156-164. Male genitalia, median lobe- ventral and dorsal views
and tegmen , of :**

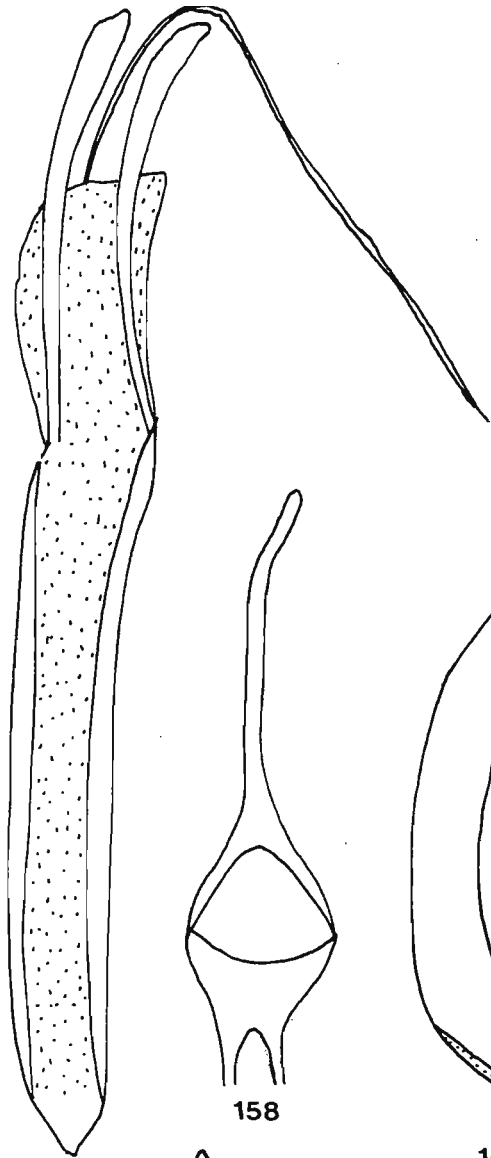
156-158. *anamalainus*,

159-161. *prasinus*,

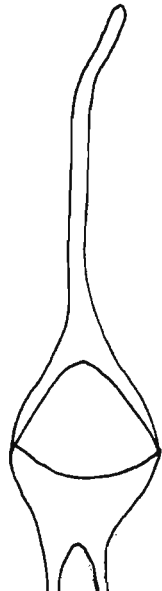
162-164. *perroteti*.



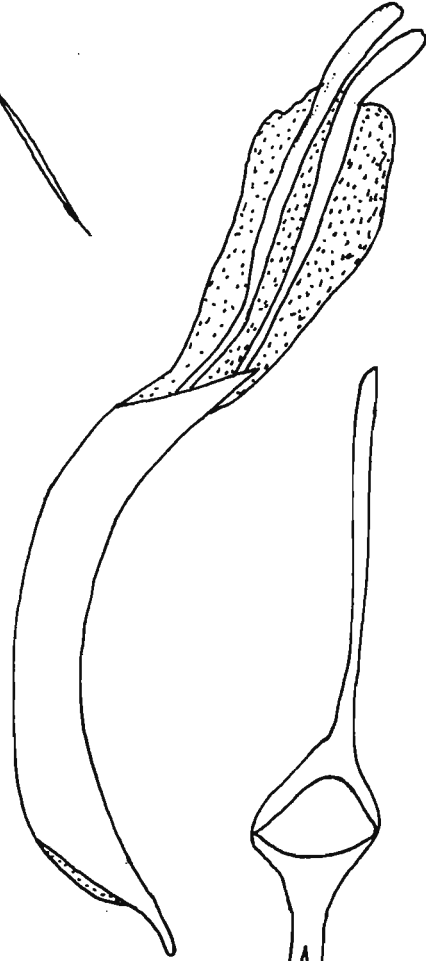
156



157



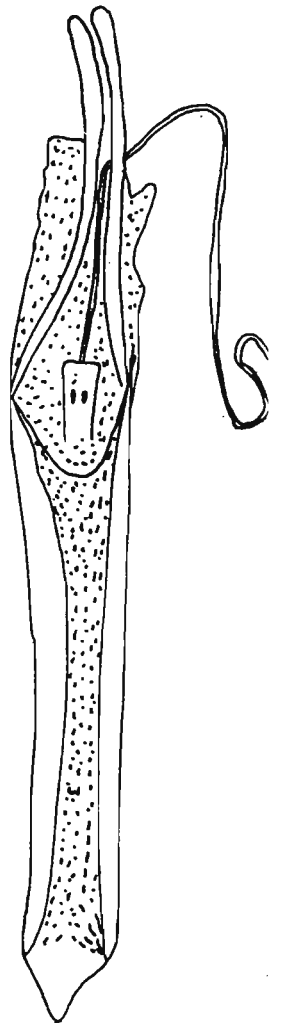
158



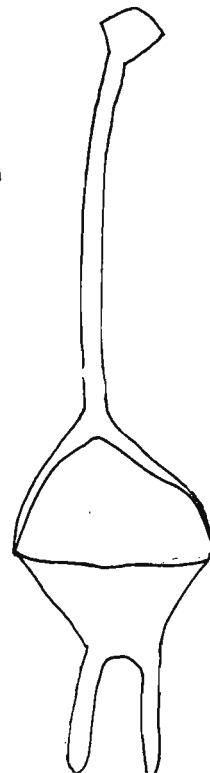
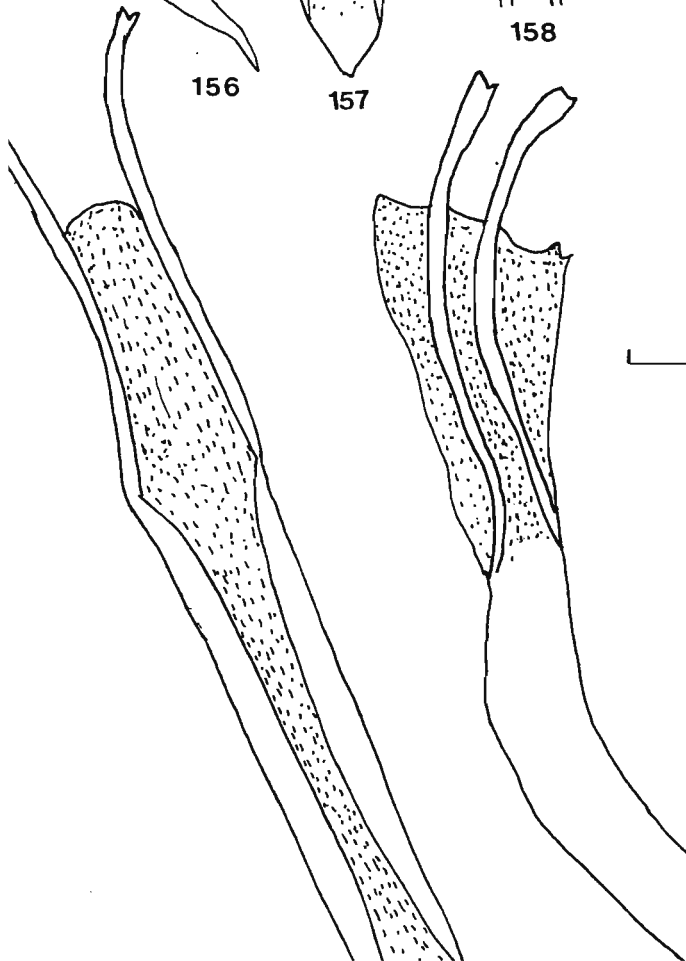
159



160



161

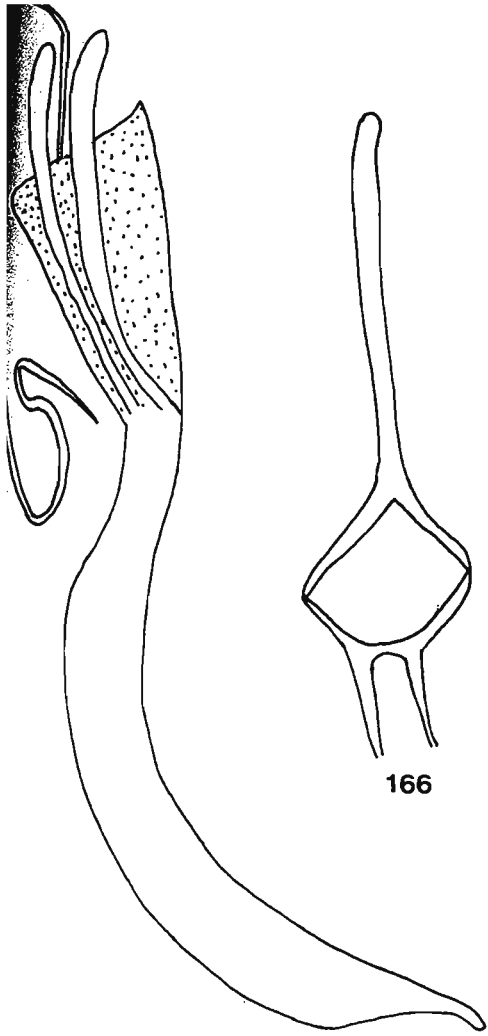


**Figs. 165-173. Male genitalia, median lobe- ventral and dorsal views
and tegmen , of :**

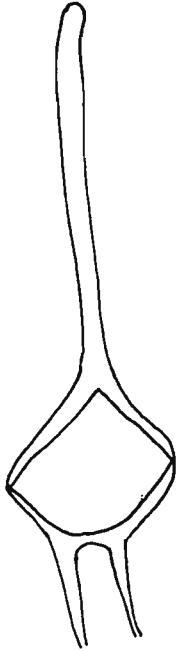
165-167. *lividus*,

168-170. *subacutipennis* sp.nov.,

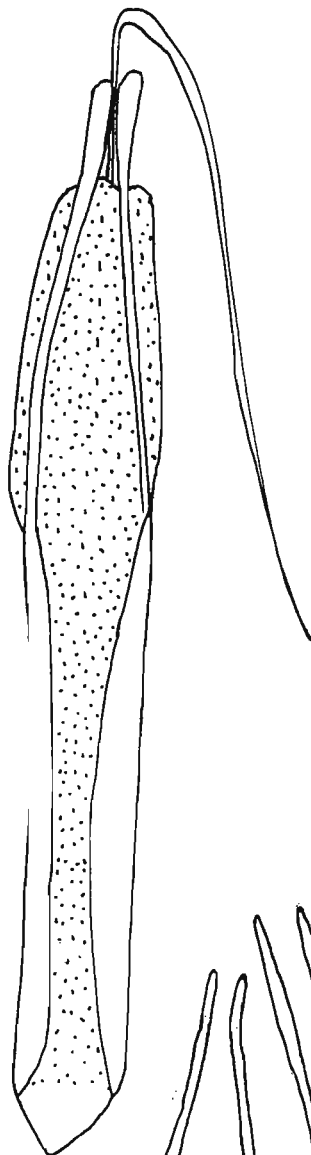
171-173. *mayarami* sp.nov.



165



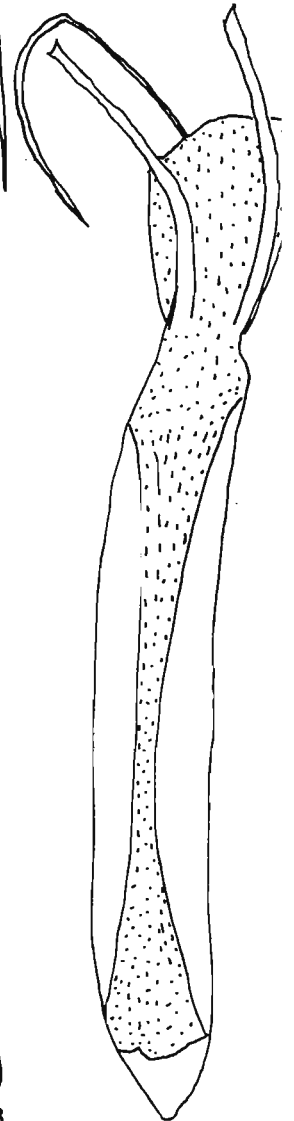
166



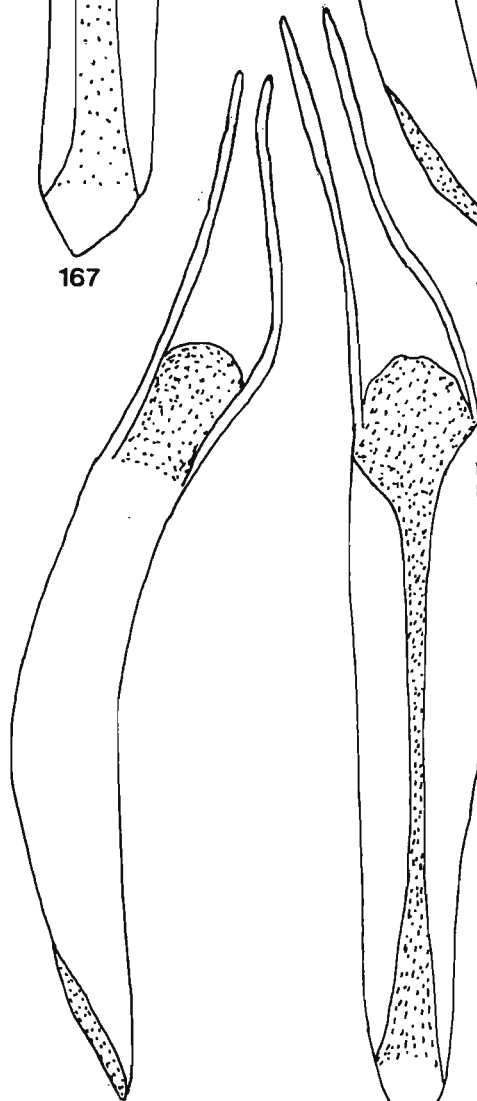
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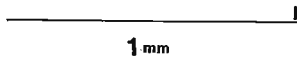
168



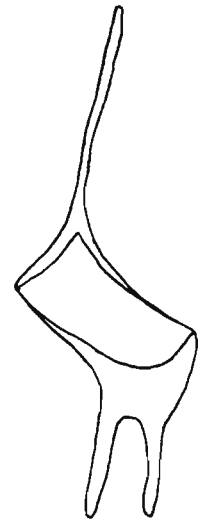
169



170



1 mm



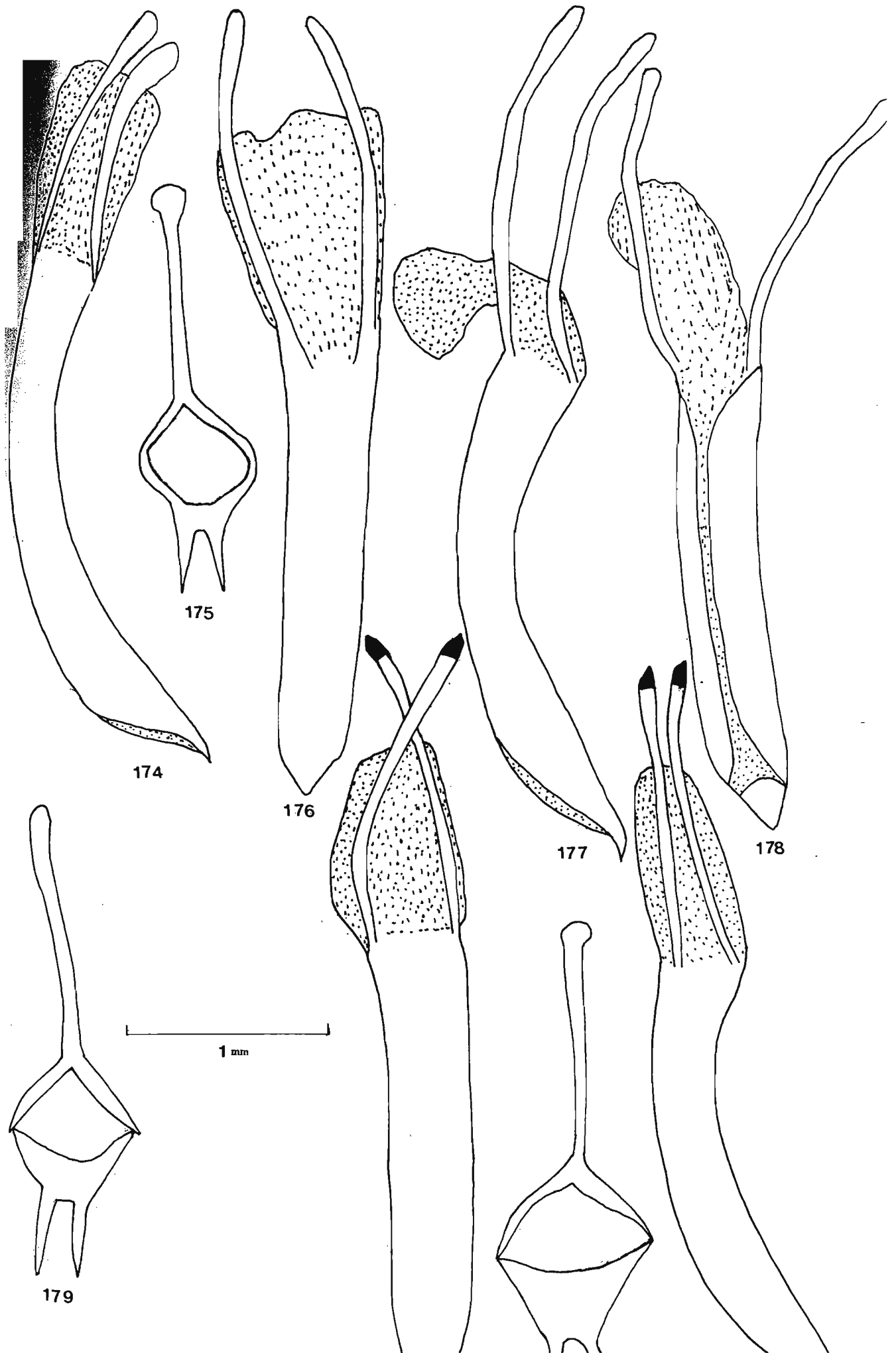
173

**Figs. 174-182. Male genitalia, median lobe- ventral and dorsal views
and tegmen , of :**

174-176. *ramakrishnani* sp.nov.,

177-179. *satyanarayanai* sp.nov.,

180-182. *menoni* sp.nov.



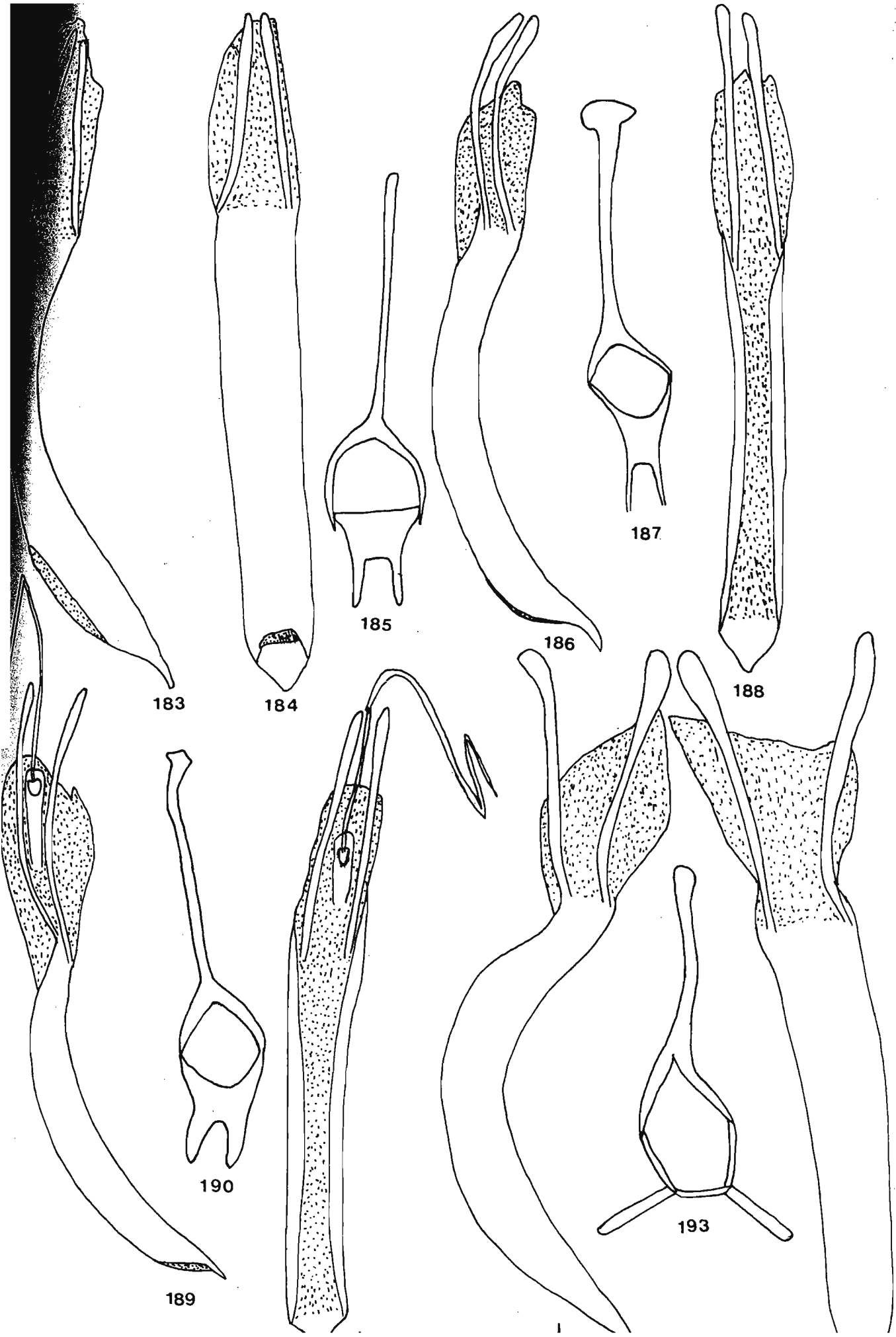
**Figs. 183-194. Male genitalia, median lobe- ventral and dorsal views
and tegmen , of :**

183-185. *subdeciepiens* sp.nov.,

186-188. *maicykuttyae* sp.nov.,

189-191. *yercaudensis* sp.nov.,

192-194. *Geotragus himalayanus*.



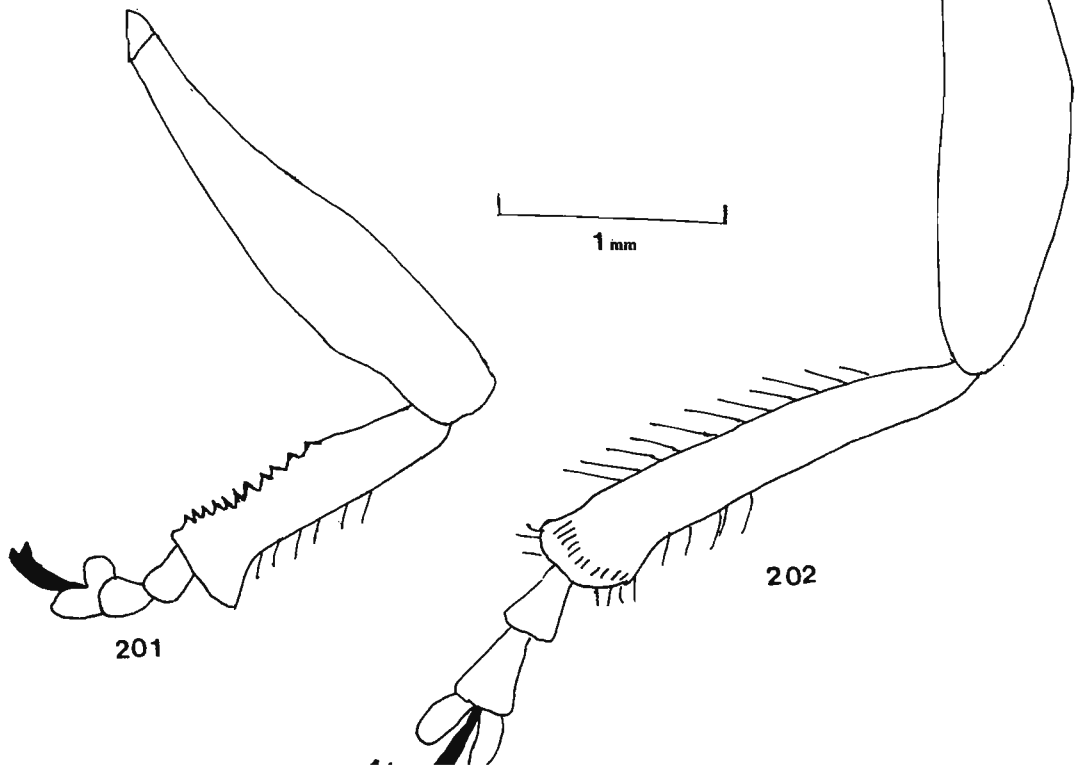
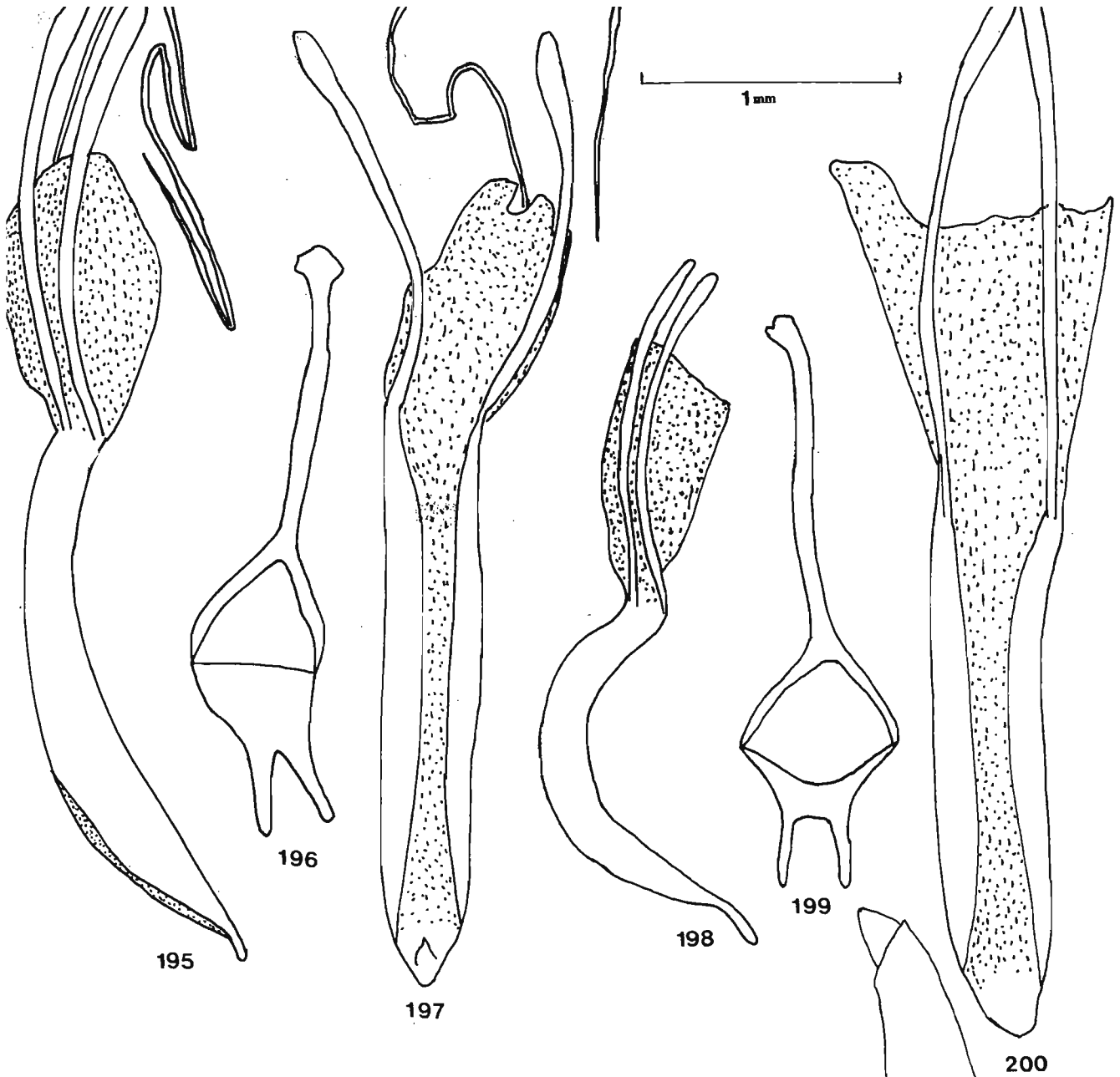
Figs. 195-200. Male genitalia, median lobe- ventral and dorsal views and tegmen , of :

195-197. *subkraatzi* sp.nov.,

198-200. *Sympiezomias subserratipes* sp.nov.

Figs. 201-202. Hind leg, of :

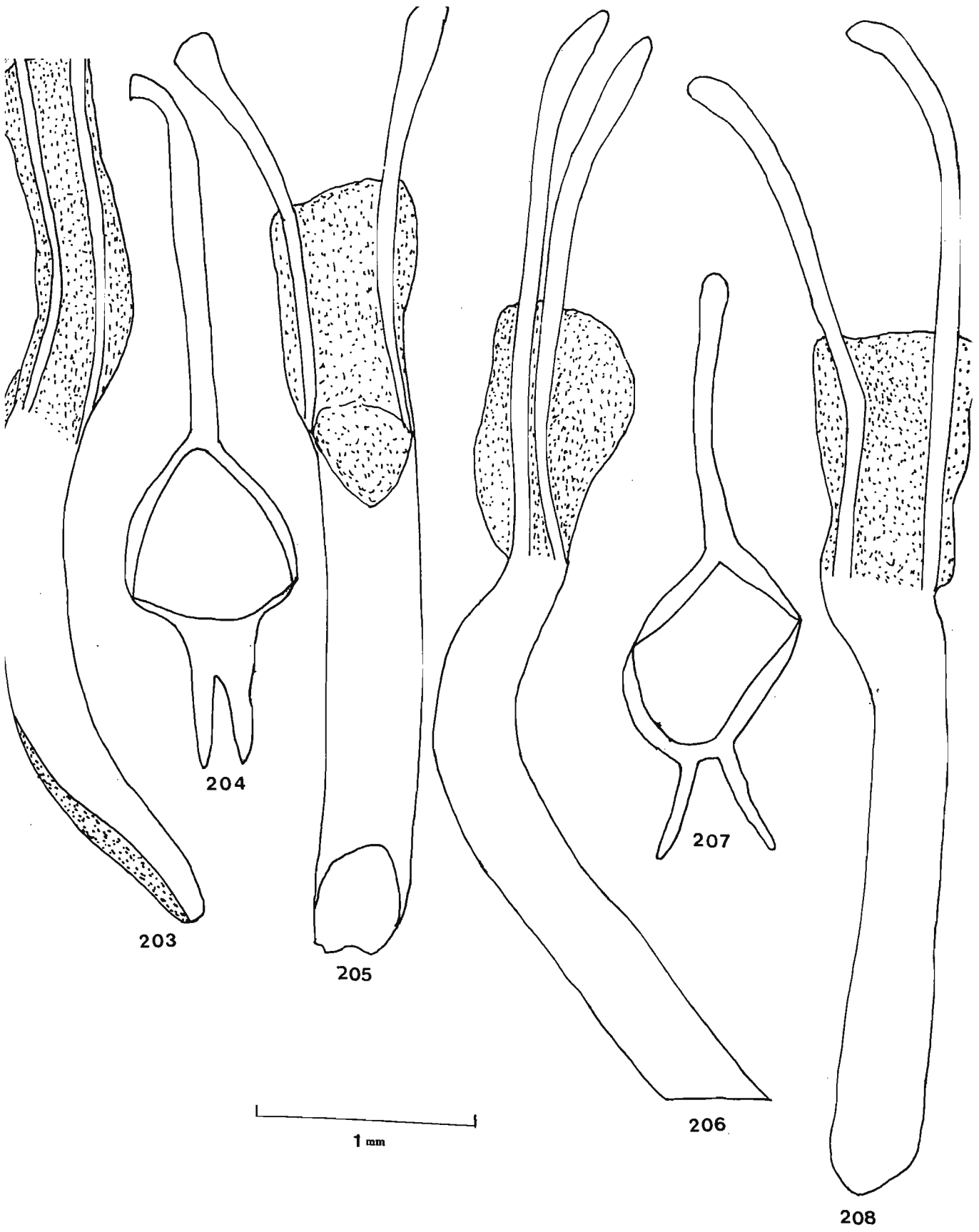
201. *Sympiezomias* Faust, 202. *Indomias* Marshall.



**Figs. 203-208. Male genitalia, median lobe- ventral and dorsal views
and tegmen , of :**

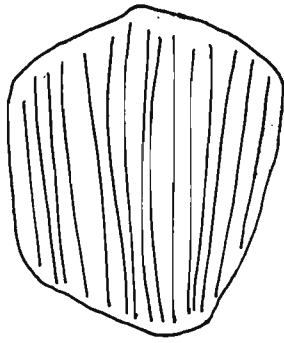
203-205. *Burmotragus similis*,

206-208. *Geotragus subfasciatus*.

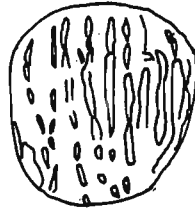


Figs. 209-229. Elytral vestiture :

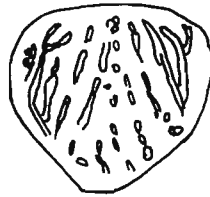
- 209. *cretaceus*,
- 210-211. *decipiens*,
- 212-214. *frater*,
- 215-216. *anamalainus*,
- 217. *beesoni*,
- 218-219. *hispidus*,
- 220. *acutipennis*,
- 221-222. *praeteritus*,
- 223. *prasinus*,
- 224. *albizziae* sp.nov.,
- 225-227. *lividus*,
- 228-229. *yercaudensis* sp.nov.



209



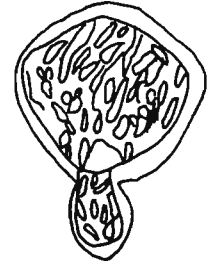
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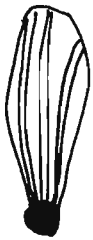
211



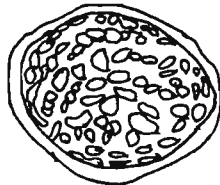
212



213



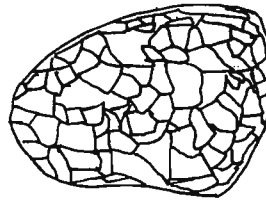
214



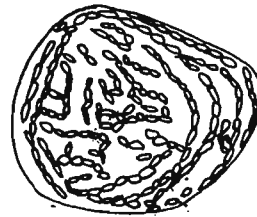
215



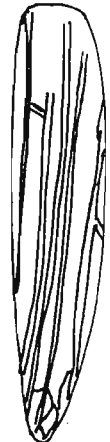
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217



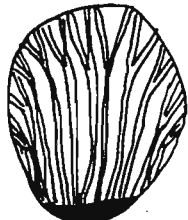
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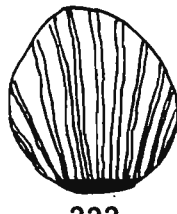
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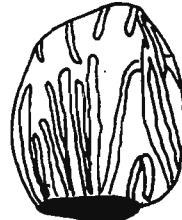
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221



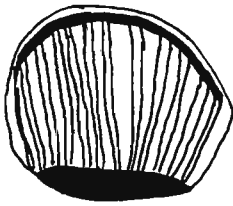
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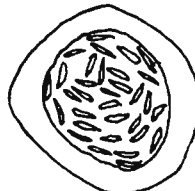
223



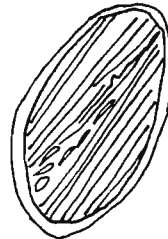
224



225



226



227



228



229

Figs. 230-246. Elytral vestiture :

230-231. *subacutipennis* sp.nov.,

232. *megakraatzi* sp.nov.,

233-234. *marshalli* sp.nov.,

235-236. *mucronatus* sp.nov.,

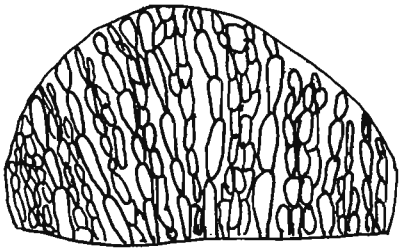
237-238. *ramakrishnani* sp.nov.,

239-240. *satyanarayanai* sp.nov.,

241-242. *menoni* sp.nov.,

243-244. *subdecipiens* sp.nov.,

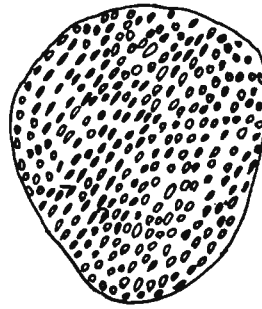
245-246. *anasuryae* sp.nov.



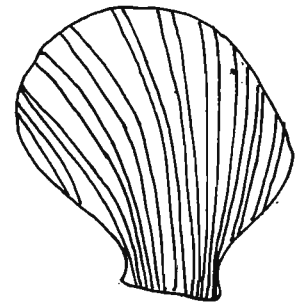
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233



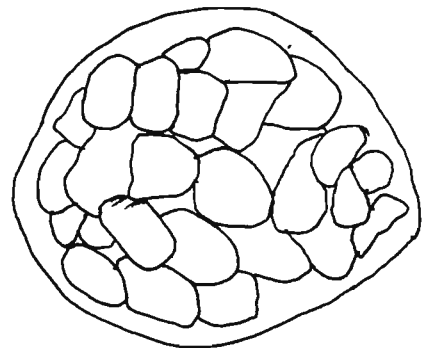
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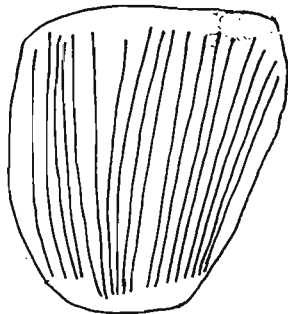
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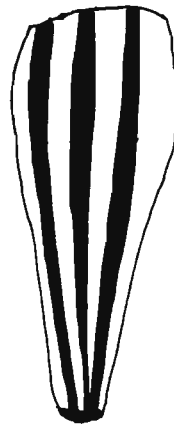
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238



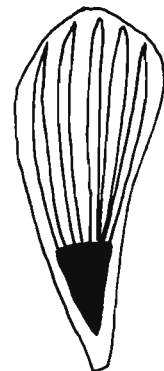
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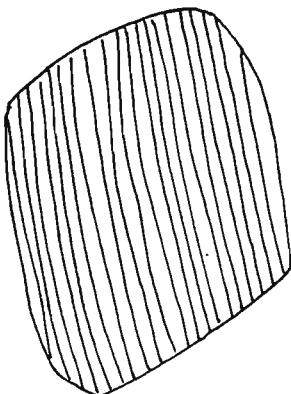
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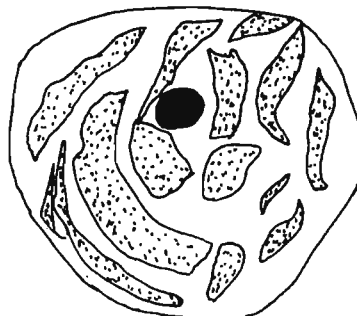
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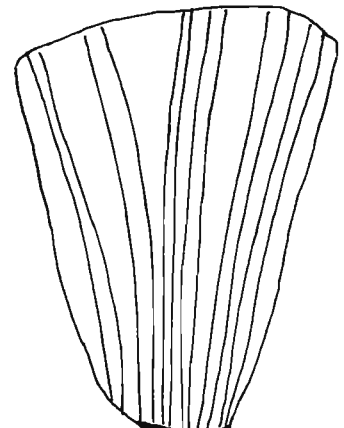
242



243



244



Figs. 247-255. Elytral vestiture :

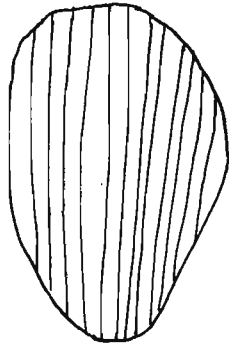
247-248. *mayarami* sp.nov.,

249. *maicykuttyae* sp.nov.,

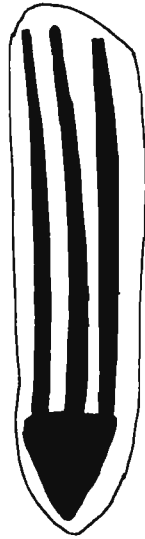
250-251. *subkraatzi* sp.nov.,

252-253. *perroteti*,

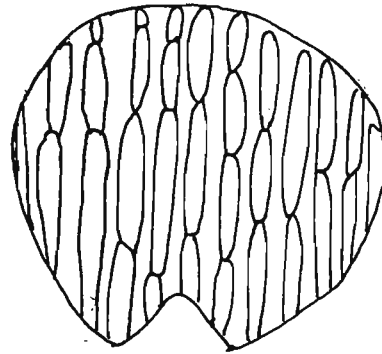
254-255. *Sympiezomias subserratipes* sp.nov.



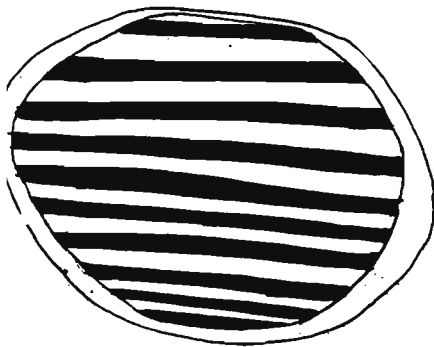
247



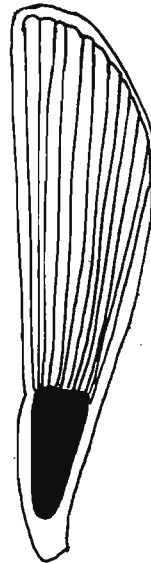
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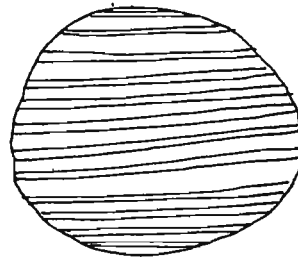
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250



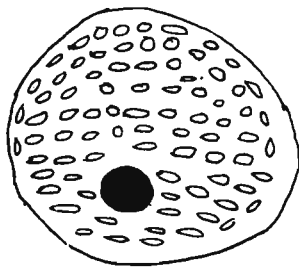
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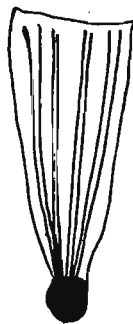
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253



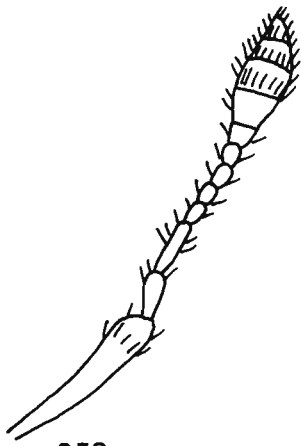
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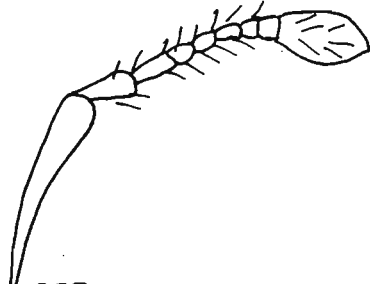
255

Figs. 256-270. Antennae, of :

- | | |
|-------------------------------------|---------------------------------|
| 256. <i>cretaceus</i> , | 257. <i>decipiens</i> , |
| 258. <i>frater</i> , | 259. <i>anamalainus</i> , |
| 260. <i>beesoni</i> , | 261. <i>hispidus</i> , |
| 262. <i>acutipennis</i> , | 263. <i>lividus</i> , |
| 264. <i>praeteritus</i> , | 265. <i>prasinus</i> , |
| 266. <i>subacutipennis</i> sp.nov., | 267. <i>albizziae</i> sp.nov., |
| 268. <i>marshalli</i> sp.nov., | 269. <i>mucronatus</i> sp.nov., |
| 270. <i>ramakrishnani</i> sp.nov., | |



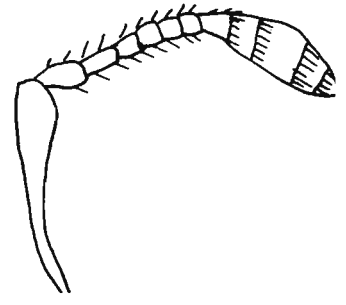
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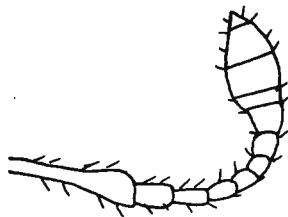
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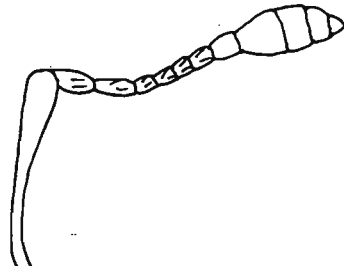
258



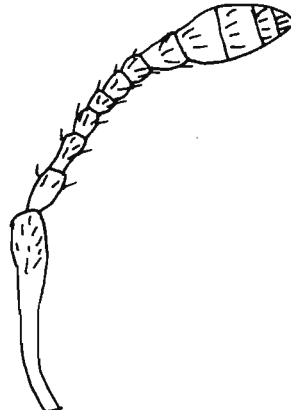
259



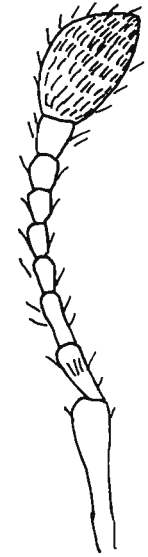
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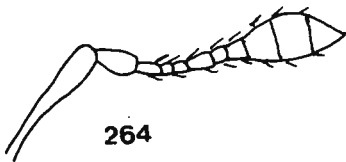
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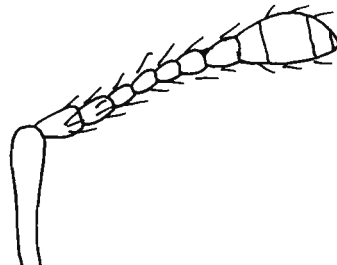
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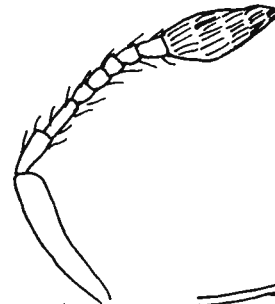
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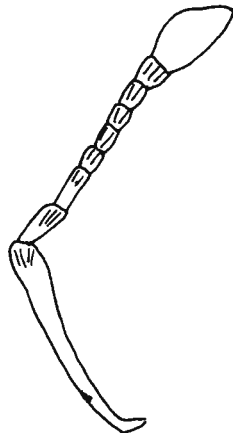
266



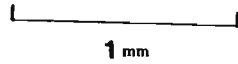
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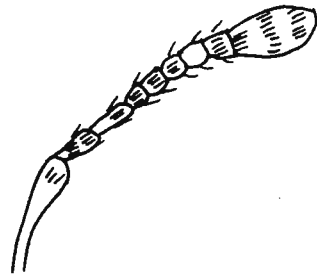
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Figs. 271-280. Antennae, of :

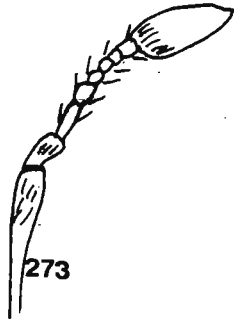
- 271. *satyanarayanai* sp.nov.,
- 272. *menoni* sp.nov.,
- 273. *perroteti*,
- 274. *subdecipiens* sp.nov.
- 275. *anasuryae* sp.nov.,
- 276. *mayarami* sp.nov.,
- 277. *maicykuttyae* sp.nov.,
- 278. *subkraatzi* sp.nov.,
- 279. *yercaudensis* sp.nov.,
- 280. *Sympiezomias subserratipes* sp.nov.



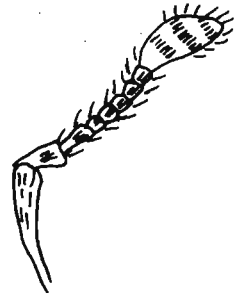
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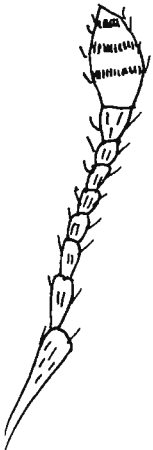
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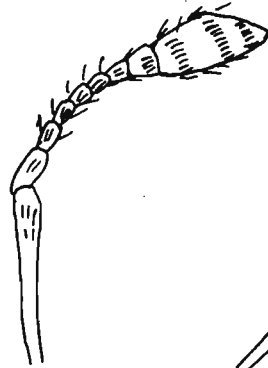
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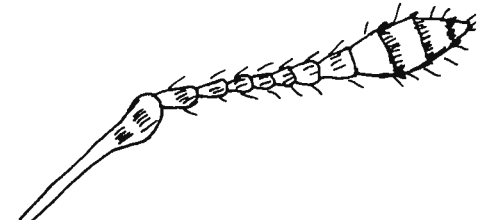
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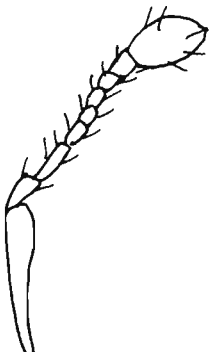
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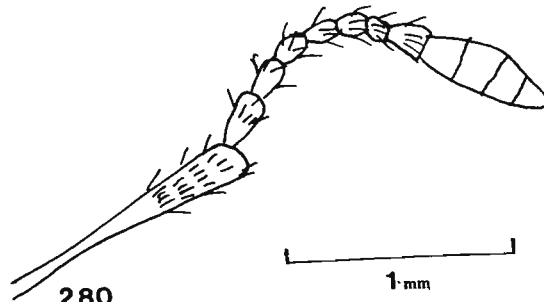
277



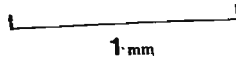
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279



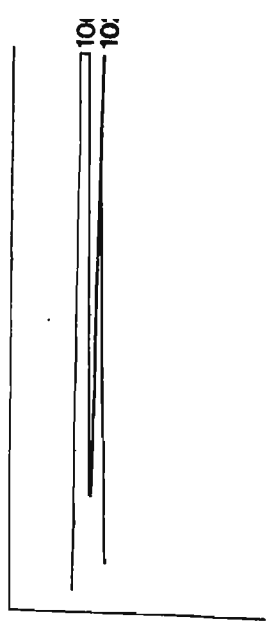
280



1 mm

Figs. 281-289. Gas chromatograms of cuticular extracts, of

- 281. *cretaceus*,**
- 282. *prasinus*,**
- 283. *praeteritus*,**
- 284. *decipiens*,**
- 285. *anamalainus*,**
- 286. *lividus*,**
- 287. *frater*,**
- 288. *acutipennis*,**
- 289. *beesoni*.**



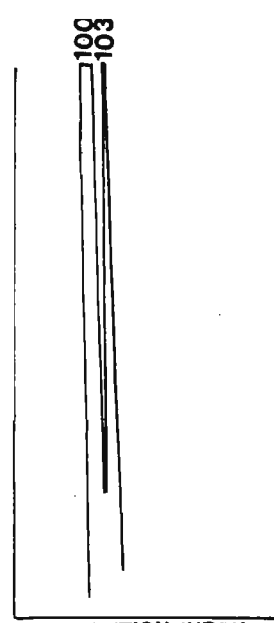
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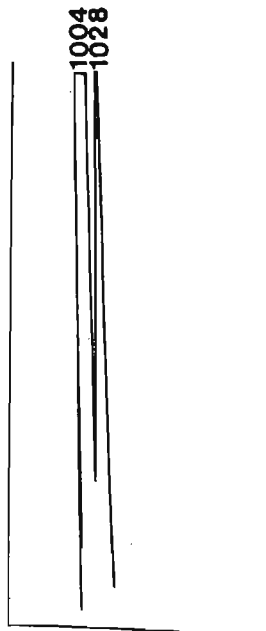
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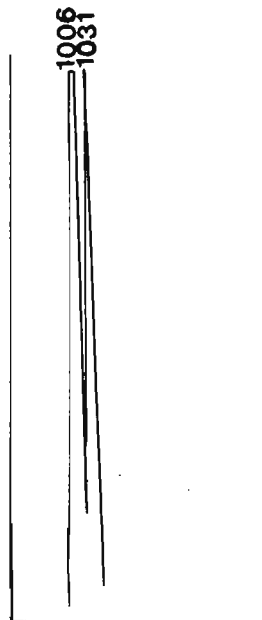
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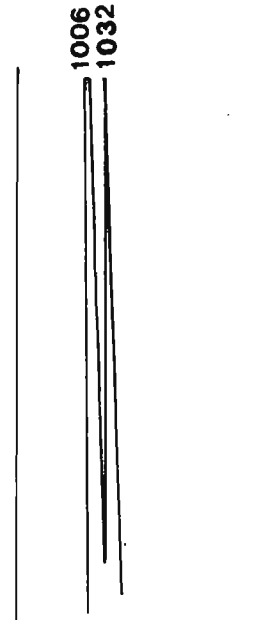
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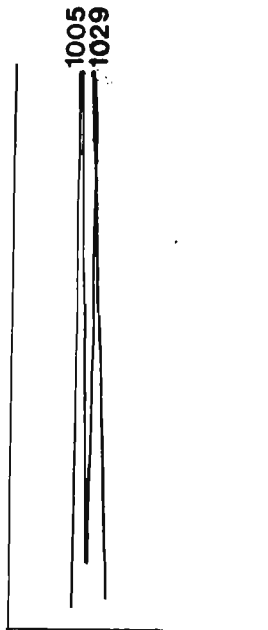
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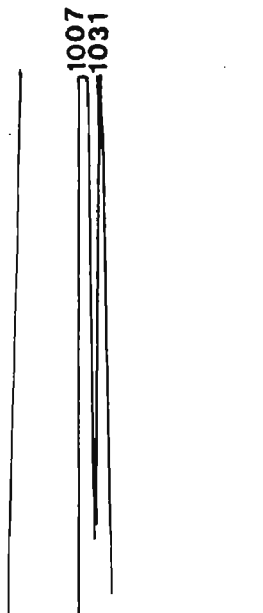


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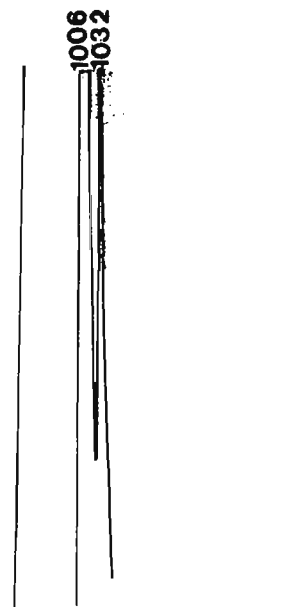
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Figs. 290-293. *Indomias* spp.

290. *subacutipennis* sp.nov.,

291. *albizziae* sp.nov.,

292. *megakraatzi* sp.nov.,

293. *marshalli* sp.nov.



290



291



292



293

Figs. 294-297. *Indomias* spp.

- 294. *mucronatus* sp.nov.,**
- 295. *ramakrishnani* sp.nov.,**
- 296. *satyanarayanai* sp.nov.,**
- 297. *menoni* sp.nov.**



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295



296



297

Figs. 298-301. *Indomias* spp.

298. *subdeciens* sp.nov.,

299. *anasuryae* sp.nov.,

300. *mayarami* sp.nov.,

301. *maicykuttyae* sp.nov.



298



299



300



301

Figs. 302-306. *Indomias* spp.

302. *yercaudensis* sp.nov.,

303. *subkraatzi* sp.nov.,

305. *perroteti*,

306. *frater*.

304. *Sympiezomias subserratipes* sp.nov.



302



303



305



306



Figs. 307-310. *Indomias* spp.

307. *decipiens*,

308. *anamalainus*,

309. *hispidus*,

310. *cretaceus*.



307



308



309



310

Figs. 311-314. *Indomias* spp.

- 311. *beesoni*,**
- 312. *acutipennis*,**
- 313. ♂ *praeteritus*,**
- 314. ♀ *praeteritus*.**



311



312



313



314

Figs. 315-318. *Indomias* spp.

315. *prasinus*,

316. *lividus*,

317. *Burmotragus similis*,

318. *Geotragus subfasciatus*.



315



6
31



317



3
31E