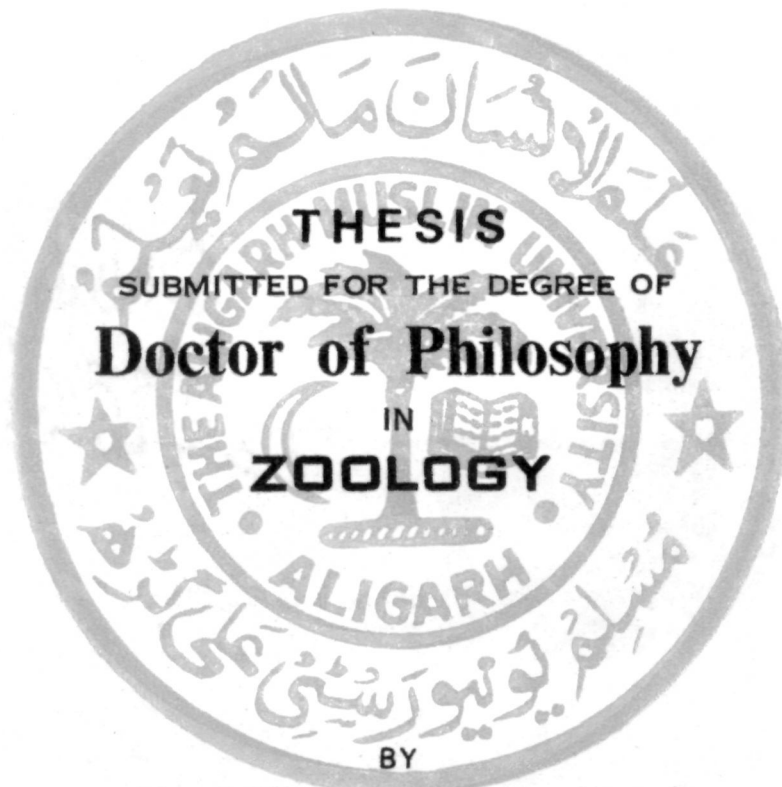




**TAXONOMIC STUDIES ON INDIAN CHELONINAE
(HYMENOPTERA : BRACONIDAE)**



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ABSTRACT

The present work incorporates studies on the taxonomy of the subfamily Cheloninae (Hymenoptera : Braconidae) . The members of the subfamily are widely distributed all over the world and most of them are economically important as they are solitary egg-larval koinobiont endoparasitoids of lepidopterous pests of agriculture , horticulture and forestry , keeping the population of their respective host species under check in nature .

In the present work , important contributions made by earlier workers on the taxonomy of chelonine parasitoids are given , along with a brief history of the taxonomy of Braconidae . Diagnosis and key to the tribes and genera of Indian Cheloninae is given . Separate keys to the Indian species of all the genera are given . A Separate key to the males of the genus *Microchelonus* Szepilgeti is also provided . In all , forty-two species of the subfamily spread over five genera have been included , of which *Phanerotomella namkyensis* Sigwalt has been reported for the first time from India . Fifteen new species are fully described and illustrated with the help of eighty-one diagrams . The new species are : *Ascogaster indica* sp.n. , *Microchelonus spinigaster* sp.n. , *M. cordiae* sp.n. , *M. lygropiae* sp.n. , *M. aligarhensis* sp.n. , *M. alucitae* sp.n. , *Phanerotomella solapurensis* sp.n. , *P. aligarhensis* sp.n. , *Phanerotoma (Bracotritoma) testacea* sp.n. , *P. (B.) ashae* sp.n. , *P. (B.) yagyai* sp.n. , *Phanerotoma (Phanerotoma) dichocrophaga* sp.n. , *P. (P.) achterbergi* sp.n. , *P. (P.) agarwali* sp.n. and *P. (P.) indica* sp.n. A new combination i.e. *Microchelonus chailini* (Walker & Huddleston) is also proposed .

The entire study is based on the specimens collected from different parts of India , specially Aligarh . Holotypes , paratypes and other material examined by the author , have been deposited in the Zoological Museum , Aligarh Muslim University , Aligarh , India .



**TAXONOMIC STUDIES ON INDIAN CHELONINAE
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THESIS
SUBMITTED FOR THE DEGREE OF
Doctor of Philosophy
IN
ZOOLOGY

BY
KALPNA VARSHNEY

DEPARTMENT OF ZOOLOGY
ALIGARH MUSLIM UNIVERSITY
ALIGARH (INDIA)

1999

*DEDICATED
TO
MY PARENTS*



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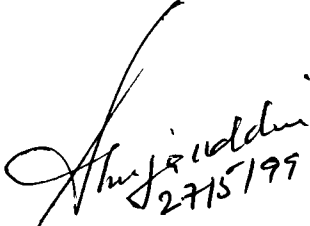
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- 2 PARASITOLOGY
- 3 ICHTHYOLOGY & FISHERIES
- 4 AGRICULTURAL NEMATOTOLOGY
- 5 GENETICS

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Date

Certificate

This to certify that Ms. Kalpna Varshney has completed her Ph.D work under my supervision on the problem entitled "Taxonomic Studies on Indian Cheloninae (Hymenoptera : Braconidae)". The work is an original contribution and distinct addition to the existing knowledge on the subject. Being satisfied with quality and quantity of work, she is permitted to submit it for the award of Ph.D. degree in Zoology of the Aligarh Muslim University , Aligarh .


(Prof. Shujauddin)

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KALPNA VARSHNEY

INTRODUCTION

The family Braconidae : Ichneumonoidea is one of the large families of Hymenoptera, widely distributed over the world , whereas from India it is known by about 500 species only . Most of the species are parasitic on other insects , belonging to Lepidoptera , Coleoptera , Hymenoptera , Diptera , Neuroptera , Psocoptera and Hemiptera , specially the family Aphididae (Achterberg , 1993) .

The subfamily Cheloninae belongs to the microgastroid assemblage of Braconidae, with 800 described species from the world (Shenefelt , 1973 ; Papp, 1981, 1989, 1993 ; Huddleston , 1984 ; Walker & Huddleston , 1987a ; Achterberg ,1990 ; Tobias ,1990, 1991, 1993, 1994,1995a, 1995b, 1995c ; Narendran *et al.* ,1992 ; Huddleston & Walker ,1994 ; Tang & Marsh , 1994 ; He *et al.*, 1994, 1997) . The subfamily is represented by 116 species from the Indo-Australian region , of which , only 27 species have been reported from India , so far . Most of the species are of economic interest , since they are solitary egg-larval koinobiont endoparasitoids of lepidopterous pests of agriculture , horticulture and forestry . They keep the population of their respective host species under check in nature . The parasitoids lay their eggs into the eggs of the host and continues development within the larvae of the host . The final instar larvae consumes the host except for the skin and head capsule (Broodryk ,1969). The biology of the chelonine wasps has been reviewed by Shaw & Huddleston (1991) .

A number of species of the subfamily Cheloninae have been tried in biological control projects . *Microchelonus blackburni* (Cameron) , was released in Texas and Mexico between 1932 and 1944 against the pink bollworm *Pectinophora gossypiella*(Saunders) , although the species was recovered in field collections, permanent establishment failed (Noble & Hunt ,1937 ; McGough & Noble ,1955). *Phanerotoma (Phanerotoma) fracta* Kokujev was introduced from Hungary into USA between 1936-38 , for biological control of the lima bean pod borer *Etiella zinckenella* Trietschke (Parker ,1951) . *Microchelonus phthorimaeae* Gahan has been established in the field near Canberra , after its introduction from California (Annon ,1944) . In 1953 and 1954 *Microchelonous heliopae* (Gupta) was released in Texas and Mexico to aid

pink bollworm control (McGough and Noble ,1957) . Again the same species was released in Louisiana in 1954 against the sugarcane borer (Charpentier , 1958) . But the establishment of this species apparently failed in all cases. *Chelonus scrobiculatus* Szepligeti has been established in Fiji where it was introduced to control banana scab-worm *Nacoleia octasema* (Meyrick) (Paine ,1964) . In India , *Microchelonus blackburni* (Cameron) was released in Tamil Nadu, against cotton bollworm *Earias vitella* (Fabricius) . The parasitoid considerably reduced numbers of *E.vitella* in the shed fruiting bodies and flowers with 11.5 % recovery (Surulivelu , 1989) .

In spite of great economic importance , little work has been done on the taxonomy of Indian Cheloninae and most of the literature consists of isolated descriptions of species (Rao & Chalikwar, 1971 ; Shenefelt , 1973 ; Narendran *et al.* , 1992 ; Kurhade & Nikam, 1993, 1994 ; Shujauddin & Varshney ,1997) . The subfamily is represented by two tribes viz., Chelonini Nees and Phanerotomini Baker including the genera *Ascogaster* Wesmael *Chelonus* Panzer , *Microchelonus* Szepligeti , *Phanerotoma* Wesmael and *Phanerotomella* Szepligeti . However , the latter genus is reported for the first time from India . The great diversity of chelonines in India and neighbouring regions necessitates an enormous amount of work. Further , keeping in view , the economic importance of the subfamily Cheloninae , the study on its taxonomy is undertaken . The present study is the first attempt on the systematics of the entire subfamily from India .

In the present work , brief diagnosis and key to the tribes and genera of the Indian Cheloninae is given . Separate keys to Indian species of all the genera are provided . A separate key to the males of the genus *Microchelonus* Szepl. is also provided . All forty-two Indian species of the subfamily representing five genera have been included , of which , fifteen new are fully described and illustrated . One new combination is also proposed . The terminology of Atterberg (1993) and for the microsculpture Eady (1968) is followed . Holotypes , paratypes and other material examined by the author has been deposited in the Zoological Museum , Aligarh Muslim University , Aligarh , India . IARI stands for Indian Agricultural Research Institute , Delhi and IFRI refers to Indian Forest Research Institute , Dehra Dun , India .

MATERIALS AND METHODS

Collection and rearing :

The adult braconid parasitoids were collected from different areas of India specially from Aligarh by using sweeping net and light traps . The parasitoids were also reared from their hosts i.e lepidopterous larvae . They were collected in collecting bags . A complete record was maintained indicating the locality , date of collection, name of the host plant and pest etc . The samples were later transferred from the collecting bags to the rearing jars . The open end of the jars were covered with muslin cloth tightly held with rubber band . The jars were checked daily and fresh leaves were provided to the caterpillars for feeding. Emerged parasitoids were preserved in 70% ethyl alcohol with one or two drops of glycerine in each vial for their future identification

Mounting methods :

Specimens were mounted on cards using water soluble glue . The permanent slides were prepared after dehydration and clearing was done in clove oil . The specimens were dissected under dissecting binocular microscope with the help of fine needles. The dissected parts viz., antennae , wings , legs and other body parts were placed in canada balsam on a slide in required positions and covered by coverslips . The slides were dried by keeping in thermostat at $35\pm 2^{\circ}\text{C}$.

Illustrations and measurements :

The permanent slides were examined under the microscope for detailed study. Drawings were made with the help of camera lucida . Measurements were taken by using ocular micrometer .

HISTORICAL REVIEW

Linnaeus (1758) described braconids, ichneumonids and other Terebrantia under the genus *Ichneumon* L . Gravenhorst & Nees ab Esenbeck (1818) divided the Ichneumonideous genera into two stirpes - the Ichneumones Genuini and the Ichneumones Adsciti . These two stirpes being further divided into numerous genera ; the Adsciti being primarily divided into two groups named. Bracones and Bassi .

The family Braconidae was erected by Stephens (1829)* . Later , he (1835) separated the Ichneumonidae into four families mainly on the basis of the number of joints in the maxillary palpi : Ichneumonidae , Braconidae (5 - jointed) , Alysiidae (6- jointed) and Aphidiidae (4-jointed) . Wesmael (1835) named the Ichneumones Genuini and Asciti as Ichneumonides characterised by having two recurrent (m-cu) veins and Braconides having only one recurrent vein in the fore wing , respectively . He further divided the Braconides into two groups viz., 'braconides endodontes' (having the teeth of the mandibles directed inwardly ; the mandibles meeting together when shut) and 'braconides exodontes' (having the teeth of the mandibles directed outwards ; the mandibles when closed , not touching each other). The latter group is now called the Alysiinae (Achterberg , 1993) . The endodontes being further divided into four subdivisions viz., (i) Polymorphi (clypeus entire , abdomen 6- to 7- jointed , posterior part of the vertex convex , second submarginal cell (when present) large) (ii) Cryptogastri (clypeus entire , posterior part of vertex convex, abdomen dorsally presenting not more than two transverse sections , second submarginal cell (when present) large) (iii) Areolarii (clypeus entire , vertex more or less emarginate behind, abdomen 6- to 7- jointed , second submarginal cell (when present) very small) and (iv) Cyclostomi (clypeus deeply notched, leaving a circular aperture between it and the jaws , abdomen generally 6- to 7- jointed , second submarginal cell (when present) large) . The "polymorphes" contain the subfamilies Aphidiinae , Cenocoeliinae , Euphorinae , Helconinae , Ichneutinae , Macrocentrinae , Opiinae and Orgilinae . The "cryptogastres" contain Cheloninae and Sigalphinae . The "areolaires" contain

* After Shaw (1985).

Agathidinae and Microgastrinae . The "cyclostomes" contain Braconinae , Doryctinae , Hormiinae , Rogadinae and Rhyssalinae .

Haliday (1838)* divided Ichneumonideous genera into five families including , Evaniidae , Ichneumonidae , Agriotypidae , Braconidae and Aphidiidae on the basis of the nature of connexion between the second and third dorsal segments (tergites)of the abdomen (metasoma) and outer discoidal (second discal) cell of the fore wing . Westwood (1840) followed the system of Wesmael (1835) and added a sixth division ie. "Flexiliventes" for the Aphidiinae . Foerster (1862) divided the family Braconidae into 26 subfamilies , adding the suffix "-oidae" . Marshall (1891) added a seventh division "Pachylommatidae" to the family termed Hybrizontinae by Achterberg (1976) . Marshall , further divided these large groups into 26 subfamilies , for the Palaearctic region and used the suffix "-ides" . Dalla Torre (1898) compiled the world list of Braconidae . Ashmead (1900) provided the first general key to the subfamilies of Braconidae . He separated Alysinae as family Alysidae , while the remaining genera were placed in 17 subfamilies .

Szepliget (1904) divided Braconidae into 31 subfamilies, of which the subfamily Lysiognathinae belongs to Ichneumonidae . Fahringer (1925) and Tobias (1971) proposed the keys to the subfamilies for the Palaearctic region . Marsh (1963) gave a key for the Nearctic region. Later he (1971) disregarded this key because of some disagreement to the limits of the various subfamilies in the Braconidae . Achterberg (1976) discussed the systematic position and evolutionary trends of the Braconidae , dividing the family into 22 subfamilies . Achterberg (1984-1988), Quicke & Achterberg (1990), Achterberg *et al.* (1992) and Whitfield & Mason (1994) gave the phylogeny of Braconidae . Recently , Achterberg (1993) has divided the family into 47 subfamilies viz., Adeliinae , Agathidinae , Alysinae , Amicrocentrinae , Aphidiinae , Apozyginae , Betylobraconinae , Blacinae , Braconinae , Cardiochilinae , Cenocoeliinae , Charmontinae , Cheloninae , Dirrhopinae , Doryctinae , Ecnomiinae , Euphorinae , Exothecinae , Gnamptodontinae, Helconinae , Histeromerinae , Homolobinae , Hormiinae , Ichneutinae , Khoikhoiinae , Lysiterminae ,

* After Westwood (1840).

Macrocentrinae , Masoninae , Mendesellinae , Mesostoinae , Meteorideinae , Microgastrinae , Microtypinae , Miracinae , Neoneurinae , Opiinae , Orgilinae , Pambolinae , Proteropinae , Pselaphaninae , Rhyssalinae , Rogadinae , Sigalphinae , Telengaiinae , Trachypetinae , Vaepellinae and Xiphozelinae . Concurrently , Sharkey (1993) has divided the family into 29 subfamilies viz., Adellinae , Agathidinae , Alysiinae , Amicrocentrinae , Aphidiinae , Apozyginae , Braconinae , Cardiochilinae , Cheloninae , Doryctinae , Dirrhopinae , Euphorinae , Gnamptodontinae , Helconinae , Homolobinae , Ichneutinae , Khoikhoiinae , Macrocentrinae , Meteoridiinae , Meteorinae , Microgastrinae , Miracinae , Neoneurinae , Opiinae , Orgilinae , Rogadinae , Sigalphinae , Trachypetinae and Xiphozelinae .

The term 'Cheloni' was first used by Nees von Esenbeck (1816) for chelonines. Later , Foerster (1862) and Parfitt (1881) used the terms Chelonoidae and Chelonides, respectively for the chelonine wasps . Marshall (1885) followed Parfitt and provided a key to the genera under the name Chelonides . Cameron (1887) gave the subfamily name 'Cheloninae' to the 'Cheloni' of Nees (1816) , followed by Cresson (1887) . Marshall (1889) promoted the subfamily to the rank of family as Chelonidae which was followed by Ivanov (1896,1899), Morley (1907) and Lyle (1923 a) . Later , Handlirsch (1925) , Baker (1926) , Brues (1926) , Sonan (1932), Fahringer (1934) , Watanabe (1937) , Granger (1949) , Baltazar (1962) , Tobias (1971), Shenefelt (1973) , Achterberg (1976,1993) and Sharkey (1993) followed Cameron (1887) considering Cheloninae as a subfamily of Braconidae. However , De Saeger (1948) placed the chelonine genera in the subfamily Sigalphinae . Hellen (1958) treated Chelonini as a tribe of the subfamily Helconinae .

Wilkinson (1928, 1930a, 1930b) , Ayyar (1929) , Nixon (1943, 1965) , Bhatnagar (1950) etc. have contributed on Indian Braconidae . Cameron (1907) for the first time described a chelonine *Chelonus indicus* from India . Subsequently, Gupta (1955), Rao & Chalikwar(1971) , Narendran *et al.* (1992) , Kurhade & Nikam (1993, 1994) , Shujauddin & Varshney (1997) added 24 species to the subfamily Cheloninae . Recently , Papp(1996) has redescribed *Microchelonus cycloporus* (Franz) and provided a checklist of the oriental species of the genus *Microchelonus* Szepi .

SUBFAMILY CHELONINAE NEES VON ESENBECK

Cheloni Nees von Esenbeck , 1816:260 .

Cryptogastrini Wesmael , 1835:205 .

Chelonoidae Foerster , 1862:243 .

Chelonides Parfitt , 1881:285 .

Cheloninae Cameron , 1887:393 .

Chelonidae Marshall , 1889:66, 321 .

Diagnosis : Body pubescent , head with occiput excavated and marginated ; eyes prominent , rounded , oval or elongate , glabrous or hairy , wider than base of mandibles ; opening between clypeus and mandibles (hypoclypeal depression) absent ; anterior tentorial pits distinct ; mandibles curved inwards , tips touching when closed , bidentate, inner tooth more or less shorter than outer ; palpi distinctly developed and easily visible ; frons more or less depressed behind antennae, with or without frontal carina ; antennae 16-63 or more segmented, usually slender , scape always longer than pedicel .

Mesosoma robust ; pronotum distinctly developed anteriorly ; notauli distinct or indistinct ; postpectal carina completely present ; scutellum triangular ; propodeum bifaced , usually equipped with a mid transverse carina and a pair of lateral and submedian tubercles , more or less developed . Fore wing with three submarginal cells , first submarginal cell and discal cell separated or confluent , vein m-cu parallel to vein 1-M , vein 3-M largely unsclerotized ; hind wing with vein 2-CU absent , vein cu-a straight and medium sized .

Metasoma sessile , inserted close to hind coxae , distinctly below dorsal level of propodeum , the first three basal tergites coalesce to form a carapace , usually equipped with two basal longitudinal carinae ; transverse suture absent (Chelonini) or at most two sutures (Phanerotomini) ; apex of metasoma rounded , oval , semi-oval , acuminate , cuspidate , truncate , indented with lateral teeth or sometimes with a spine ; ovipositor of variable length .

The subfamily is represented by two tribes from India viz., Chelonini Nees , 1816 and Phanerotomini Baker , 1926 including five genera : *Ascogaster* Wesmael , 1835 , *Chelonus* Panzer , 1806 and *Microchelonus* Szepligeti , 1908a in the tribe Chelonini ;

Phanerotoma Wesmael , 1838 and *Phanerotomella* Szepliget , 1900 in the tribe Phanerotomini .

Key to the tribes and genera of Indian Cheloninae

1. Metasoma much convex , with edges inflexed ventrally , without distinct transverse sutures; mesosoma usually black ; vein 1-SR of fore wing when present , distinct ; eyes glabrous or setose(tribe Chelonini Ness)...2 .
 - Metasoma less convex , with edges slightly or not inflexed ventrally , with two complete transverse sutures ; mesosoma usually yellowish ; vein 1-SR of fore wing absent or very small ; eyes glabrous(tribe Phanerotomini Baker)...4 .
2. Vein 1-SR+M of fore wing present ; eyes glabrous , exceptionally hairy (eg. *Ascogaster setula* Tang & Marsh ,1994).....*Ascogaster* Wesmael , 1835 .
 - Vein 1-SR+M of fore wing absent ; eyes setose.....3.
3. Antenna of female with more than 16-segments ; metasoma of male never with a foramen apically ; metasoma in lateral view 2-2.3 x as long as high , about twice higher behind than basally , i.e. distinctly increasing in height posteriorly.....*Chelonus* Panzer , 1806 .
 - Antenna of female with 16-segements ; metasoma of male usually with a foramen Apically ; metasoma in lateral view 2.5-3.5 x as long as high, distintly less than twice as high behind as basally , ie.less increasing in height posteriorly.....*Microchelonus* Szepligeti , 1908 a .
4. Second submarginal cell triangular and petiolate ; vein 2-R1 of fore wing present ; vein CU1b of fore wing absent , resulting in an open first subdiscal cell apico-posteriorly ; antenna with 24-60 segments ; fore wing without vein 3-SR ; hind wing with vein M+CU shorter than vein 1-M.....*Phanerotomella* Szepligeti , 1900 .
 - Second submarginal cell quadrangular ; vein 2-R1 of fore wing absent ; vein CU1b of fore wing usually present, resulting in a closed subdiscal cell apico-posteriorly ; antenna usually with 23 segments ; fore wing with vein 3-SR ; hind wing with vein M+CU equal to vein 1-M or longer *Phanerotoma* Wesmael , 1838 .

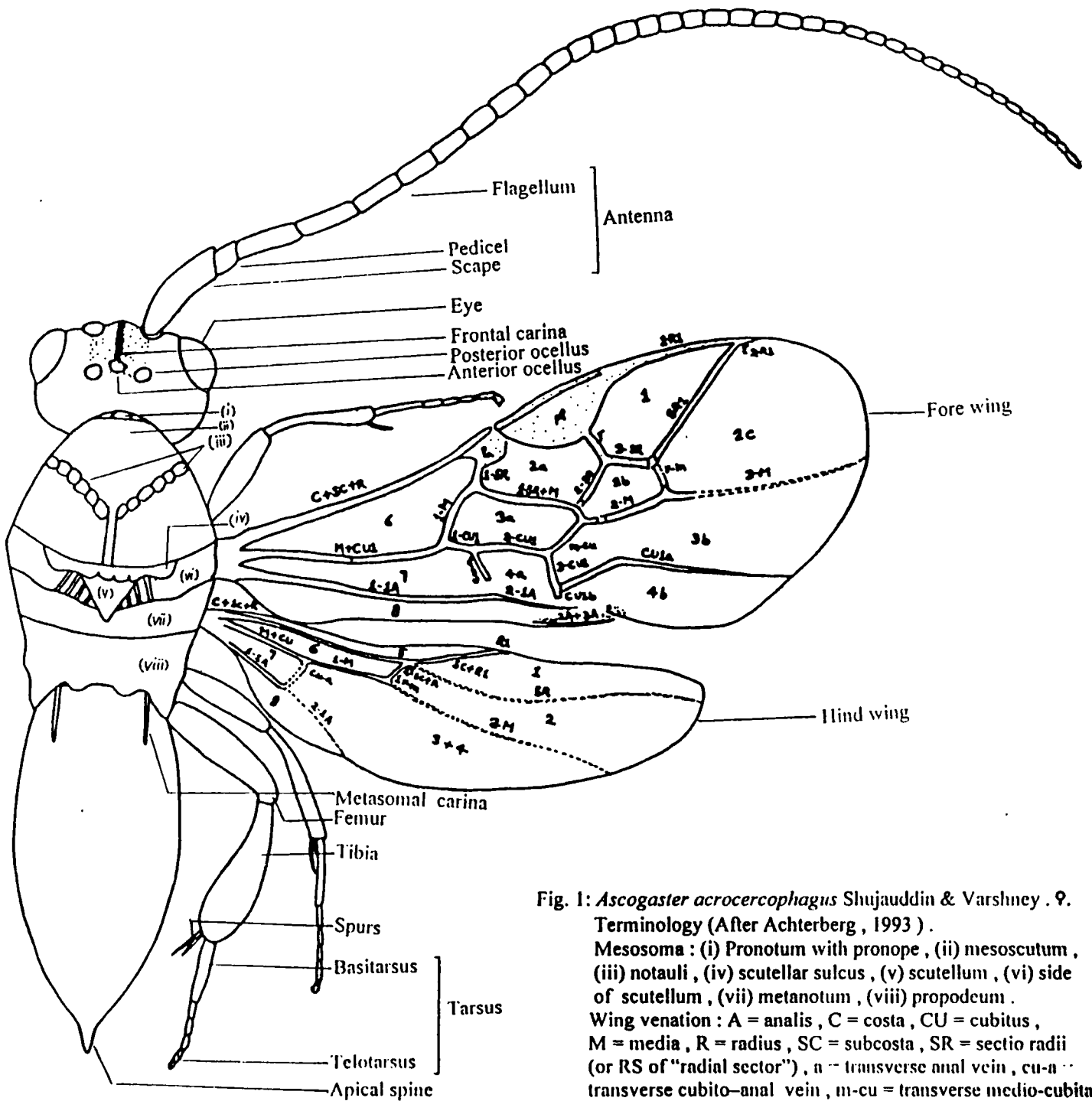


Fig. 1: *Ascogaster acrocercophagus* Shujauddin & Varshney . ♀.

Terminology (After Achterberg, 1993) .

Mesosoma : (i) Pronotum with pronope , (ii) mesoscutum , (iii) notauli , (iv) scutellar sulcus , (v) scutellum , (vi) side of scutellum , (vii) metanotum , (viii) propodeum .

Wing venation : A = analis , C = costa , CU = cubitus , M = media , R = radius , SC = subcosta , SR = sectio radii (or RS of "radial sector") , n = transverse anal vein , cu-n = transverse cubito-anal vein , m-cu = transverse medio-cubital vein , r = transverse radial vein , r-m = transverse radio-medial vein , pa = parastigma , pt = pterostigma . Cells : 1 = marginal cell , 2 = submarginal cell , 3 = discal cell , 4 = subdiscal cell , 5 = costal cell , 6 = basal cell , 7 = subbasal cell , 8 = plical cell or (if protruding) lobe ; a , b and c indicate first , second and third cell , respectively .

TRIBE CHELONINI NEES

Cheloni Nees von Esenbeck ,1816:260 .

Cryptogastris Wesm., 1835:205 .

Chelonini Handlirsch , 1925:748 .

Chelonina De Saeger , 1948 : 72,87 .

Diagnosis : Colour usually black ; eyes glabrous or setose , usually subcircular , sometimes elongated ; antennae filiform or subfiliform , with 16-40 or more segments ; tubercles on propodeum usually well developed ; fore wing with vein 1-SR+M present (genus *Ascogaster* Wesm.) or absent (genus *Chelonus* Panz. and *Microchelonus* Szepl.) , marginal cell usually short , r emitted from middle or beyond middle of pterostigma , 3-SR always present , 1-SR when present , distinct ; mid tibiae without blister ; metasoma convex, without sutures .

The tribe Chelonini is represented by three genera viz. , *Ascogaster* Wesm., *Chelonus* Panzer and *Microchelonus* Szepliget from India . The earlier works on the taxonomy of Indian species of *Chelonus* and *Microchelonus* are by Cameron (1881,1907), Franz (1930), Gupta (1955), Subba Rao (1955), Rao & Chalikwar (1971), Narendran *et al.* (1992) and Kurhade & Nikam (1993,1994) . Recently , Papp (1996) has redescribed *M. cycloporus* (Franz) and provided a checklist of the oriental species of the genus *Microchelonus* .

GENUS *ASCOGASTER* WESMAEL

Ascogaster Wesmael, 1835 : 226 .

Type-species : *Ascogaster instabilis* [= *abdominator* (Dahlbom)] , subsequently designated by Foerster ,1862 .

Cascogaster Baker ,1926 : 482 .

Type-species : *Cascogaster fullawayi* Baker , original designation ; syn. by Watanabe ,1937.

Leptodrepana Shaw ,1983 : 37 .

Type-species : *Leptodrepana opuntiae* Shaw , original designation ; syn. by Achterberg ,1990 .

Diagnosis : Fore wing with vein 1-SR+M present, separating the first submarginal and discal cell ; eyes glabrous , exceptionally hairy in *A. setula* (Tang & Marsh,1994) ; antennae usually filiform , with more than 20 segments ; vein 1-SR of fore wing distinct .

The genus *Ascogaster* Wesm. is represented by 40 species from Indo-Australian region (Shenefelt ,1973 ; Walker & Huddleston ,1987a ; Tang & Marsh,1994) , however , only 3 species have been reported from India . In the present work, a new species of the genus i.e. *A. indica* has been described from India and a key to the Indian species of the genus is also provided .

Key to the Indian Species of the genus *Ascogaster* Wesmael

1. Metasoma with a spine at apex ; antennal segments not dilated medially.....
..... *acrocercophagus* Shujauddin & Varshney .
- Metasoma without spine at apex ; antennal segments weakly or moderately dilated medially..... 2.
2. Ocelli not on line;antenna 30-segmented..... *indica* sp.n.
- Ocelli on line or almost on line ; antenna more than 40-segmented3.
3. Antenna 42-segmented ; face areolate-rugose ; mesonotum strongly rugose , notauli indistinct;hind coxa strongly strigate;metasoma in lateral view somewhat pointed....

- *armatoides* Tang & Marsh .
 - Antenna 45-49 segmented ; face rugose – punctate ; mesonotum densely punctate except posteromedially areolate – rugose , notauli foveolate ; hind coxa finely punctate ; metasoma in lateral view clavate.....*formosensis* Sonan .

1. *Ascogaster acrocercophagus* Shujauddin & Varshney

Ascogaster acrocercophagus Shujauddin & Varshney , 1997 : 95-97 .

Material examined : 8♀, 6♂♂, INDIA : Uttar Pradesh, Meerut ; 5. IX. 1982 ; ex. *Acrocercops syngamma* Meyrick on *Mangifera indica* L. ; coll. (Shujauddin). 1♂, INDIA : Uttar Pradesh , Aligarh ; 13. IX. 1997 ; ex. *A. syngamma* Meyrick on *M. indica* L. ; coll. (A.A. Haider).

Host : *Acrocercops syngamma* Meyrick .

Distribution : INDIA : Aligarh , Meerut .

2. *Ascogaster indica* sp.n. (Fig.2 A-G)

Female : Head , mesosoma , eyes and ocelli black ; antennae brown , becoming darker towards apex ; legs brownish - yellow with coxae , hind trochanters , trochantelli and femora brown ; metasoma blackish- brown with a light brown band on basal one- third ; wings hyaline with a brown infuscation below pterostigma ; parastigma, pterostigma , C+ SC+R , r , 2-SR , 3-SR , 1-R1 , SRI , 2-M yellowish - brown , rest of the veins pale .

Head (fig. 2- E) 2.2 x as broad as long in dorsal view ; temples 0.59 x as long as eye length ; frons reticulate , shiny , conspicuously depressed , with median carina ; ocelli not on line , OOL=2.3 x ocellar diameter ; face reticulate - rugose , 1.3 x as broad as high , more or less flat except for median carina ; clypeus punctate , apical border produced medially into a blunt tooth, slightly more convex than face. Antenna (fig.2- B) 30-segmented , 1.27 x shorter than body , scape and first flagellar segment 2.8 x as long as broad , further segments gradually shortening , flagellar

segments 9-20 slightly broader than long, segments 21-27 as long as broad , apical segment 1.7 x as long as broad .

Mesosoma 1.4 x as long as broad ; pronotum rugose with an elliptical pronope ; mesoscutum rugose- reticulate , notauli shallow , median ridge absent ; scutellar sulcus foveolate ; scutellum reticulate ; propodeum rugose , with a broken transverse carina , submedian pair of tubercles much broader than lateral pair . Fore wing (fig.2-A) with pterostigma almost as long as 1-R1 ; r slightly shorter than 3-SR ; SR1 slightly curved ; m-cu postfurcal ; hind wing (fig. 2-C) with SR indistinct.Hind femur (fig. 2-D) 3.6 x as long as broad , 1.2 x shorter than hind tibia .

Metasoma (fig.2. F-G) reticulate – rugose , 1.6 x as long as broad , almost as long as mesosoma , carinae indistinct , apex rounded , without apical spine ; ventral opening not reaching at apex , distance from apex of ventral opening to apex of metasoma almost as long as hind basitarsus ; ovipositor sheath in lateral view slightly shorter than hind basitarsus .

Length : 3.37 mm .

Male : Unknown .

Holotype ♀ : INDIA : Uttar Pradesh , Aligarh ; 17.IV.1969 ; light trap ; coll . (Shujauddin) .

Remarks : The new species *Ascogaster indica* runs close to *cava* De Saeger , however , differs in having : ocelli not on line , antenna 30-segmented , face without median tubercle , clypeus with an apical blunt tooth and metasoma almost as long as mesosoma .

3. *Ascogaster armatoides* Tang & Marsh.

Ascogaster armatoides Tang & Marsh , 1994 : 84-285 .

Host : Unknown .

Distribution : INDIA : Ammatti , S. Coorg .

4. *Ascogaster formosensis* Sonan

Ascogaster formosensis Sonan ,1932:78 .

Ascogaster formosanus [!]-Watanabe , 1934 : 198 .

Ascogaster longicornis Huddleston , 1984 : 368 .

Host : Unknown .

Distribution : INDIA .

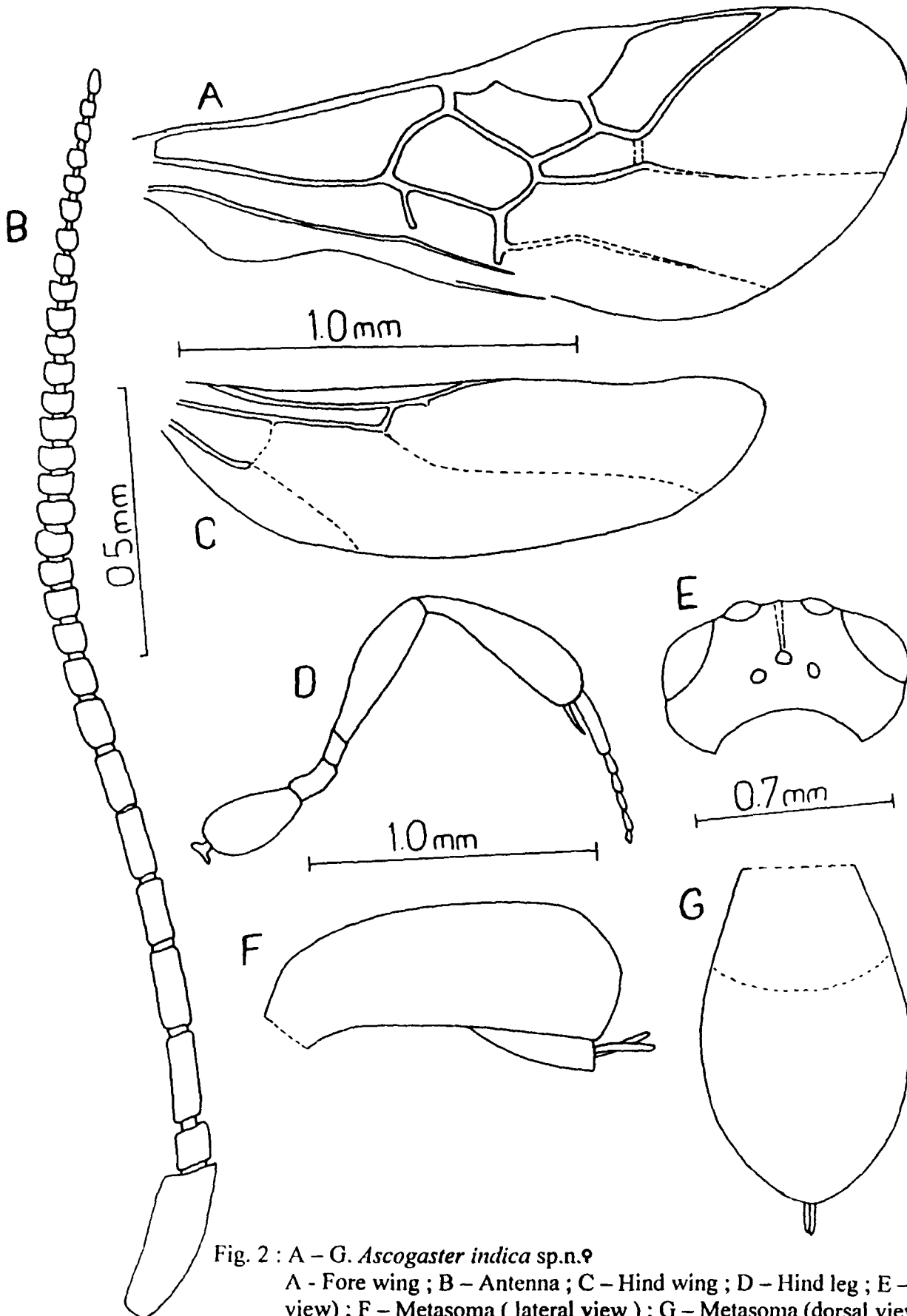


Fig. 2 : A - G. *Ascogaster indica* sp.n.9

A - Fore wing ; B - Antenna ; C - Hind wing ; D - Hind leg ; E - Head (dorsal view) ; F - Metasoma (lateral view) ; G - Metasoma (dorsal view).

GENUS *CHELONUS* PANZER

Chelonus Panzer , 1806 : 164 .

Type - species : *Ichneumon oculator* Fabricius .

Sigalphus (Cheloni) Nees von Esenbeck, 1816 : 260 .

Chelone Latreille , 1825 : 446 .

Trachionus Haliday , 1833 : 265 .

Type-species : *Chelonus mandibularis* Haliday , Monotypic ; syn.by Dalla Torre , 1898 .

Davisania La Munyon , 1877. [No page number] .

Type-species : *Davisania aughei* La Munyon , Design. by Viereck , 1914 .

Arichelonus Viereck , 1913 : 641 .

Type-species : *Chelonus aculeatus* Ashmead , Monotypic & original designation; syn. by De Saeger , 1948 .

Megachelonus Baker , 1926:457 .

Type-species : *Megachelonus bidentatus* Baker , original designation ; syn. by De Saeger , 1948 .

* *Anomala* von Block , 1799 : 11 .

Type- species : *Anomala integra* von Block , syn.by van Achterberg , 1982 .

Diagnosis : Fore wing with vein 1- SR+M absent , eyes setose , antennae of female with more than 16-segments ; metasoma in lateral view 2 -2.3 x as long as high , about twice higher behind than basally, ie. distinctly increasing in height posteriorly , males without a foramen at the apex of metasoma .

The genus *Chelonus* Panz. is represented by 33 species from Indo-Australian region , however , only 8 species have been reported from India , so far (Rao & Chalikwar ,1971 ; Shenefelt , 1973 ; Narendran *et al.* , 1992 ; Kurhade & Nikam , 1994) . A revised key to the Indian species of the genus have been provided .

Key to the Indian species of the genus *Chelonus* Panzer

1. Female antennae 18-segmented..... *gastrus* Narendran & Sumodan .
- Female antennae more than 18-segmented.....2 .

* After Achterberg (1982) .

2. Fore wings uniformly subhyaline or infuscated.....3 .
 - Fore wings uniformly hyaline or basal half hyaline , apical half infuscated.....4 .
3. Fore wings subhyaline ; metasoma entirely rufous*rufus* Lyle .
 - Fore wings infuscated ; metasoma with a small pale yellowish spot on each side*carbonator* Marshall .
4. Fore wings hyaline with a broad fuscous cloud in the middle filling the marginal and first and second submarginal cells ; antennae more than 30-segmented.....
 -*indicus* Cameron .
 - Fore wings entirely hyaline without any cloud or basal half hyaline , apical half infuscated ; antennae less than 30-segmented.....5 .
5. Fore wings entirely hyaline ; female antennae 26-segmented6 .
 - Fore wings basal half hyaline , apical half infuscated ; female antennae less than 26-segmented.....7 .
6. Frons with a horn between the antennae ; ovipositor concealed.....
 -*formosanus* Sonan .
 - Frons without a horn between the antennae ; ovipositor as long as hind basitarsus*deogiri* Kurhade & Nikam .
7. Ventral opening extending almost to the apex of metasoma ; vertex coarsely punctate ; female antennae 24-segmented.....*narayani* Subba Rao .
 - Ventral opening not extending upto the apex of metasoma ; vertex deeply reticulately rugose ; female antennae 25-segmented.....*dwibindus* Rao & Chalikwar .

1. *Chelonus gastrus* Narendran & Sumodan.

Chelonus gastrus Narendran & Sumodan , 1992 : 2 .

Host : Unknown .

Distribution : INDIA : Nilambur , Trichur , Thariyod , Wynaad .

2. *Chelonus rufus* Lyle

Chelonus rufus Lyle , 1923 b: 337 .

Hosts : *Earias insulana* (Boisduval) , *Laphygma exigua* Hb .

Distribution : INDIA : Dehra Dun .

3. *Chelonus carbonator* Marshall

Chelonus carbonator Marshall , 1885 : 123 .

Material examined : 27 ♀♀ ♂♂, C.Morley (det.) Pusa , 10-18.I.1915 , ex.*Spodoptera mauritia* (Boisduval) (IARI) .

Hosts : *Crambus luteelus* Schiff ; *Eupithecia* sp., *Lespeyresia janthinana* Dup., *Lespeyresia* spp., *Pachynematus scutellatus* Htg., *Pristiphora abietina* Christ., *Spodoptera mauritia* (Boisduval) , *Tortrix diversana* Hb.

Distribution : INDIA : Nagpur, Pusa .

Note : 27 specimens deposited in IARI were studied , however, none of these possesses antennal segments 30 or more than 30 , as indicated in Papp 1971 ; Watanabe , 1937 .

4. *Chelonus indicus* Cameron

Chelonus indicus Cameron , 1907 : 584 .

Host : Unknown .

Distribution : INDIA : Ferozepur .

5. *Chelonus formosanus* Sonan

Chelonus formosanus Sonan , 1932 : 70 .

Hosts : *Cirphis loreyi* Duponchel , *Prodenia litura* Fabricius .

Distribution : INDIA : Coimbatore .

6. *Chelonus deogiri* Kurhade & Nikam

Chelonus deogiri Kurhade & Nikam , 1994 : 145 –147 .

Host : *Heliothis armigera* Fb .

Distribution : INDIA : Aurangabad .

7. *Chelonus narayani* Subba Rao

Chelonus narayani Subba Rao , 1954: 426 n. nudum .

Chelonus narayani Subba Rao , 1955:63 .

Material examined : 20♀♀♂♂, B. R . Subba Rao (det.) Delhi , 10.x.1952 , ex. *Heliothis armigera* (Fab.) (IARI) .

Hosts : *Chilo zonellus* Swinhoe, *Corcyra cephalonica* Stt. (in lab), *Heliothis armigera* Fab., *H. zea* (Boddie), *Pectinophora gossypiella* (Saund.) .

Distribution : INDIA : New Delhi .

8. *Chelonus dwibindus* Rao & Chalikwar

Chelonus dwibindus Rao & Chalikwar , 1971 : 475-476 .

Material examined : 2♀♀, INDIA : Uttar Pradesh , Aligarh , 20.IX.1980 , light trap ; coll.(Shujauddin) .

Host : Unknown .

Distribution : INDIA : Aurangabad , Parbhani .

GENUS *MICROCHELONUS* SZEPLIGETI

Chelonus Reinhard , 1867 : 360 .

Microchelonus Szepligeti , 1980 a : 403 .

Type-species : *Microchelonus hungaricus* Szepligeti .

Chelonella Szepligeti , 1908a : 403 .

Type-species : *Chelonus basalis* Curtis ; syn. by Muesebeck & Walkley , 1951 .

Chelonus (Microchelonus) Fahringer , 1934 : 505 .

Neochelonella Hincks , 1943 : 98 , replacement name for *Chelonella* Szepligeti .

Type-species : *Chelonus basalis* Curtis ; syn. by Muesebeck & Walkley , 1951 .

Chelonus (Neochelonella) De Saeger , 1948 : 97 .

Diagnosis : Fore wing with vein 1-SR+M absent ; eyes setose ; antennae of female with 16-segments , males usually have a foramen of variable sizes and shapes at the apex of metasoma , when antennae with more than 16-segments then males always with a foramen ; metasoma in lateral view 2.5-3.5 x as long as high , distinctly less than twice as high behind as basally , i.e. less increasing in height posteriorly .

The genus *Microchelonus* Szepl. is represented by 32 species from Indo-Australian region , however 13 species have been reported from India so far (Rao & Chalikwar , 1971 ; Shenefelt , 1973 ; Walker & Huddleston , 1987b ; Narendran *et al.*, 1992 ; Kurhade & Nikam, 1993) . In the present work , five new species have been described and separate keys to the females and males of the Indian species of the genus have been provided . The genus *Chelonus chailini* Walker & Huddleston has been transferred in the genus *Microchelonus* , as it closely resembles with the group of species bearing spine , described from India viz. , *M. spinigaster* sp. n . and *M. cordiae* sp. n .

*Key to the Indian species of the genus *Microchelonus* Szepligeti (females only)

1. Metasoma with a spine at apex.....2 .
- Metasoma without spine at apex4 .
2. Metasoma strongly declivous below the spine ; clypeus rugose.....*spinigaster* sp.n .
- Metasoma not declivous but making an angle with the spine ; clypeus punctate3 .

* *M. pikeni* Kurhade & Nikam is not included in the key as its female is unknown .

3. Metasoma elongate-oval ; ovipositor short , generally retracted beneath carapace ; wings more or less infuscated ; OOL 3.5-4.0 x ocellar diameter.....
.....*chailini* (Walker&Huddleston) comb.n .
- Metasoma strongly convex in the middle ; ovipositor sheath in lateral view 1.4 x as long as hind basitarsus ; wings hyaline ; OOL 2.4 x ocellar diameter*cordiae* sp.n .
4. Metasoma entirely black 5 .
- Metasoma not entirely black , with pale yellow or white band or spots6 .
5. Scutellum with a U-shaped areola in the middle ; OOL=0.67 POL ; fore wing with r nearly half the breadth of pterostigma..... *shyamus* (Narendran & Rema) .
- Scutellum without areola ; OOL=POL ; fore wing with r nearly one-third the breadth of pterostigma *cycloporus* (Franz) .
6. Ventral opening reaching nearly upto half of metasoma ; body length more than 4mm.....7 .
- Ventral opening always exceeding half of metasoma ; body length less than 4mm.....8 .
7. Head 3.0 x as broad as long ; frons and scutellum coarsely punctate ; pterostigma 2.5 x as long as broad ; metasoma with a yellow basal band ; body length 5.1 mm.....
..... *scutellatus* (Narendran & Sumodan) .
- Head 2.0 x as broad as long ; frons strigose-rugose , laterally bounded by prominent carinae running upto posterior ocelli ; scutellum rugose ; pterostigma 3.1 x as long as broad ; metasoma with two large pale yellow basal spots ; body length 4.83 mm.....
.....*lygropiae* sp.n .
8. Body length less than 2 mm ; ventral opening of metasoma reaching at apex9 .
- Body length more than 2 mm ; ventral opening of metasoma may or may not reaching at apex..... 10 .
9. Fore wings not hyaline ; OOL = POL ; frons longitudinally strigose , without a mid longitudinal carina ; fore wing with r nearly one-third the breadth of pterostigma ; metasoma longitudinally strigose becoming reticulately punctate at apex ; ovipositor slightly extends beyond apex of metasoma and visible dorsally.....
.....*narendrani* (Narendran & Sumodan) .

- Fore wings hyaline ; OOL = 0.25 x POL ; frons punctate , with a mid longitudinal carina ; fore wing with r nearly half the breadth of pterostigma ; metasoma rugose-punctate , ovipositor not visible dorsally.....
.....*keralensis* (Narendran & Sumodan) .
- 10.Clypeus rugose or rugulose ; ventral opening reaching or almost reaching at apex.....11 .
- Clypeus punctate ; ventral opening not reaching at apex 12 .
- 11.Fore wings hyaline ; frons with a mid longitudinal carina ; pterostigma 3.4 x as long as broad ; marginal cell on wing margin 0.29 x as long as pterostigma ; metasoma with longitudinal carinae reaching basal one-third ; ovipositor not visible dorsally
.....*naethrus* (Narendran & Sumodan) .
- Fore wings basal half hyaline , apical half infuscated ; frons with carina indistinct ; pterostigma 2.2 x as long as broad ; marginal cell on wing margin 0.7 x as long as pterostigma ; metasoma with longitudinal carinae reaching basal one-sixth only ; ovipositor visible dorsally *aligarhensis* sp.n .
- 12.Malar space as long as basal width of mandible..... 13 .
- Malar space more than basal width of mandible.....15 .
- 13.Fore wings entirely hyaline ; antennae extending back upto end of basal third of metasoma.....*heliopae* (Gupta) .
- Fore wings basal half hyaline apical half more or less infuscated ; antennae extending back upto the base of metasoma.....14 .
- 14.Propodeum with lateral tubercles small ; fore wing with r straight.....
.....*blackburni* (Cameron) .
- Propodeum with lateral tubercles strong , tooth like ; fore wing with r evenly curved
..... *nigripes* Rao & Chalikwar .
- 15.Malar space 2.35 x basal width of mandible ; clypeus closely , deeply punctate.....
.....*raoi* Kurhade & Nikam .
- Malar space less than twice the basal width of mandible ; clypeus sparsely punctate
.....16 .
- 16.Flagellar segments 8-13 slightly broader than long ; frons without median carina ; propodeum with submedian pair of tubercles distinct*alucitae* sp.n .

- Flagellar segments at least 1.25 x as long as broad ; frons with median carina ; propodeum with submedian pair of tubercles indistinctnotauli Rao & Chalikwar .

***Key to the Indian species of the genus *Microchelonus* Szepligeti
(males only)**

1. Apex of metasoma with a foramen.....2 .
 - Apex of metasoma without foramen.....7 .
2. Antennae 18- or less than 18-segmented3 .
 - Antennae more than 18-segmented.....4 .
3. Apical foramen narrow and slit like , 5.0 x as wide as high ; antennae 16-segmented*blackburni* (Cameron) .
 - Apical foramen small , round or somewhat elliptic ; antennae 16-18 segmented*cycloporus* (Franz) .
4. Apical foramen 4.0 x or more as wide as high5 .
 - Apical foramen less than 4.0 x as wide as high6 .
5. Apical foramen 4.0 x as wide as high ; antennae 24-26 segmented.....*heliopae* (Gupta) .
 - Apical foramen 4.5 x as wide as high ; antennae 29-segmented*nigripes* Rao & Chalikwar .
6. Frons with carina ; head 2.0 x as wide as long*notauli* Rao & Chalikwar .
 - Frons without carina ; head 2.5 x as wide as long as*pikeni* Kurhade & Nikam .
7. Metasoma without spine at apex.....8 .
 - Metasoma with a spine at apex.....12 .
8. Antennae more than 16-segmented9 .
 - Antennae 16-segmented.....10 .

* The males of *M.aligarhensis* sp.n.,*M. narendrani* (Narendran & Sumodan) , *M.raoi* Kurhade & Nikam, *M.shyamus* (Narendran & Rema) are unknown , hence they are not included in the key .

9. OOL = 0.25 x POL ; malar space 2.8 x breadth of eye ; sculpture punctate or rugose-punctate*keralensis* (Narendran & Sumodan) .
- OOL = 0.67x POL ; malar space 1.5 x breadth of eye ; sculpture punctate or rugose-punctate.....*naethrus* (Narendran & Sumodan) .
- 10.Body length less than 4 mm ; ventral opening always exceeding half of metasoma...
.....*alucitae* sp.n .
- Body length more than 4 mm ; ventral opening reaching nearly upto half of metasoma
.....11 .
- 11.Head 3.0 x as broad as long ; frons coarsely punctate ; scutellum coarsely punctate ; pterostigma 2.5 x as long as broad ; metasoma with a yellow basal band.....
.....*scutellatus* (Narendran & Sumodan) .
- Head 2.0 x as broad as long ; frons strigose-rugose , laterally bounded by prominent carinae running upto posterior ocelli ; scutellum rugose ; pterostigma 3.1 x as long as broad ; metasoma with two large pale yellow basal spots.....*lygropiae* sp.n .
- 12.Metasoma strongly declivous below the spine ; clypeus rugose.....
.....*spinigaster* sp.n .
- Metasoma not declivous but making an angle with the spine ; clypeus punctate...13 .
- 13.Metasoma elongate-oval ; wings more or less infuscated ; OOL 3.5-4.0 x ocellar diameter.....*chailini* (Walker & Huddleston) comb.n .
- Metasoma strongly convex in the middle ; wings hyaline ; OOL 2.4 x ocellar diameter.....*cordiae* sp.n .

1. *Microchelonus spinigaster* sp.n
(Fig. 3 A-G)

Female : Head and mesosoma black ; antennae yellow , gradually becoming brown towards apex ; eyes black with yellowish tint ; ocelli brownish black , ocellar spot black ; metasoma brownish-black ; apical spine of metasoma and legs brown with fore and mid tibiae and tarsi yellowish , coxae blackish-brown ; wings hyaline , pterostigma , parastigma , C+SC+R and 1-R1 brown , rest of the veins pale .

Head 1.6 x as broad as long ; eye 1.75 x as long as temple ; frons strigose , slightly depressed , carina distinct ; OOL=1.5 x POL ; face rugulose , 1.8 x as wide as

high, carina absent ; clypeus rugose ; malar space 2.0 x basal width of mandible, the latter with subequal teeth. Antenna (fig.3-C) 16-segmented , subfiliform , extending back slightly beyond the base of metasoma, scape 2.0 x as long as broad , first flagellar segment almost 3.0 x as long as broad , this ratio decreases gradually , segments 8-11 almost as long as broad , segments 12-13 slightly longer than broad , apical segment 2.0 x as long as broad .

Mesosoma 1.2 x as long as broad ; mesoscutum reticulate-rugose , notauli shallow ; scutellum reticulate ; propodeum reticulate-rugose , lateral pair of tubercles almost as long as submedian pair . Fore wing (fig.3-A) 1.4 x shorter than body ; pterostigma 2.0 x as long as broad , slightly longer than 1-R1 ; 3-SR 1.6 x as long as r ; SR1 curved . Hind femur (fig.3-D) 3.3 x as long as broad , 0.8 x as long as hind tibia , the latter 1.3 x as long as broad , the latter 1.3 x as long as hind tarsus .

Metasoma (fig.3-E,G) strongly convex in the middle , reticulate-rugose with converging carinae on basal fourth and a spine at apex , in lateral view 2.8 x as long as high , distinctly less than twice as high behind as basally ; ventral opening not reaching at apex , distance from ventral opening to apex of metasoma 1.7 x as long as hind basitarsus ; ovipositor sheath in lateral view almost as long as hind basitarsus ; metasoma strongly declivous below the spine .

Length : 2.43 mm .

Male : Similar to female but with longer antennae , reaching upto basal-third in males with 16-segmented antennae (10 specimens) and upto the middle of metasoma in males with 18-segmented antennae (fig.3-B) (4-specimens) ; apex of metasoma devoid of a foramen .

Holotype ♀ ; 7♀♀ , 14♂♂ , paratypes ; INDIA : Uttar Pradesh , Aligarh ; 15.IX.1980.; ex. *Acrocercops lysibathra* Meyrick on *Cordia latifolia* Roxb. ; coll.(Shujauddin) .

Remarks : The new species *Microchelonus spinigaster* runs close to *chailini* (Walker & Huddleston) and *cordiae* sp.n. however, can be differentiated easily by metasoma strongly declivous below the spine and clypeus rugose .

2. *Microchelonus chailini* (Walker & Huddleston) comb.n.

Chelonus chailini Walker & Huddleston, 1987b : 437-440.

Hosts : *Acrocercops caerulea* Meyrick, *A. diffluella* van Deventer, *A. globulifera* Meyrick, *A. phaeospora* Meyrick, *Epicephala chalybacma* Meyrick.

Distribution : INDIA: Kuala Lumpur.

3. *Microchelonus cordiae* sp.n. (Fig.4 A-E)

Female : Head and metasoma brownish-black ; antennae yellow gradually becoming yellowish-brown towards apex ; eyes black with yellowish tint ; ocelli yellow , ocellar spot brownish-black ; mesosoma black ; legs yellow with hind femur and bases and apex of hind tibiae yellowish-brown , coxae red-testaceous ; wings hyaline ; parastigma ; pterostigma C+SC+R and 1-R1 brown , rest of the veins pale .

Head almost twice as broad as long; eye twice as long as temple ; frons strigose , depressed , carina distinct ; OOL=1.2 x POL ; face rugulose , 1.7 x as wide as high , carina present ; clypeus sparsely punctate ; malar space 2.5 x basal width of mandible , the latter with inner tooth distinctly shorter than outer . Antenna (fig.4-B) 16-segmented , subfiliform, extending back slightly beyond the base of metasoma , scape 2.3 x as long as broad , first flagellar segment almost 3.0 x as long as broad , this ratio decreases gradually , segments 7-10 slightly broader than long , segments 11-13 almost as long broad , apical segment less than twice as long as broad .

Mesosoma 1.2 x as long as broad ; mesoscutum reticulate-rugose , notauli shallow ; scutellum reticulate ; propodeum reticulate-rugose , lateral pair of tubercles almost as long as submedian pair . Fore wing (fig.4-A) 1.3 x shorter than body ; pterostigma 2.0 x as long as broad , as long as 1-R1 ; 3-SR 1.3 x as long as r ; SR1 slightly curved . Hind femur(fig.4-C) 3.3 x as long as broad , 0.77 x as long as hind tibia , the latter 1.2 x as long as hind tarsus .

Metasoma (fig.4D,E) strongly convex in the middle , reticulate-rugose , with converging carinae on basal-fourth and a spine at apex , in lateral view 2.5 x as long as high , distinctly less than twice as high behind as basally ; ventral opening not reaching

at apex , distance from ventral opening to apex of metasoma almost as long as hind basitarsus ; ovipositor sheath in lateral view 1.4 x as long as hind basitarsus ; metasoma not declivous but making an angle with the spine .

Length : 2.25 mm .

Male : Similar to female but with 17- segmented antennae ; apex of metasoma devoid of a foramen .

Holotype ♀ ; 191♂ paratypes ; INDIA : Uttar Pradesh , Aligarh ; 3.x.1968 ; ex *Acrocercops lysibathra* Meyrick on *Cordia latifolia* Roxb. ; coll. (Shujauddin) .

Remarks : The new species *Microchelonus cordiae* is closely related to *chailini* (Walker & Huddleston) , however , can be differentiated by metasoma strongly convex in the middle , ovipositor sheath in lateral view 1.4 x as long as hind basitarsus , wings hyaline and OOL = 2.4 x ocellar diameter .

4. *Microchelonus shyamus* (Narendran & Rema)

Chelonus shyamus Narendran & Rema, 1992 : 8-9 .

Microchelonus shyamus – Papp , 1996 : 206 (comb.n.) .

Host : Unknown .

Distribution : INDIA : Calicut .

5. *Microchelonus cycloporus* (Franz)

Chelonus cycloporus Franz , 1930 : 4 .

Chelonus (*Chelonella*) *cycloporus* – Glover , 1939 : 22 .

Microchelonus cycloporus Shenefelt , 1973 : 882 (comb.n.) ; Papp , 1996 : 203-205 (redescribed) .

Material examined : 1♀, 1♂, INDIA : Uttar Pradesh , Aligarh , 8.ix.1968 , ex *Eublemma amabilis* Moore on *Kerria lacca* (Kerr) ; coll. (Shujauddin) .

Hosts : *Eublemma amabilis* Moore , *Holcocera pulverea* Meyr .

Distribution : INDIA : Aligarh , Bangalore , Dodabetta Peak , Namkum , Nilgiri , Ootacamud , Schagpur (Central province) .

6. *Microchelonus scutellatus* (Narendran & Sumodan)

Chelonus scutellatus Narendran & Sumodan, 1992 : 4 .

Microchelonus scutellatus – Papp , 1996 : 206 (comb.n.) .

Host : Unknown .

Distribution : INDIA : Amalagiri , Calicut , Maliyankara , Mangode .

7. *Microchelonus lygropiae* sp.n. (Fig.5 A-E)

Female : Head , mesosoma and ocelli black ; eyes black with yellowish tint ; scape brown with apex and pedicel brownish-yellow, flagellum blackish-brown ; coxae , femora and metasoma brownish-black , the latter with two large pale yellow sub-basal spots ; trochanters , trochantelli and spurs pale yellow ; fore tibiae and tarsi yellow to brownish-yellow ; mid and hind tibiae and tarsi brown ; wings basal-half hyaline , apical-half infuscated ; parastigma , pterostigma and veins brown with C+SC+R , 1-M , M+CU1 , 1-1A and 2-1A yellow ; 1A + 2A and r-m pale .

Head twice as broad as long ; eye almost twice as long as temple ; frons strigose-rugose , conspicuously depressed , laterally bounded by prominent carinae running upto posterior ocelli , carina distinct , begins from a prominent tubercle between the antennal sockets and bifurcates just above the anterior ocellus ; OOL = 2.0 x POL ; face reticulate , 1.7 x as wide as high , carina indistinct ; clypeus punctate ; malar space 1.5 x basal width of mandible , the latter with inner tooth distinctly shorter than outer . Antenna (fig. 5-B) 16-segmented , filiform , extending back upto basal third of metasoma, scape twice as long as broad , first three flagellar segments elongated , almost 4.0 x as long as broad , this ratio decreases gradually , flagellar segments 7-10 less than twice as long as broad , 11-13 almost as long as broad , apical segment 2.8 x as long as broad .

Mesosoma 1.3 x as long as broad ; mesoscutum rugose-reticulate , punctate at the middle , notauli shallow ; scutellum rugose ; propodeum rugose-reticulate with

prominent tubercles . Fore wing (fig. 5-A) 1.5 x shorter than body ; pterostigma 3.1 x as long as broad , 1.2 x as long as 1-R1 ; 3-SR 1.5 x as long as r ; SR1 slightly curved . Hind femur (fig. 5-C) 3.3 x as long as broad , 0.75 x as long as hind tibia , the latter as long as hind tarsus .

Metasoma (fig.5-D,E) elongate-oval , rugose-reticulate basally , reticulate towards apex , with parallel carinae on basal-fourth , thereafter merging into rugosities , in lateral view 2.5 x as long as high , 2.2 x high behind as basally ; ventral opening not reaching at apex , distance from ventral opening to apex of metasoma 1.8 x as long as hind basitarsus .

Length : 4.83 mm .

Male : Similar to female but with antennae extending back almost upto basal-half of metasoma, the latter with a pale yellow sub-basal band , apex without foramen .

Holotype ♀ : 1♀ , 1♂ paratypes : INDIA : Uttar Pradesh , Aligarh ; 1-3.ix.1997 ; ex. *Lygropia quaternalis* (Zeller) on *Sida cordifolia* L. ; coll. (Kalpna Varshney) .

Remarks : The new species *Microchelonus lygropiae* runs close to *scutellatus* (Narendran & Sumodan) , however , can be easily differentiated by head 2.0 x as broad as long ; frons strigose-rugose , laterally bounded by prominent carinae running upto posterior ocelli ; scutellum rugose and pterostigma 3.1 x as long as broad .

8. *Microchelonus narendrani* (Narendran & Sumodan)

Chelonus caudatus Narendran & Sumodan , 1992 : 3 (preoccupied) .
Microchelonus narendrani – Papp , 1996 : 206 (nom.n.) .

Host : Unknown .

Distribution : INDIA : Amalagiri , Anappadi , Erumeli .

9. *Microchelonus keralensis* (Narendran & Sumodan)

Chelonus keralensis Narendran & Sumodan , 1992 : 3 .
Microchelonus keralensis-Papp , 1996 : 206 (comb.n.) .

Host : Unknown .

Distribution : INDIA : Amalagiri , Kazhakkootam , Moolamattom , Parambikulam , Ranni , Sreekaryam .

10. *Microchelonus naethrus* (Narendran & Sumodan)

Chelonus naethrus Narendran & Sumodan , 1992 : 4-8 .

Microchelonus naethrus- Papp , 1996 : 206 (comb.n.) .

Host : Unknown .

Distribution : INDIA : Agali , Kallai , Kasargod , Moolamattom , Nilambur , Sreekaryam .

11. *Microchelonus aligarhensis* sp.n. (Fig. 6 A-B)

Female : Head and mesosoma black ; eyes and ocelli brownish-black ; antennae yellow becoming brown towards apex ; fore legs except coxae , mid tibiae and tarsi yellow , fore and mid coxae , trochanters , trochantelli and femora brown , hind legs blackish-brown with basal-half of tibiae and tarsi yellow ; spurs pale yellow ; metasoma brownish-black with pale yellow transverse band on basal-third ; wings basal-half hyaline , apical half infuscated ; basal-half of C+SC+R , parastigma , M+CU1 .1- M, CU1 , cua , m-cu , 1A , r-m , 3-M yellow , pterostigma and rest of veins brown .

Head 2.3 x as broad as long ; eye 2.2 x as long as temple ; frons strigose , depressed , carina indistinct ; OOL = 1.6 x POL ; face rugose , 1.7 x as wide as high , without carina , with a small median tubercle ; clypeus rugose ; malar space as long as basal width of mandible , the latter with inner tooth distinctly shorter than outer. Antenna 16-segmented , filiform , extending back upto base of metasoma ; scape 1.8 x as long as broad, first flagellar segment 3.6 x as long as broad , further segments longer than broad , apical segment 3.3 x as long as broad .

Mesosoma 1.5 x as long as broad ; mesoscutum reticulate , much fine medially , notauli indistinct ; scutellum reticulate-punctate ; propodeum rugose-reticulate , lateral tubercles much longer and prominent than submedians . Fore wing 1.3 x

shorter than body ; pterostigma 2.2 x as long as broad , 1.4 x as long as 1-R1; 3-SR 1.3 x as long as r ; SR1 almost straight.Hind femur 4.0 x as long as broad , 0.9 x as long as hind tibia , the latter 1.1 x as long as hind tarsus .

Metasoma (fig.6.A-B) convex in the middle , rugose becoming rugose-reticulate towards apex , with converging carinae on basal one-sixth , in lateral view , 2.7 x as long as high , less than twice as high behind as basally ; ventral opening reaching almost upto apex of metasoma ; ovipositor sheath almost as long as hind basitarsus .

Length : 3.28 mm .

Male : Unknown .

Holotype ♀ : INDIA : Uttar Pradesh , Aligarh ; 23.ix.1997; light trap ; coll. (Kalpna Varshney) .

Remarks : The new species *Microchelonus aligarhensis* runs close to *bickleyi* McComb and *caulicola* McComb, however can be differentiated by the antennae extending back upto base of metasoma , penultimate segments of antennae longer than broad , clypeus rugose , mesoscutum reticulate , pterostigma 2.2 x as long as broad , 1.4 x as long as 1-R1.

12. *Microchelonus heliopae* (Gupta)

Chelonus heliopae Gupta , 1955 : 209 .

Chelonus (Microchelonus) heliopae – McComb , 1968 : 71-72 .

Material examined : 2♀♀ : INDIA : Uttar Pradesh , Aligarh , 20.viii.1982 ,light trap ; coll. (Shujauddin) .

Hosts : *Corcyra cephalonica* Stainton (in lab.), *Diatraea saccharalis* (F.), *Earias* sp. , *Heliothis virescens* (F.) , *H. zea* (Boddie) , *Pectinophora gossypiella* (Saunders) , *Phthorimaea heliopae* (Low) .

Distribution : INDIA : Aligarh , Annand , Rajasthan .

13. *Microchelonus blackburni* (Cameron)

Chelonus carinatus Cameron , 1881 : 599 (preoccupied) .

Chelonus blackburni Cameron , 1886 : 242 (nom.n.) .

Chelonus cameronii Dalla Torre , 1898 : 200 (nom.n.) .

Chelonus (Microchelonus) blackburni-Muesebeck & Walkley , 1951 : 145 .

Material examined : 10♀♀ : INDIA : Delhi , 3.ix.1980 bred on *Corcyra cephalonica* (IARI) 2♀♀ : INDIA : Uttar Pradesh , Aligarh , 13.x.1982 , light trap ; coll. (Shujauddin) .

Hosts : *Acrolepia assectella* (Zeller) , *Bactra truculenta* Meyr. , *Batachedra cuniculator* Busck , *Earias insulana* Boisduval , *Ephestia kuehniella* (Zeller) , *Genophantes leahi* Swezey , *Hellula undalis* Fabr. , *Hymenia facialis* Cram. , *H. recurvalis* (Fabricius) , *Kieferia lycopersiella* Busck , *Levuana iridescens* B.-B. , *Lineodes ochrea* Walsingham , *Oebia dispecta* (Butler) , *Omphisa anastomosalis* (Guenee) , *Pectinophora gossypiella* (Saunders) , *Petrochroa dimorpha* Busck , *Phthorimaea (=Gnorimoschema) operculella* (Zeller) , *Plutella capparidis* Swezey , *P. maculipennis* Curtis , *Sitotroga cerealella* (Olivier) , *Unadilla humeralis* (Butler) .

Distribution : Widely distributed in India .

14. *Microchelonus nigripes* Rao & Chalikwar

Chelonus (Microchelonus) nigripes Rao & Chalikwar , 1971 : 471- 473 .

Host : Unknown .

Distribution : INDIA : Aurangabad .

15. *Microchelonus raoi* Kurhade & Nikam

Chelonus (Microchelonus) raoi Kurhade & Nikam , 1993 : 476-478 .

Host : *Heliothis armigera* Fab .

Distribution : INDIA : Aurangabad .

16. *Microchelonus alucitae* sp.n.
(Fig. 7 A-E)

Female : Head , mesosoma, metasoma at 2/3 rd apex and area bounded by basal carinae black , basal 1/3rd of metasoma yellow ; eyes black with yellowish tint ; ocelli blackish-yellow ; fore and mid legs brownish-yellow except coxae , hind trochanters , trochantelli and middle of tibiae brown ; fore and mid coxae brown ; hind coxae , femora except base , base and apex of tibiae brownish-black ; fore wings basal-half hyaline , apical-half infuscated ; parastigma , pterostigma and veins brown with M+CU1 , 1A+2A , r-m , bases of 2-SR and 2-M pale .

Head almost twice as broad as long ; eye 1.5 x as long as temple ; frons strigose , depressed , without carina ; OOL almost 2.0 x POL ; face rugulose , 1.6 x as wide as high , with a small median tubercle ; clypeus sparsely punctate ; malar space 1.3 x basal width of mandible , the latter with inner tooth slightly shorter than outer . Antenna (fig 7-B)16-segmented , subfiliform , extending back beyond the base of carapace ; scape 2.6 x as long as broad , first flagellar segment 3.3 x as long as broad , this ratio decreases gradually , segments 8-13 slightly broader than long , apical segment 1.5 x as long as broad .

Mesosoma 1.2 x as long as broad ; mesoscutum rugose , notauli indistinct ; scutellum rugose-punctate ; propodeum rugose-reticulate, lateral pair of tubercles slightly longer than submedian pair. Fore wing (fig.7-A) 1.3 x shorter than body; pterostigma 2.3 x as long as broad , 1.5 x as long as 1-R1 ; 3-SR 1.5 x as long as r ; SR1 straight . Hind femur (fig.7-D) 3.0 x as long as broad 0.8 x as long as hind tibia, the latter 1.12 x as long as hind tarsus .

Metasoma (fig.7C-E) broadening posteriorly , rugose , with converging carinae on basal one-sixth , in lateral view 3.0 x as long as high , about twice higher behind than basally ; ventral opening not reaching at apex , distance from ventral opening to apex of metasoma 0.66 x as long as hind basitarsus ; ovipositor sheath in lateral view 1.13 x as hind basitarsus .

Length : 3.6 mm .

Male : Similar to female , apex of metasoma devoid of a foramen .

Holotype ♀ : 1♂ paratype ; INDIA : South Andaman , Port Blair , 29. iii.1982, ex. *Alucita* sp. near *spilodesma* Meyrick on *Thunbergia laurifolia* Roxb.; coll. (Shujauddin) .

Remarks : The new species *Microchelonus alucitae* runs close to *natauli* Rao & Chalikwar , however , differs in having flagellar segments 8-13 slightly broader than long , frons without median carina and propodeum with submedian pair of tubercles distinct .

17. *Microchelonus notauli* Rao & Chalikwar

Chelonus (Microchelonus) notauli Rao & Chalikwar , 1971 : 469-471 .

Host : Unknown .

Distribution : INDIA : Aurangabad .

18. *Microchelonus pikenii* Kurhade & Nikam

Chelonus (Microchelonus) pikenii Kurhade & Nikam , 1993 : 474-476 .

Host : Unknown .

Distribution : INDIA : Ahmednagar .

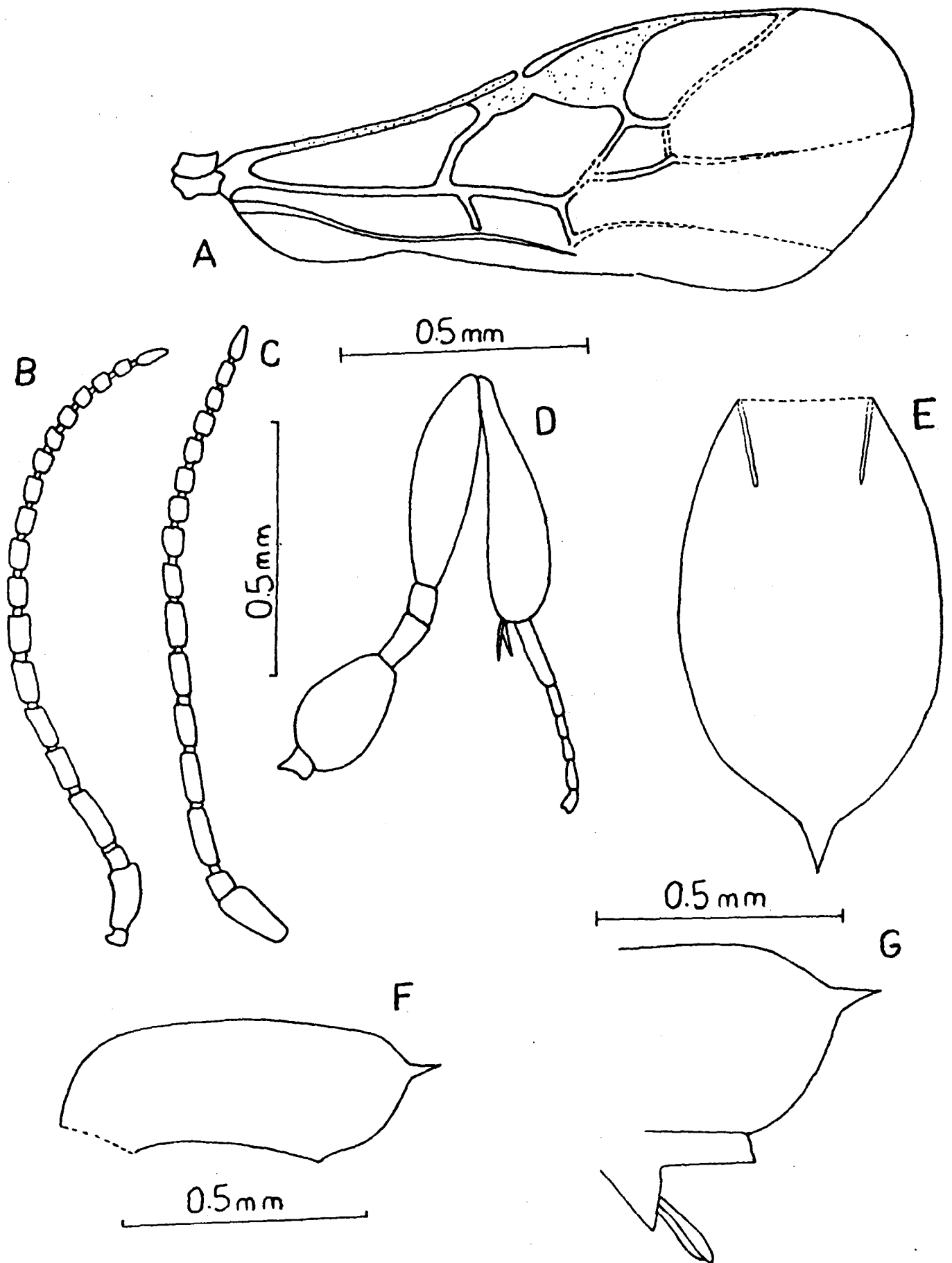


Fig. 3 : A - G. *Microchelonus spinigaster* sp.n. 9 σ .

A - Fore wing 9 ; B - Antenna σ ; C - Antenna 9 ; D - Hind leg 9 ; E - Metasoma (dorsal view) 9 ; F - Metasoma (lateral view) σ ; G - Metasoma (lateral view) 9.

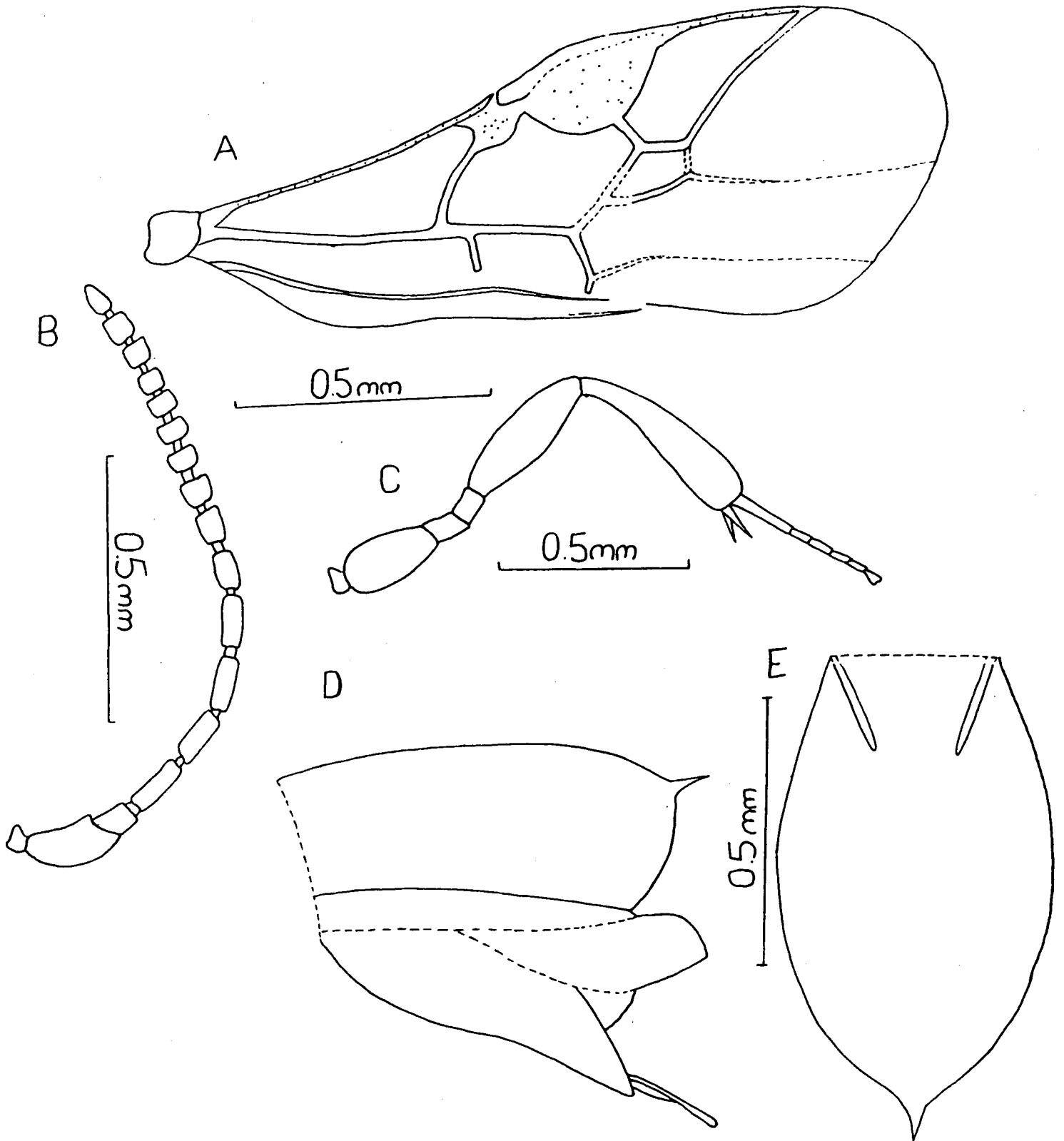


Fig.4 : A -E. *Microchelonus cordiae* sp.n. ♀.
 A - Fore wing ; B - Antenna ; C - Hind leg ; D - Metasoma (lateral view) ;
 E - Metasoma (dorsal view).

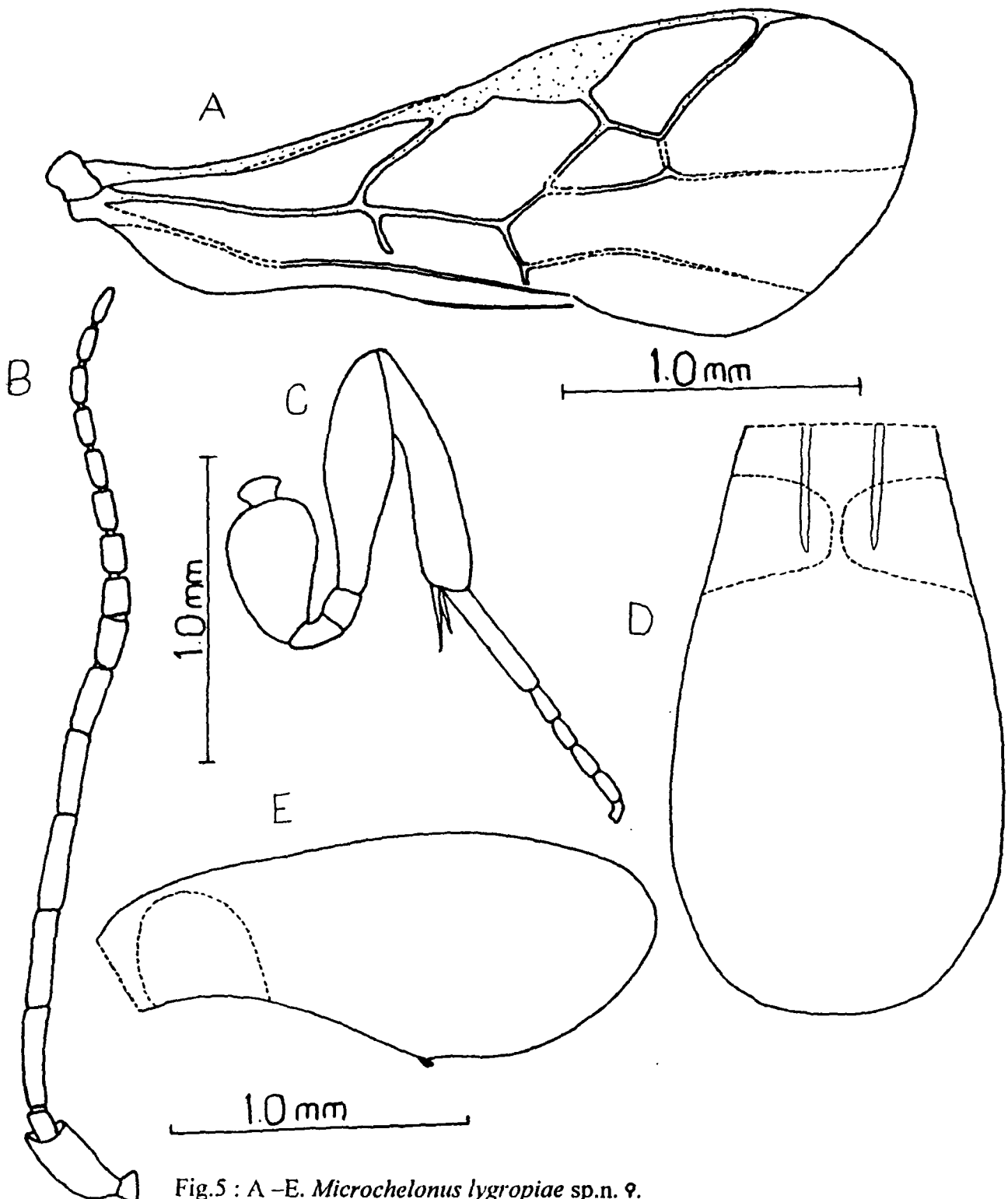


Fig.5 : A -E. *Microchelonus lygropiae* sp.n. ♀.

A - Fore wing ; B - Antennae ; C - Hind leg ; D - Metasoma (dorsal view) ;
 E - Metasoma (lateral view).

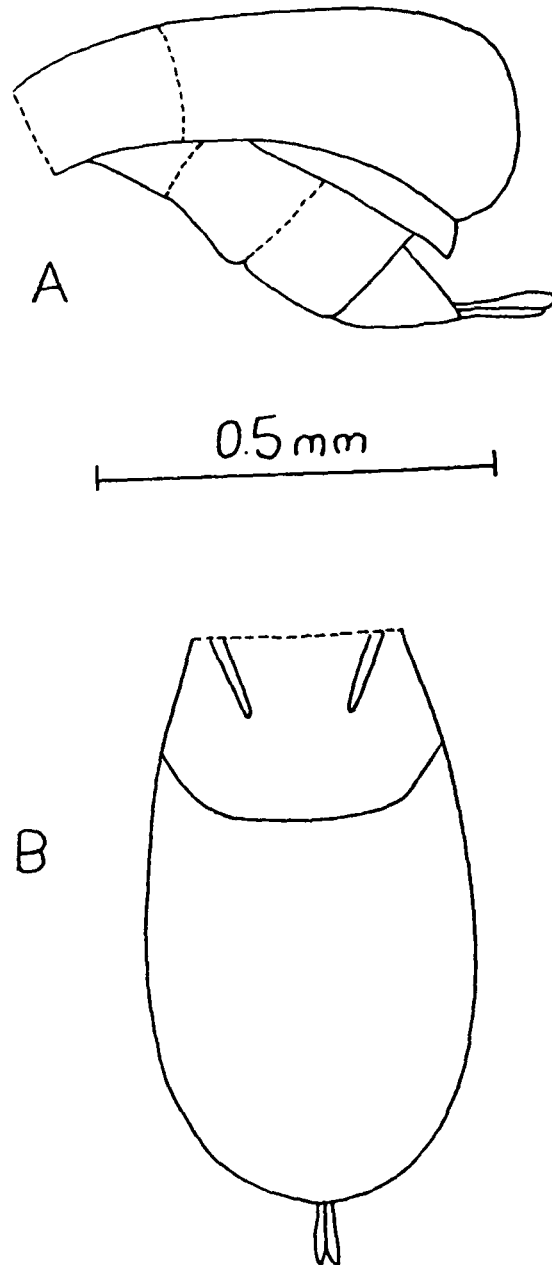


Fig.6 : A -B. *Microchelonus aligarhensis* sp.n. 9.
A - Metasoma (lateral view) ; B - Metasoma (dorsal view).

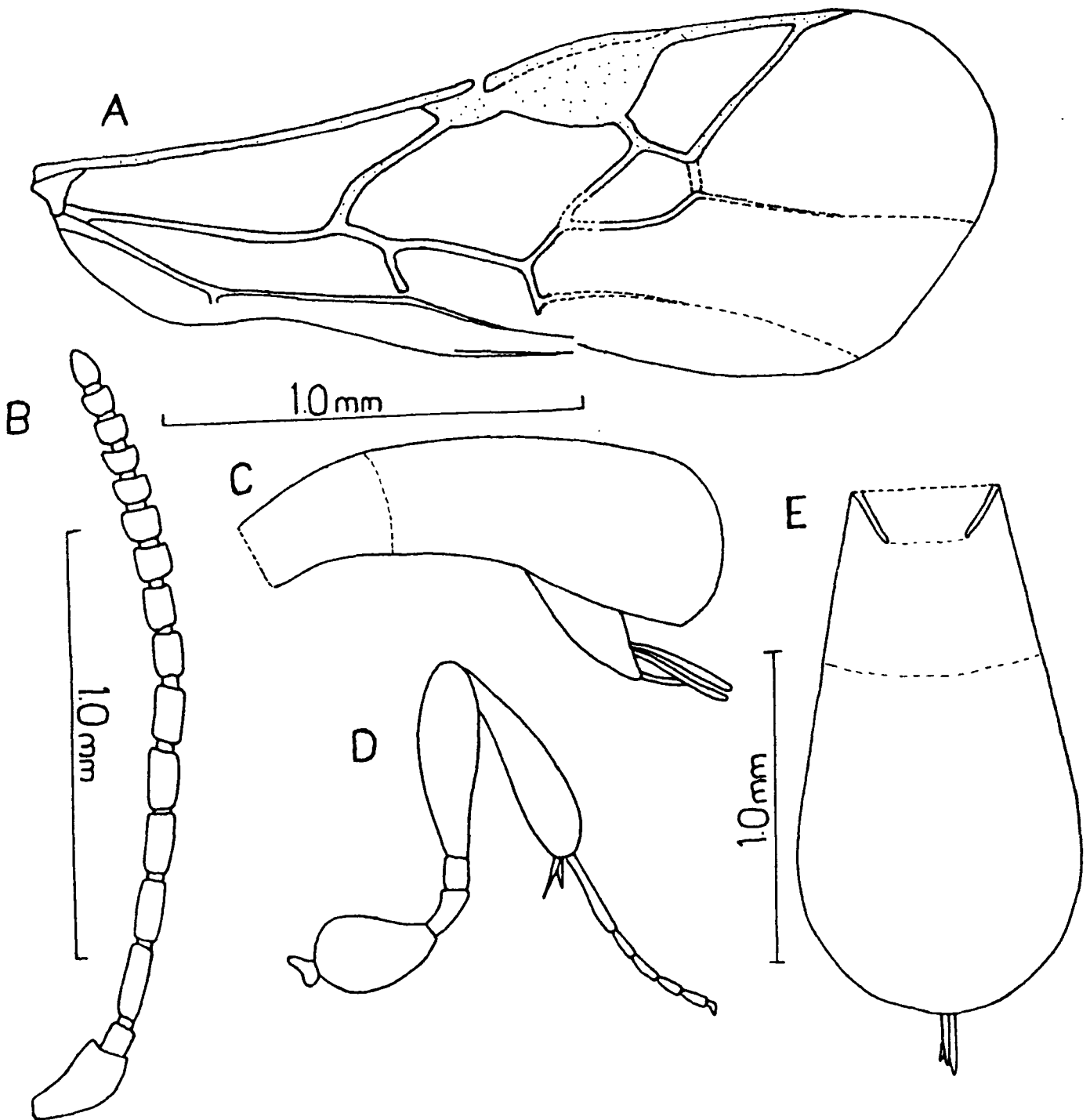


Fig.7 : A -E. *Microchelonus alucitae* sp.n. ♀.

A - Fore wing ; B - Antenna ; C - Metasoma (lateral view) ; D - Hind leg ;
E - Metasoma (dorsal view).

TRIBE PHANEROTOMINI BAKER

Phanerotomini Baker , 1926 : 451 .

Phanerotomina De Saeger , 1948 : 72 , 159 .

Diagnosis : Colour usually testaceous , sometimes black ; eyes glabrous , rounded, oval or elongated ; antennae filiform, with 23-63 or more segments ; tubercles on propodeum small ; fore wing with vein 1-SR+M present , marginal cell comparatively longer , r emitted beyond middle of pterostigma , 3-SR present or absent , 1-SR absent or when present , very small ; mid tibiae with or without blister at the base on external face ; metasoma comparatively less convex, with two distinct transverse sutures .

The tribe Phanerotomini Baker is represented by two genera viz. , *Phanerotoma* Wesmael and *Phanerotomella* Szepligeti from India . Recently , a third genus i.e. *Siniphanerotomella* He *et al.* is added to the tribe from China .

GENUS PHANEROTOMELLA SZEPLIGETI

Phanerotomella Szepligeti , 1900 : 59 .

Type-species : *Phanerotomella longipes* Szepligeti , designated by Viereck , 1914 .

Plesiosphaeropyx Cameron , 1912 : 82 , 84 .

Type-species : *Plesiosphaeropyx albipalpis* Cameron , syn. by De Saeger , 1948 .
Monotypic .

Diagnosis : Antennal segments 24-63 ; fore wing usually elongated , pterostigma comparatively slender , second submarginal cell usually triangular and petiolate , vein 2-R1 present , vein CU1b absent resulting in an open subdiscal cell apico- posteriorly , vein 3-SR absent , if present very small ; hind wing with vein r absent , vein M+CU shorter than vein 1-M ; legs slender and elongated ; third metasomal tergite with postero-lateral teeth more or less developed .

The genus *Phanerotomella* Szepl. is represented by 7 species from Indo-Australian region (Shenefelt , 1973 ; Sigwalt , 1978) and is reported for the first time from India . In the present work *P. namkyensis* Sigwalt is reported for the first time and

two new species of the genus have been described from India . A key to the Indian species of the genus is also provided .

Key to the Indian species of the genus *Phanerotomella* Szepligeti.

1. Mid tibia without blister but weakly arched at its anterior third ; mesoscutum with notauli indistinct*namkyensis** Sigwalt .
- Mid tibia with blister ; mesoscutum with notauli weakly indicated2 .
2. Fore wing with m-cu postfurcal ; face without median tubercle , carina ending medially into rugosities ; frons with carina*solapurensis* sp. n.
- Fore wing with m-cu antefurcal ; face with median tubercle , carine absent ; frons without carina.....*aligarhensis* sp. n.

1. *Phanerotomella namkyensis* Sigwalt

Phanerotomella namkyensis Sigwalt , 1978 : 719-720 .

Material examined : 1 ♂ INDIA : Uttar Pradesh , Aligarh ,2. IX.1970, light trap ; coll. (Shujauddin) .

Host: Unknown .

Distribution : INDIA : Aligarh .

**2. *Phanerotomella solapurensis* sp.n.
(Fig. 8)**

Female : Head , ocelli and first tergite brownish-yellow ; eyes and ocellar spot black ; antennae brownish-yellow becoming brownish-black towards apex ; mesosoma testaceous ; legs yellow to brownish- yellow ; second and third tergite testaceous ; wings subhyaline , parastigma , pterostigma and veins more or less brown with r-m and 3-M pale .

* Female of *P. namkyensis* Sigwalt is unknown .

Head almost as broad as mesosoma ; temple reticulate , 0.64 x the eye length ; frons reticulate , depressed , with carina ; OOL= 4.0x POL ; face rugose-reticulate , 1.7 x as broad as high , with carina ending medially into rugosities ; clypeus punctate with two very small , blunt teeth ; malar space 1.3 x basal width of mandible , the latter with inner tooth almost half as long as outer . Antenna 32-segmented , filiform, almost as long as body , scape twice as long as broad , first flagellar segment 3.2 x as long as broad , apical segment 2.5 x as long as broad .

Mesosoma 1.3 x as long as broad ; mesoscutum rugose , notauli weakly indicated ; mesosternum reticulate ; propodeum rugose , with distinct tubercles . Fore wing (fig.8) with pterostigma 2.9 x as long as broad ; 1-R1 0.87 x as long as pterostigma ; r 0.8 x as long as breadth of pterostigma , 0.7 x as long as r-m ; second submarginal cell distinctly petiolate ; SR1 curved at distal end ; 2-R1 0.8 x as long as r-m ; m-cu postfurcal ; 2A just indicated . Mid tibia without blister ; hind coxa 1.3 x as long as first tergite ; hind femur 4.0 x as long as broad , 1.2 x shorter than hind tibia .

Metasoma reticulate , 1.7 x as long as broad , 1.1 x as long as mesosoma , with converging carinae on basal-forth ; first and second tergites almost equal , third smaller (16:17:14) ; lateral lobes at the apex of third tergite distinct ; ovipositor sheath in lateral view 0.4 x as long as hind basitarsus .

Length : 2.68 mm .

Male : Unknown .

Holotype ♀ : INDIA : Maharashtra , Solapur , 20.VIII.1998, light trap ; coll. (Kalpna Varshney) .

Remarks : The new species *P.solapurensis* runs close to *rufa* (Marshall) , however , differs in having frons reticulate , temple not sinuated posteriorly , mesosternum reticulate, parastigma large , third tergite of female not truncate .

3. *Phanerotomella aligarhensis* sp.n. (Fig. 9 A-F)

Female : Head , ocelli and legs yellow ; eyes and ocellar spot black ; mesosoma yellowish-brown ; metasoma medially yellow with posterior and lateral margins dark

brown ; wings subhyaline , parastigma and pterostigma brown , veins yellow with 2-SR+M , r-m , 3-M and CU1a transparent .

Head almost as broad as mesosoma ; temple rugose , 0.75 x the eye length ; frons rugulose , depressed , without carina ; OOL=5.3 x POL ; face rugose , almost as broad as high , with a small median tubercle , carina absent ; clypeus sparsely punctate , without teeth ; malar space 1.7 x basal width of mandible , the latter with inner tooth shorter than outer. Antenna (fig.9-A) 32-segmented , filiform, 1.2 x as long as body , scape 2.2 x as long as broad, first flagellar segment 3.5 x as long as broad , apical segment 2.5 x as long as broad .

Mesosoma 1.6 x as long as broad ; mesoscutum reticulate-punctate , notauli weakly indicated ; mesosternum reticulate ; propodeum reticulate , with a mid transverse carina , tubercles small but distinct .Fore wing (fig.9-B) with pterostigma 3.5 x as long as broad ; 1-R1 1.2 x as long as pterostigma ; r 1.5 x as long as breadth of pterostigma , 1.5 x as long as r-m ; second submarginal cell distinctly petiolate ; SR1 slightly curved ; 2-R1 0.5 x as long as r-m , m-cu antefurcal ; 2-A just indicated . Mid tibia (fig. 9-E) with blister ; hind coxa (fig. 9-F) almost as long as first tergite ; hind femur 4.3 x as long as broad , 1.2 x shorter than hind tibia .

Metasoma reticulate-rugose , 1.7 x as long as broad , almost as long as mesosoma , with converging carinae on basal-third of first tergite ; tergites almost equal (14: 13:14) ; lateral lobes at the apex of third tergite distinct ; ovipositor sheath in lateral view as long as hind basitarsus .

Length : 2.48 mm .

Male: Unknown .

Holotype♀ : INDIA : Uttar Pradesh , Aligarh , 21.IX.1996 , light trap ; coll. (Kalpna Varshney) .

Remarks : The new species *P. aligarhensis* runs close to *namkyensis* Sigwalt, however , differs in having mid tibia with blister , head 1.2 x as broad as mesosoma and metasoma almost as long as mesosoma, with carinae on basal-third of first tergite .

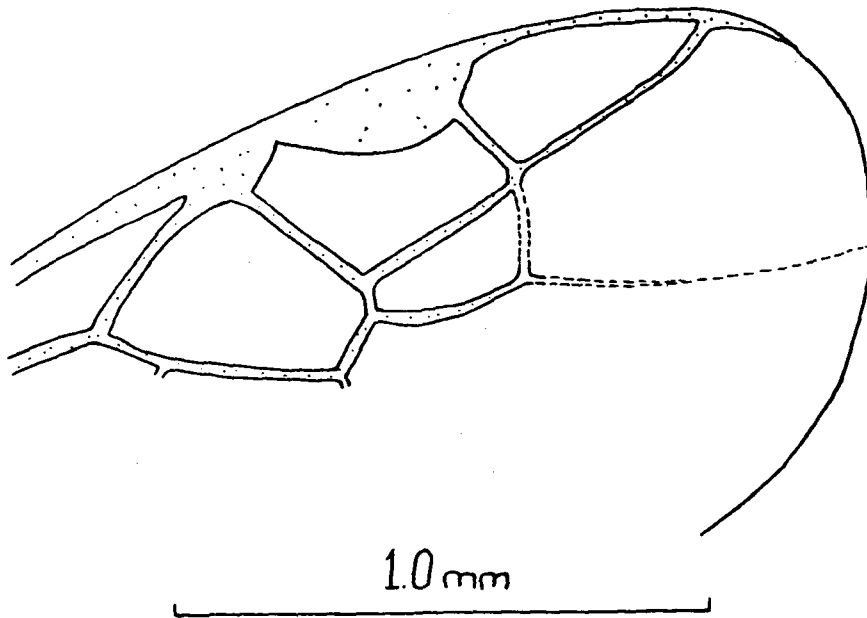


Fig.8 : *Phanerotomella solapurensis* sp.n. ♀.
Apical part of fore wing.

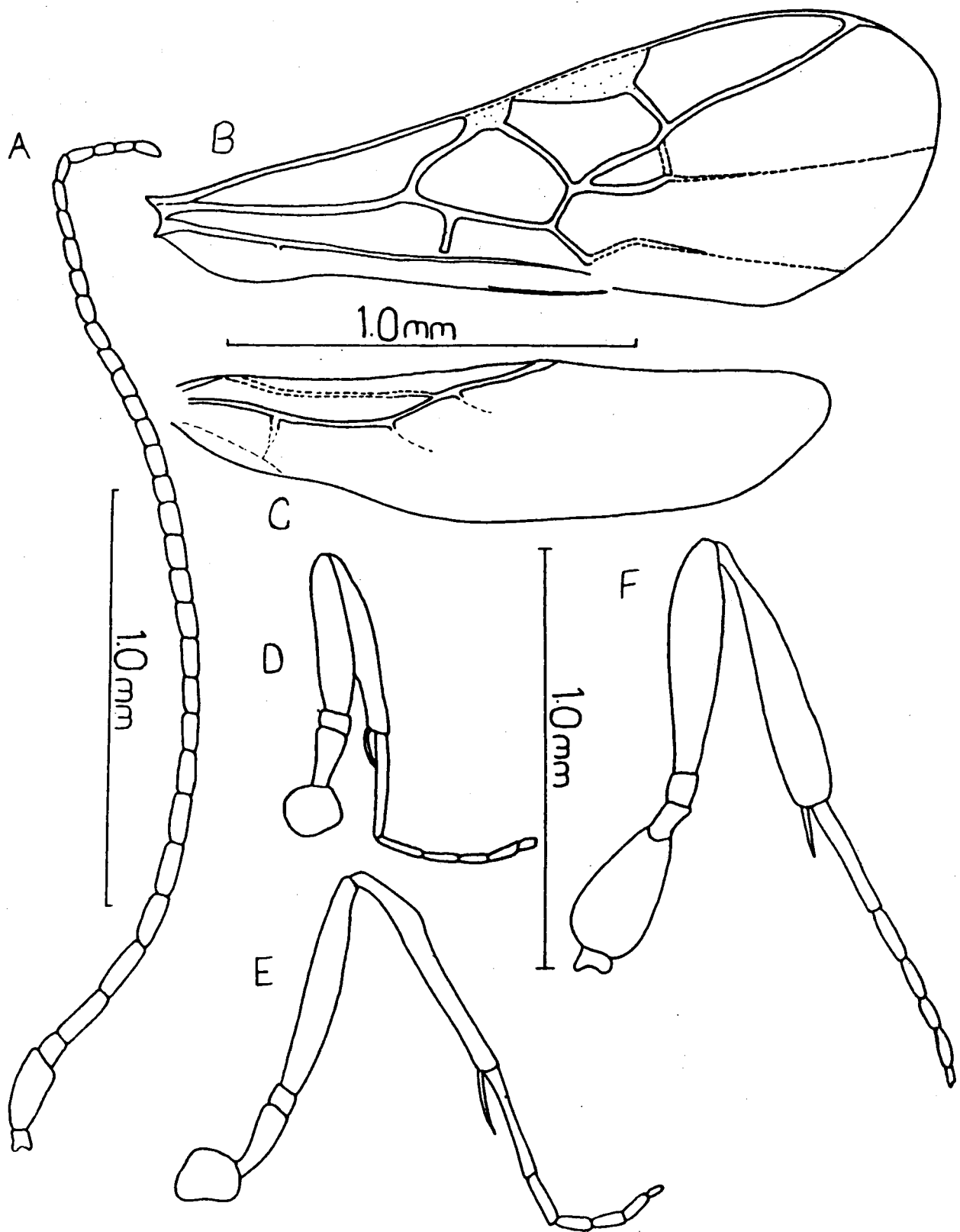


Fig.9 : A-F. *Phanerotomella aligarhensis* sp.n. ♀.

A - Antenna ; B - Fore wing ; C - Hind wing ; D - Fore leg ; E - Mid leg ;
 F - Hind leg.

GENUS *PHANEROTOMA* WESMAEL

Phanerotoma Wesmael, 1838 : 165 .

Type-species : *Chelonus dentatus* Panzer , designated by Haliday , 1840 ;
Neotype designated by Achterberg , 1990 .

Phanerogaster Wesmael , 1838 : 165 (unavailable name , published in synonymy with
Phanerotoma) .

Phaenotoma [!] Ashmead , 1894 : 124 [err.typ.] .

Sulydus Du Buysson , 1897 : 354 .

Type-species : *Sulydus marshalli* Du Buysson , syn. by Fischer , 1963. Monotypic .

Ichneutipterus Vachal , 1907 : 122 .

Type-species : *Sigalphus? ichneutipterus* Vachal , syn. by Achterberg , 1990 .
Monotypic .

Neophanerotoma Szepligeti , 1908b : 227 .

Type-species : *Phanerotoma orientalis* Szepligeti , designated by Viereck , 1914 ,
syn. by De Saeger , 1948 .

Tritoma Szepligeti , 1908a : 410 not Fabricius , 1775 .

Type-species : *Chelonus tritonus* Marshall , syn. by Achterberg , 1990 .
Monotypic .

Szepligetia Schulz , 1911 : 89 . Replacement name for *Tritoma* Szepligeti .

Neoacampis Szepligeti , 1914 : 210 .

Type-species : *Neoacampis gracilipes* Szepligeti , syn. by Achterberg , 1990 .
Monotypic .

Tritomios Strand , 1921 : 174 . Replacement name for *Tritoma* Szepligeti , syn. by
Achterberg , 1990 .

Neoacampsis [!] Brues , 1926 : 395 .

Phanerotomina Shestakov , 1930 : 100 .

Type-species : *Phanerotomina gussakovskii* Shestakov (= *Phanerotoma parva*
Kokujev, 1903) , syn. by Telenga , 1941. Monotypic .

Unica Snoflak , 1951 : 7 , 9 .

Type-species : *Phanerotoma moravica* Snoflak. Monotypic .

Diagnosis : Antennal segments 23 ; fore wing with pterostigma globular ,
second submarginal cell quadrangular , vein 2-R1 absent , vein CUIb more or less
developed , resulting in a closed first subdiscal cell apico-posteriorly , vein 3-SR
distinctly developed ; hind wing with vein r often present , vein M+CU equal to vein
1-M or longer ; legs comparatively less slender ; third metasomal tergite with postero-
lateral teeth absent or less developed ; at most apical third of ovipositor sheath setose .

The genus *Phanerotoma* Wesm. comprises two subgenera viz., *Bracotritoma*
Csiki and *Phanerotoma* s.str . The subgenus *Bracotritoma* is reported for the first time
while the subgenus *Phanerotoma* is represented by only two species viz. ,

buchneri Fahringer and *hendecasisella* Cameron from India . However , the genus is repeatedly reported from India as *P.hendecasisella* (Patil & Thontadarya, 1987 ; Peter & David , 1991 ; Sundheendrakumar , 1993) or without specific identification (Mallik *et al.*, 1989 ; Thakur & Gangwar , 1989 ; Tripathi & Singh, 1991) . In the present work 7 new species of the genus have been described from India , of which , 3 belongs to the subgenus *Bracotritoma* and 4 to the subgenus *Phanerotoma*. Since , a number of species have been identified from the limited material collected from Aligarh , U.P, it is presumed that India , a large country with varied climate , may still have a large number of undescribed species of this genus .

Key to the subgenera and Indian species of the genus *Phanerotoma* Wesmael

1. Maximum width of pterostigma 1.1-5.3 x length of vein 3-SR of fore wing ; vein 1-R1 of fore wing as long as pterostigma or distinctly shorter ; inner tooth of mandible somewhat shorter than outer tooth and comparatively robust.....
..... (subgenus *Bracotritoma* Csiki)...2 .
- Maximum width of pterostigma 0.5-1.0 (1.1) x length of vein 3-SR of fore wing ; vein 1-R1 of fore wing somewhat longer than pterostigma ; inner tooth of mandible about half as long as outer tooth or shorter..... (subgenus *Phanerotoma* s. str.)...4 .
2. Vein r of fore wing 0.6 x as long as vein 3-SR ; length of eye in dorsal view 2.5 x length of temple ; fore wing without infuscation below pterostigma.....
.....*testacea* sp.n.
- Vein r of fore wing as long as 3-SR ; length of eye in dorsal view less than twice the length of temple ; fore wing with a light brown infuscation below pterostigma.....3 .
3. Mid tibia without blister , vein r and 3-SR of fore wing almost in a straight line ; m-cu almost interstitial ; mesosternum rugose-granulate ; hind femur 3.8 x as long as broad ; subapical antennal segments submoniliform.....*ashae* sp.n.
- Mid tibia with a blister ; vein r and 3-SR of fore wing not in a straight line ; m-cu Antefurcal ; mesosternum granulate ; hind femur 4.8 x as long as broad ; subapical antennal segments moniliform.....*yagyai* sp.n.
4. Fore wing with r and 3-SR forming an arc of a circle ; second submarginal cell

- much narrowed at the apex and the veins almost touching there.....
 *hendecasisella* Cameron.
- Fore wing with r and 3-SR not forming an arc ; veins at the apex of second submarginal cell distinctly separated.....5 .
 - 5. Fore wing with r very short , hardly indicated ; 2-SR strongly curved at the base...6 .
 - Fore wing with r long ; 2-SR curved or straight.....7 .
 - 6. Wings opaque ; scape hardly broader than flagellar segments..... *buchneri* Fahringer .
 - Wings hyaline ; scape distinctly broader than flagellar segments....*dichocrophaga* sp.n.
 - 7. 2-SR curved ; OOL=5.5 x POL..... *achterbergi* sp.n.
 - 2-SR straight ; OOL less than 4.0 x POL.....8 .
 - 8. Fore wing with m-cu interstitial ; malar space 0.86 x basal width of mandible ; carinae on first metasomal tergite not reaching upto first suture ; antennae shorter than body ; OOL= 4.0 x POL..... *agarwali* sp.n.
 - Fore wing with m-cu antefurcal ; malar space 0.43 x basal width of mandible ; carinae on first metasomal tergite reaching upto first suture ; antennae almost as long as body ; OOL = 3.3 x POL*indica* * sp.n.

s.gen. *Bracotritoma* Csiki

Bracotritoma Csiki , 1909 : 13 . Replacement name for *Tritoma* Szepligeti .
Bracotritoma – Achterberg , 1990 : 11 .

**1. *Phanerotoma (Bracotritoma) testacea* sp.n.
 (Fig. 10A-D)**

Female : Head and ocelli testaceous , ocellar spot black ; eyes brownish-black ; antennae blackish-yellow ; mesosoma and metasoma in major parts red-testaceous ; mesoscutum with four longitudinal brown bands , of which middle two reaching upto

* The female of *P. (P.) indica* sp. n. is unknown .

basal half only ; legs yellow with hind tibia , mid and hind tarsi blackish-yellow ; wings hyaline , infuscation below pterostigma absent , the latter medially brown ; veins brown with M + CU¹, 1A+2A , m-cu , 3-CU1 , 3-M and CU1a pale .

Head 1.2 x wider than maximum width of mesoscutum ; frons granulate , slightly depressed , carina present ; OOL=4.3 xPOL ; length of eye in dorsal view 2.5 x length of temple ; face rugose-granulate , carina absent , 1.7 x as wide as high ; clypeus punctate , without teeth ; malar space 0.88 x basal width of mandible , the latter with inner tooth slightly shorter than outer . Antenna (fig.10-B) 23-segmented , almost as long as body ; scape twice as long as broad , subapical antennal segments moniliform .

Mesoscutum rugose-granulate ; scutellum granulate ; mesosternum rugose-granulate ; propodeum rugose with mid transverse carina , tubercles small but distinct . Fore wing (fig. 10-A) with pterostigma almost as long as 1-R1 , maximum width of pterostigma 1.2 x vein 3-SR ; r 0.6 x as long as 3-SR ; 2-SR and SR1 straight ; m-cu interstitial . Mid tibia (fig.10-C) with blister ; hind femur (fig.10-D) 3.4 x as long as broad , 1.3 x shorter than hind tibia .

Metasoma rugose , slightly longer than mesosoma ; first tergite slightly longer than second but shorter than third (15:13:19) , with converging carinae on basal- third , becoming parallel upto first suture ; apex of metasoma with lateral tubercles distinct ; ovipositor sheath protruding well beyond the apex of metasoma , 0.58 x as long as hind basitarsus in lateral view .

Length of body 2.65 mm , of fore wing 2.5 mm .

Male: Unknown .

Holotype ♀ : INDIA : Uttar Pradesh , Aligarh , 18.x.1996 ; light trap ; coll. (Kalpna Varshney) ; 1♀ paratype ; INDIA : Uttar Pradesh , Aligarh , 20. ix.1997 ; light trap ; coll. (Kalpna Varshney) .

Remarks : The new species *P.(B.) testacea* resembles *grapholithae* Muesebeck , however , can be differentiated by having clypeus punctate , without teeth , infuscation below pterostigma absent , carinae on first tergite reaching upto first suture , ovipositor exerted .

2. *Phanerotoma (Bracotritoma) ashae sp.n.**
(Fig.11-A)

Female : Head and mesosoma testaceous ; eyes and ocellar spot black ; ocelli yellowish-black ; antennae testaceous gradually becoming brown towards apex ; legs yellow to yellowish-brown ; first and second tergites yellow , third brown ; wings subhyaline with a light brown infuscation below pterostigma , the latter dark brown medially ; veins yellowish-brown with r-m , 3-M and CU1a pale .

Head 1.2 x wider than maximum width of mesoscutum ; frons finely granulate slightly depressed , carina absent ; OOL=5.0 x POL ; length of eye in dorsal view 1.4 x length of temple ; face finely granulate , carina absent , 1.6 x as wide as high ; clypeus punctate , tridentate ; malar space as long as basal width of mandible , the latter with inner tooth somewhat shorter than outer. Antenna almost as long as body , scape 2.4 x as long as broad , subapical antennal segments submoniliform .

Mesoscutum granulate ; scutellum finely granulate ; mesosternum rugose-granulate ; propodeum reticulate , transverse carina and tubercles indistinct . Fore wing (fig.11-A) with pterostigma almost as long as 1-R1 ; maximum width of pterostigma 1.3 x vein 3-SR ; r as long as 3-SR ; r and 3-SR almost in a straight line ; 2-SR and SR1 slightly curved ; m-cu almost interstitial . Mid tibia without blister ; hind femur 3.8 x as long as broad , 1.3 x shorter than hind tibia .

Metasoma rugose , 1.3 x as long as mesosoma ; first tergite as long as second , distinctly shorter than third , with converging carinae on basal-third ; apex of metasoma with lateral tubercles very small ; ovipositor sheath protruding much beyond the apex of metasoma , 0.6 x as long as hind basitarsus in lateral view .

Length of body 2.6 mm , of fore wing 2.2 mm .

Male : Unknown .

Holotype ♀ : 19 paratype : INDIA : Uttar Pradesh , Aligarh ; 10.viii.1982 ; sweeping ; coll. (Shujauddin) .

Remarks: The new species *P.(B.) ashae* runs close to *parva* Kokujev , however ,

* The new species is named after the mother of writer .

can be differentiated by malar space as long as basal width of mandible , 1-R1 as long as pterostigma and maximum width of pterostigma 1.3 x vein 3-SR.

**3. *Phanerotoma (Bracotritoma) yagyai* * sp.n.
(Fig.11-B)**

Female : Head , mesosoma and ocelli testaceous ; eyes and ocellar spot black ; antennae yellow becoming brown towards apex ; legs yellow ; first and second tergites yellowish-brown, third brown, with black maculae ; wings subhyaline with a light brown infuscation below pterostigma , the latter dark brown medially , veins yellowish-brown with C+SC+R , 1-R1 and r pale .

Head 1.4 x wider than maximum width of mesoscutum ; frons finely granulate, slightly depressed , carina indistinct ; OOL = 4.5 x POL ; length of eye in dorsal view 1.6 x length of temple ; face finely granulate , without carina , 1.6 x as wide as high ; clypeus punctate , tridentate ; malar space as long as basal width of mandible , the latter with inner tooth somewhat shorter than outer . Antenna 23-segmented slightly shorter than body ; scape twice as long as broad , subapical antennal segments moniliform .

Mesoscutum , scutellum and mesosternum granulate ; propodeum reticulate , transverse carina and tubercles indistinct . Fore wing (fig.11-B) with pterostigma as long as 1-R1 , maximum width of pterostigma 1.3 x vein 3-SR ; r as long as 3-SR ; r and 3-SR not in a straight line ; 2-SR and SR1 slightly curved ; m-cu antefurcal . Mid tibia with blister ; hind femur 4.8 x as long as broad , 1.2 x shorter than hind tibia .

Metasoma with first and second tergites rugose , third reticulate , 1.3 x as long as mesosoma ; first tergite almost as long as second , distinctly shorter than third (16:15:22) ; with carinae indistinct ; apex of metasoma with lateral tubercles distinct ; ovipositor sheath protruding much beyond the apex of metasoma , 0.75 x as long as hind basitarsus in lateral view .

Length of body 2.52 mm , of fore wing 2.1 mm .

* The new species is named after the father of writer .

Male : Unknown .

Holotype ♀ : INDIA : Uttar Pradesh , Aligarh ; 10.viii. 1992 ; sweeping ; coll. (Shujauddin) .

Remarks : The new species *P.(B.) yagyai* runs close to *ashae* sp.n. but differs in having mid tibia with blister , vein r and 3-SR of fore wing not in a straight line, m-cu antefurcal , mesosternum granulate and hind femur 4.8 x as long as broad .

s.gen. *Phanerotoma* s.str.

Phanerotoma s.str. Tobias , 1971 : 108 ; Achterberg , 1990 : 11 .

***Phanerotoma (Phanerotoma) hendecasisella* Cameron**

Phanerotoma hendecasisella Cameron , 1905 : 80 .

Phanerotoma hendecasiella [!]-Wilkinson , 1930b : 482 .

Phanerotoma hendecailla [!] – Butani , 1958 : 272 .

Material examined : 1♀ , S.N. Chatterjee (det.) Dehra Dun , 24. viii.1935 , ex. *Salebria strigivenata* Hmps. (IARI) ; 44♀♀ ♂♂ , S.N.Chatterjee (det.) , Dehra Dun , 24.viii.1935 , ex. *Nephoteryx rhodobasalis* Hmps. and *Dichomeris eridantis* Mayr. (R.N.Mathur) , 5♀♀ , 5♂♂ , INDIA : Uttar Pradesh , Aligarh , 9. viii.1995 , ex. *N. rhodobasalis* Hmps. on *Cassia fistula* L. ; coll. (Kalpna Varshney) .

Hosts: *Diaphania indica* (Saunders) , *Dichomeris eridantis* Meyr. , *Earias insulana* Boisd. , *Emmalocera depressella* Swinh. , *Etiella zinckenella* (Treischke) , *Eucosma critica* Meyrick , *Glyphodes pyloalis* Wlk. , *Hapalia machaeralis* Walk. , *Hendecasis duplifascialis* Hmps. , *Hyperargyria metalliferella* Rag. , *Hysipylla robusta* Moore , *Laodamia strigivinata* Hamd. , *Lygropia quaternalis* Zell. , *Margaronia pyloalis* Walk. , *Maruca testulalis* Guen. , *Nephoteryx rhodobasalis* Hmps. , *Palpita laticostalis* Guen. , *Pammene theristis* Meyr. , *Pilocrocis milvinalis* Swinh. , *Pionea aureolaris* Led. , *P. ochracealis* Wlk. , *Pyrausta machaeralis* Wlk. , *Salebria strigivenata* Hmps. , *Sylepta balteata* Fab. , *S.crotonalis* Wlk. , *S. derogata* Fab .

Distribution : Widely distributed in India .

Note : The material reared by the writer from the buds and webbed leaves of *Cassia fistula* L. infested by *Nephoteryx rhodobasalis* Hmps. , resembles the specimens of *P.hendecasisella* Cameron deposited in the National Pusa collection , IARI and in IFRI . However , all these specimens differs from the original description by Cameron (1905) in following characters : antenna shorter than body , clypeus punctate , fore wing with r and 3-SR straight not forming an arc , second submarginal cell with veins not touching at apex . As the original description is not sufficient and the 'type' is not available (lectotype needed ; Shenefelt , 1973:917) , further study after comparison with type can only establish the true identity of these specimens .

4. *Phanerotoma (Phanerotoma) buchneri* Fahringer

Phanerotoma buchneri Fahringer , 1932 : 144 .

Host : *Holcocera pulverea* Meyr .

Distribution : INDIA : Assam , Bihar .

5. *Phanerotoma (Phanerotoma) dichocrophaga* sp.n. (Fig.12 A-M)

Female : Head and third metasomal tergite testaceous ; eyes and ocellar spot black ; posterior ocelli testaceous , anterior one brown ; proximal segments of antennae yellow , becoming yellowish-brown towards apex ; mesosoma red-testaceous with three light brown longitudinal bands , middle one reaching upto basal-third only ; first and second tergites yellow ; legs yellow with apex and a small spot at the base of hind tibiae brownish-yellow ; wings hyaline , without infuscation below pterostigma , the latter completely yellow , veins brownish-yellow with M+CU1 , 1-SR+M , m-cu , 3-CU1 , bases of 2-SR and 2M , r-m , 3-M , and CU1b pale .

Head 1.3 x wider than maximum width of mesoscutum ; frons rugose-granulate , slightly depressed , carina absent ; OOL=3.8 x POL ; length of eye in dorsal view twice the length of temple ; face granulate , with carina , almost twice as wide as high ; clypeus rugose- punctate , tridentate ; malar space 0.7 x basal width of mandible , the latter with inner tooth much shorter than outer . Antenna almost as long as body ; scape twice as long as broad ; subapical antennal segments (fig. 12 -B) moniliform .

Mesoscutum reticulate ; scutellum granulate ; mesosternum rugose-granulate ; propodeum rugose-granulate , with mid transverse carina , lateral tubercles small . Fore wing (fig.12-A) with pterostigma 0.7 x as long as 1-R1 , maximum width of pterostigma 0.7 x vein 3-SR ; r much shorter than 3-SR ; 2-SR strongly curved ; SR1 almost straight ; m-cu antefurcal . Mid tibia with blister ; hind femur 3.7 x as long as broad , 1.2 x shorter than hind tibia .

Metasoma (fig.12 E,F) reticulate , slightly longer than mesosoma , first tergite almost as long as second but shorter than third (12:13:16) , with converging carinae on basal-half ; apex of metasoma with tubercles indistinct ; ovipositor sheath protruding slightly beyond the apex of metasoma , 0.54 x as long as hind basitarsus in lateral view.

Length of body 2.35 mm , of fore wing 2.4 mm .

Male: Similar to female but with subapical antennal segments (fig.12C-D) submoniliform , apex of metasoma (fig.12-J) slightly less excised .

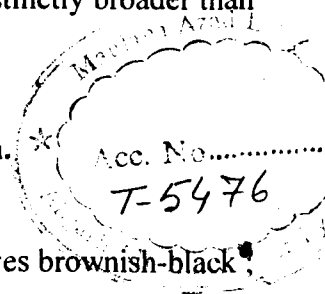
Holotype ♀ : 1♂ paratype ; INDIA : Uttar Pradesh , Aligarh , 15. IX.1980 , ex. *Dichocrocis punctiferalis* Guenee on *Riccinus comunis* L. ; coll. (Shujuddin) .

Remarks : The new species *P.(P.) dichocrophaga* closely resembles *buchneri* Fahringer , however , differs in having wings hyaline and scape distinctly broader than flagellar segments .

6. *Phanerotoma (Phanerotoma) achterbergi sp.n.**
(Fig. 13 A-I)

Female: Head and third metasomal tergite red-testaceous ; eyes brownish-black .

* Named in the honour of Prof. C. van Achterberg , Nationaal Natuurhistorisch Museum , Leiden , The Netherlands , for his valuable contribution to the taxonomy of family Braconidae .



ocelli yellow , ocellar spot black ; antennae , first and second tergites testaceous ; mesosoma yellowish-brown with base and lateral sides of mesoscutum brown ; legs yellow to yellowish-brown ; wings subhyaline with a light brown infuscation below pterostigma ; veins C+SC+R , 1-R1 , 1-M, parastigma and pterostigma yellowish-brown, M+CU1 , proximal portion of 1-SR+M , m-cu , bases of 2-SR and 2-M , 3-M , and Cula pale , rest of the veins brown .

Head 1.4 x wider than mesoscutum ; frons granulate , depressed , carina indistinct ; OOL=5.5 x POL ; length of eye in dorsal view 1.6 x length of temple ; face rugose- granulate , with a small median tubercle , without carina , almost twice as wide as high ; clypeus granulate , tridentate ; malar space 0.5 x basal width of mandible; inner tooth of mandible (fig. 13-D) much shorter than outer . Antenna (fig. 13-B) almost as long as body , scape 2.1 x as long as broad , subapical antennal segments robust .

Mesoscutum and scutellum granulate ; mesosternum rugose-granulate ; propodeum reticulate-granulate , with a broken transverse carina , lateral tubercles distinct . Fore wing (fig. 13-A) with pterostigma 0.7 x as long as 1-R1 , maximum width of pterostigma 0.4 x vein 3-SR ; r 0.3 x as long as 3-SR ; 2-SR strongly curved ; SR1 curved ; m-cu interstitial . Mid tibia (fig. 13-E) with blister ; hind femur (fig.13-F) almost 4.0 x as long as broad , 1.3 x shorter than hind tibia .

Metasoma (fig.13-G,H) with first and second tergites rugose , third granulate, 1.4 x as long as mesosoma ; first tergite slightly shorter than second , but much shorter than third (20:22:34) , with converging carinae on basal-half ; apex of metasoma (fig. 13-I) with lateral tubercles small ; ovipositor sheath protruding well beyond the apex of metasoma , 0.8 x as long as hind basitarsus in lateral view .

Length of body 3.72 mm , of fore wing 2.9 mm .

Male : Unknown .

Holotype ♀ : 3 ♀ ♀ paratypes ; INDIA : Uttar Pradesh , Aligarh ; 21.IX.1996 ; light trap ; coll. (Kalpna Varshney) .

Remarks : The new species *P.(P.) achterbergi* runs close to *curvimaculata* Cameron , however , can be differentiated by having wings subhyaline , face without carina , scutellum and third metasomal tergite granulate .

7. *Phanerotoma (phanerotoma) agarwali sp.n.**
(Fig. 14 A-C)

Female : Head , ocelli , antennae and mesosoma yellowish-brown ; mesoscutum with three brown longitudinal bands ; eyes black with yellowish tint ; ocellar spot black ; legs and metasoma yellow to yellowish-brown ; wings hyaline with a brown infuscation below pterostigma ; parastigma , pterostigma , C+SC+R , 1-R1 , 1-M , r , 3-SR , proximal portions of 2-SR and SR1 , 1-CU1 and cu-a brown , rest of the veins pale .

Head 1.2 x wider than maximum width of mesoscutum ; frons transversely rugose , slightly depressed , with a distinct broad carina ; OOL= 4.0 x POL ; length of eye in dorsal view 1.7 x length of temple ; face 1.7 x as wide as high , transversely rugose , carina in the form of a broad raised band ; clypeus punctate , tridentate ; malar space 0.86 x basal width of mandible , the latter with inner tooth much shorter than outer. Antenna (fig. 14-B) 23-segmented , shorter than body , scape 2.1 x as long as broad , subapical segments (fig. 14-C) not moniliform , rather robust .

Mesoscutum reticulate-granulate ; scutellum and mesosternum granulate ; propodeum rugose , transverse carina formed by rugosities , lateral tubercles very small. Fore wing (fig. 14-A) with pterostigma 0.6 x as long as 1-R1 , maximum width of pterostigma 0.54 x vein 3-SR ; r 0.15 x as long as 3-S R ; 2-SR almost straight ; SR1 straight ; m-cu interstitial . Mid tibia with blister ; hind femur 4.0 x as long as broad , 1.2 x shorter than hind tibia .

Metasoma longiltudinally rugose , 1.14 x as long as mesosoma ; first and second tergites almost equal , third longer (20:21:33) with converging carinae on basal -half of first tergite ; apex of metasoma with two small lateral tubercles ; ovipositor sheath

* Named after late Prof. M.M.Agarwal , Department of Zoology , A.M.U. , Aligarh .

protruding much beyond the apex of metasoma, 0.6 x as long as hind basitarsus in lateral view.

Length of body 4.15 mm, of fore wing 3.0 mm.

Male : Similar to female but with subapical antennal segments slender than in female; apex of metasoma with lateral tubercles indistinct.

Holotype ♀ : 2 ♀♀, 2 ♂♂ paratypes; INDIA : Uttar Pradesh, Aligarh, 29.IX. 1971; ex. *Sylepta derogata* Fabricius on *Gossypium arboreum* L.; coll. (Shujauddin).

Remarks : The new species *P.(P.) agarwali* runs close to *ocularis* Kohl, however, can be differentiated by the subapical antennal segment of female not moniliform, malar space 0.86 x basal width of mandible and vein 1-SR+M of fore wing not pigmented.

8. *Phanerotoma (Phanerotoma) indica* sp.n. (Fig. 14 D-F)

Male : Head, ocelli and first tergite brownish-yellow; eyes black with yellowish tint; ocellar spot black; antennae yellowish-brown gradually becoming darker apically; mesoscutum brownish-yellow with two lateral and one medio-basal brown band, rest of the mesosoma, second and third tergites brown; legs yellow to brownish-yellow; wings subhyaline with brown infuscation below pterostigma; parastigma, pterostigma, C+SC+R, 1-R1, 1-M, r, 3-SR, proximal portion of 2-SR and SR1, 1-CU1 and cu-a brown, rest of the veins pale.

Head 0.9 x wider than maximum width of mesoscutum; frons reticulate-granulate, slightly depressed, with a distinct carina (not reaching upto anterior ocellus in 2♂♂); OOL = 3.3 x POL; length of eye in dorsal view 1.8 x length of temple; face 1.8 x as wide as high, rugose-granulate, carina ending in a tubercle medially; clypeus punctate, tridentate; malar space 0.43 x basal width of mandible, the latter with inner tooth much shorter than outer. Antenna (fig. 14 -D) 23-segmented, almost as long as body; scape 2.2 x as long as broad, subapical segments (fig. 14 -E) slender and elongated.

Mesoscutum reticulo-granulate ; scutellum and mesosternum granulate ; propodeum rugose , with mid transverse carina , lateral tubercles small . Fore wing (fig. 14-F) with pterostigma 0.7 x as long as 1-R1, maximum width of pterostigma 0.8 x vein 3-SR , r 0.25 x as long as 3-SR ; 2-SR and SR1 straight ; m-cu antefurcal . Mid tibia with blister ; hind femur 3.5 x as long as broad , 1.14 x shorter than hind tibia .

Metasoma with first and third tergites reticulate , second tergite longitudinally rugose ; first tergite longer than second but shorter than third (18: 16: 20) with carinae converging on basal two-third then becoming parallel upto first suture ; apex of metasoma with tubercles indistinct .

Length of body 3.63 mm , of fore wing 2.65 mm .

Female : Unknown .

Holotype ♂: 6 ♂♂ paratypes ; INDIA : Uttar Pradesh , Aligarh , 29.IX.1968 , light trap ; coll. (Shujauddin) .

Remarks : The new species *P.(P.) indica* runs close to *soror* Achterberg , however , can be differentiated by 2-SR and SR1 straight , m-cu antefurcal , maximum width of pterostigma 0.8 x vein 3-SR , hind tibia brownish-yellow , male with medial length of third tergite 1.2 x medial length of second tergite .

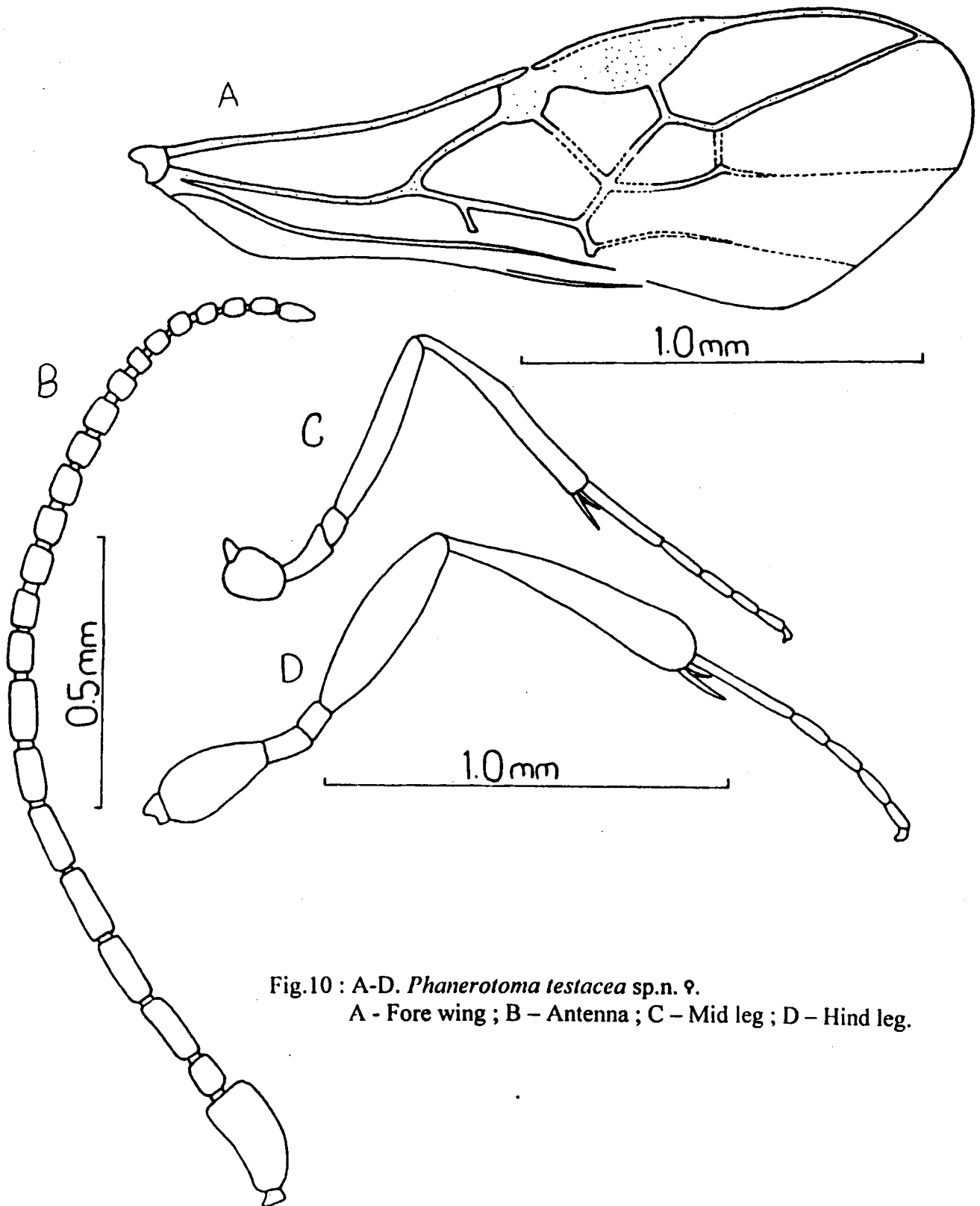


Fig.10 : A-D. *Phanerotoma testacea* sp.n. ♀.
A - Fore wing ; B - Antenna ; C - Mid leg ; D - Hind leg.

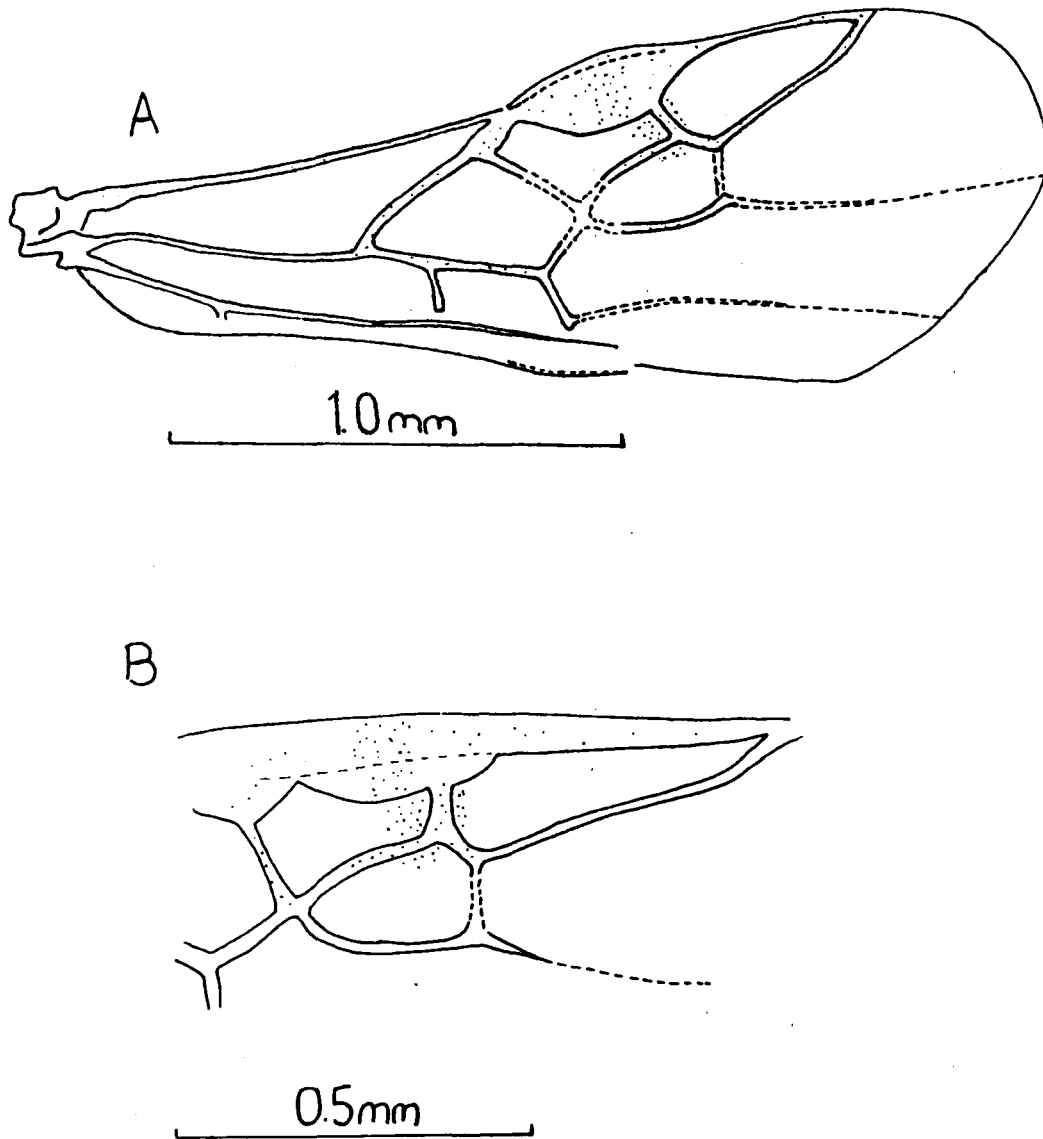


Fig.11 : A. *Phanerotoma ashae* sp.n. ♀.
Fore wing.
B. *Phanerotoma yagyae* sp.n. ♀.
Fore wing.

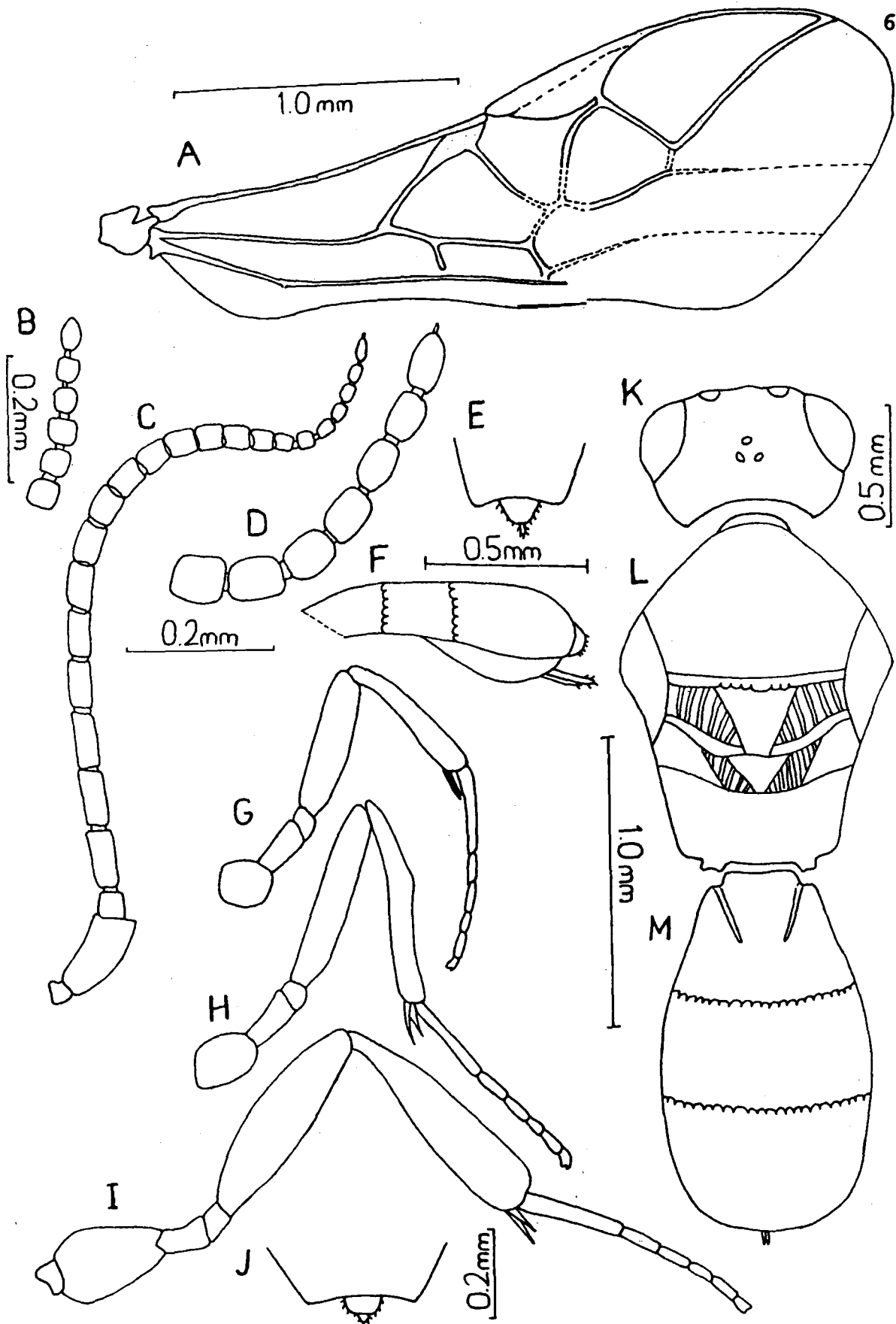


Fig.12 : A - M, *Phanerotoma dichocrophaga* sp.n. ♀♂.

A - Fore wing ♀ ; B - Apex of antēna ♀ ; C - Antenna ♂ ; D - Apex of antenna ♂ ; E - Apex of metasoma ♀ ; F - Metasoma (lateral view) ♀ ; G - Fore leg ♂ ; H - Mid leg ♂ ; I - Hind leg ♂ ; J - Apex of metasoma ♂ ; K - Head (dorsal view) ♂ ; L - Mesosoma (dorsal view) ♂ ; M - Metasoma (dorsal view) ♂ .

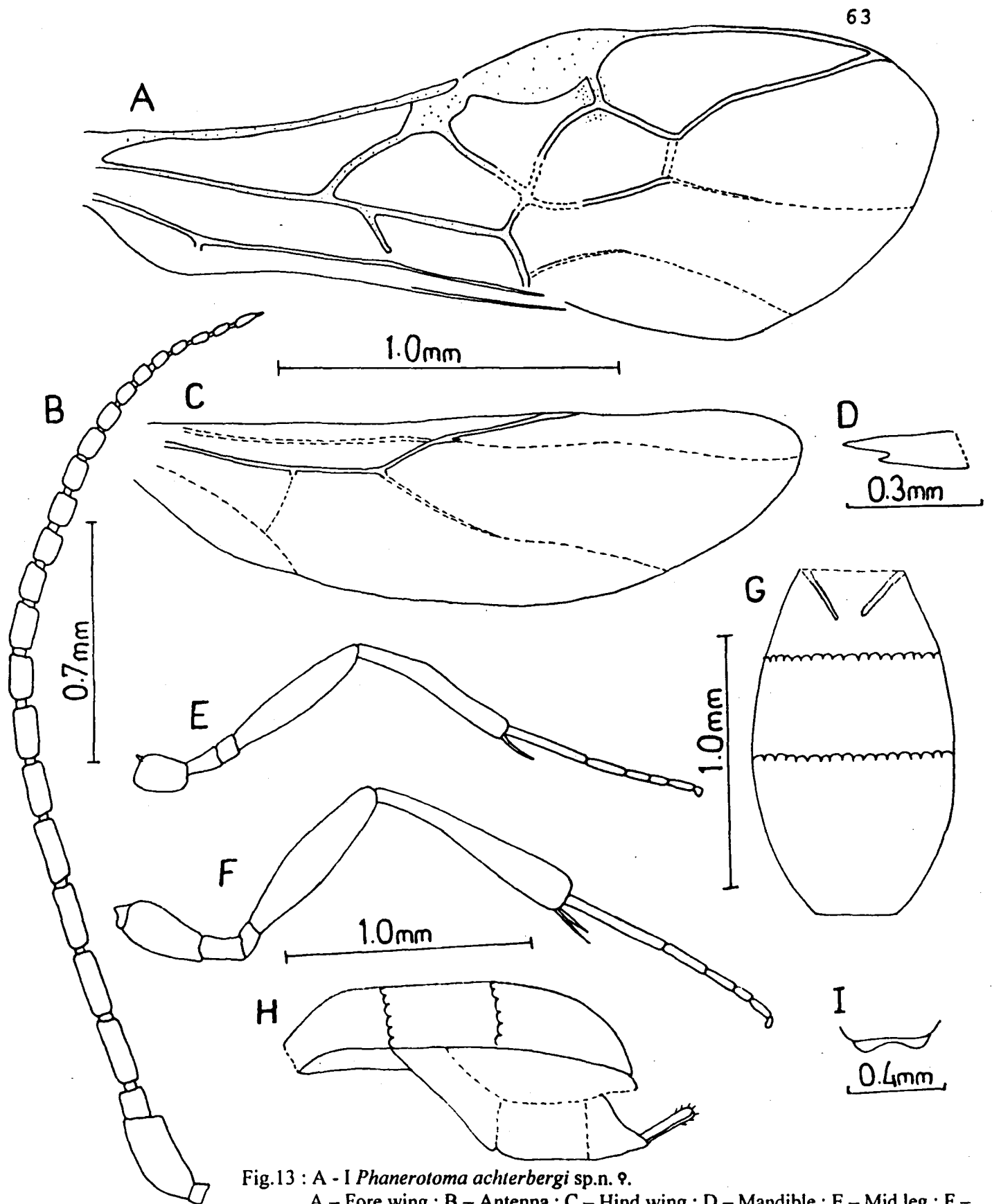


Fig.13 : A - I *Phanerotoma achterbergi* sp.n. 9.

A - Fore wing ; B - Antenna ; C - Hind wing ; D - Mandible ; E - Mid leg ; F - Hind leg ; G - Metasoma (dorsal view) ; H - Metasoma (lateral view) ; I - Apex of metasoma.

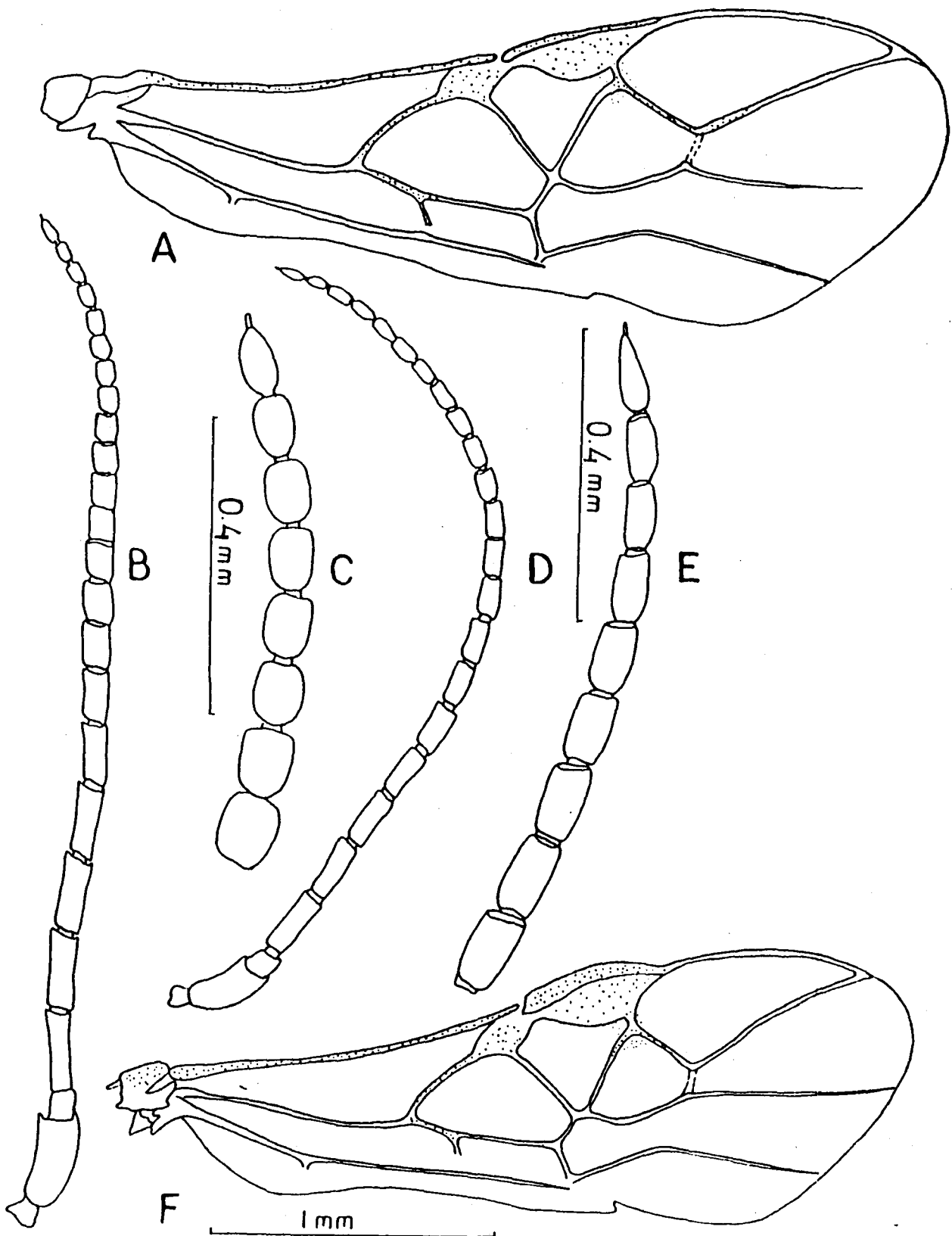


Fig.14 : A - C *Phanerotoma agarwali* sp.n. ♀.
 A - Fore wing ; B - Antenna ; C - Apex of antenna.
 D - F *Phanerotoma indica* sp.n. ♂.
 F - Fore wing ; D - Antenna ; E - Apex of antenna.

DISCUSSION

The subfamily Cheloninae is an assemblage of easily recognizable group of genera of Braconidae [Ichneumonoidea : Hymenoptera] represented by about 800 described species from the world. Traditionally, the Braconidae has been divided into two groups viz., cyclostomes and non-cyclostomes, based on the presence or absence of hypoclypeal depression, respectively. Wesmael (1835) proposed the division Cryptogastri for chelonine wasps. The Cryptogastres were differentiated from other braconids by having "clypeus entire, posterior part of vertex convex, metasoma dorsally presenting not more than two transverse sections, second submarginal cell (when present) large". Westwood (1840) placed the genera *Sigalphus* Nees, *Chelonus* Panzer, *Ascogaster* Wesmael, *Phanerotoma* Wesmael and *Rhitigaster* Wesmael in the division Cryptogastri, mainly on the basis of presence of 3 submarginal cells in the fore wing. Cresson (1887) followed Wesmael (1835) and placed the two subfamilies i.e. Cheloninae (including *Phanerotoma* Wesm., *Sphaeropyx* Illig., *Chelonus* Panz. and *Ascogaster* Wesm.) and Sigalphinae (including *Allodorus* Forst and *Sigalphus* Latr.) in the group Cryptogastres. He separated the Cheloninae from Sigalphinae for having "fore wing with three submarginal cells; venter concave, edges reflexed and body rugose". These characters can be applied to the genera within both the subfamilies, hence, it was not followed by subsequent workers. Dalla Torre (1898) in 'Catalogus Hymenopterorum' placed the genera *Fornicia* Brulle, *Acampsis* Wesm., *Sphaeropyx* Illig., *Tetrasphaeropyx* Ashmead, *Phanerotoma* Wesm., *Gastrotheca* Guerin, *Ascogaster* Wesm. and *Chelonus* Panz. in the subfamily Cheloninae and placed *Rhitigaster* Wesm. as a synonym of *Sigalphus* Latr.

Morley (1907) described Cryptogastres as a small and natural group in the family Braconidae, recognised from all other Parasitica by the presence of carapace. He promoted the two subfamilies i.e. Cheloninae and Sigalphinae to the rank of family and differentiated the Chelonidae from Sigalphidae by having clouded wings and elongate abdomen, disregarding the usual distinctions between the two. Viereck (1912) synonymized the genus *Sphaeropyx* Illig. with *Sigalphus* Latr. Brues (1924) pointed out the wrong placement of *Gastrotheca* Guerin (= *Physaraia* Guerin) in the

subfamily Cheloninae . Baker (1926) placed the tribes Chelonini Nees, Phanerotomini Baker and Sigalphini Handlirsch in the subfamily Cheloninae. He separated Chelonini from the other two tribes by having metasomal sutures obsolete, however , the tribe Phanerotomini was distinguished from Sigalphini for having : “metasoma shorter than head and mesosoma together, not strongly narrowed basally , but subelliptical in outline , the third tergite not broader than quadrate second ; second submarginal cell never elongate rectangular , usually subtriangular and head subcubical”. Subsequently, Fahringer (1928) placed the genera of Cheloninae under two tribes viz., (i) Triaspidini (Hal.) including *Allodorus* Forst , *Forsteria* Szepl. and *Tritomios* Strand (*Tritoma* Szepl.) (ii) Chelonini Handl. including *Chelonus* Panz., *Microchelonus* Szepl., *Ascogaster* Wesm., *Gastrotheca* Guer., *Sigalphus* Latr. (*Sphaeropyx* Illig.) , *Acampsis* Wesm., *Phanerotomella* Szepl. and *Phanerotoma* Wesm. He differentiated Chelonini from Triaspidini in having : “fore wing with 3 submarginal cells ; m-cu vein interstitial or inserted in the second submarginal cell ; cu-a sometimes interstitial ; marginal cell usually short , as a rule terminating before the wing apex ; ovipositor of the ♀ usually short , small or not at all exerted” . Watanabe (1937) followed Fahringer (1928) and differentiated Chelonini from Triaspidini (= Sigalphini) using first two characters only.

De Saeger (1948) placed the tribe Chelonini and Sigalphini in the subfamily Sigalphinae , and arranged the genera of Chelonini into three subtribes viz., (i) Chelonina (including *Cubochelonus* Baker , *Chelonus* Panz. , *Ascogaster* Wesm. and *Megascogaster* Baker) (ii) Minangina (including *Minanga* Cameron , *Pachychelonus* Brues and *Odontosphaeropyx* Cameron) and (iii) Phanerotomina (including *Phanerotoma* Wesm. and *Phanerotomella* Szepl.) . He discussed the articulation of first metasomal suture by juxtaposition in *Sigalphus* , *Sphaeropyx* and *Acampsis* , which clearly separates these genera from the chelonines. He further transferred the genera *Gastrotheca* Guerin (= *Physaraia* Guerin) and *Trigastrotheca* Cameron to the subfamily Braconinae , as they possess hypoclypeal depression . Subsequently , Granger (1949) placed the subfamilies Cheloninae and Triaspidinae in the section Cryptogastres differentiating the two on the basis of : fore wings with three or two submarginal cells respectively. He arranged the genera of Cheloninae into three tribes viz., (i) Chelonini (including *Chelonus* , *Ascogaster* and *Minanga*) (ii) Sigalphini (including *Sigalphus*) and (iii) Phanerotomini

(including *Phanerotoma* and *Phanerotomella*). Muesebeck & Walkley (1951) placed the genus *Sigalphus* Latr. in the subfamily Cheloninae along with other chelonine genera and the genus *Triaspis* Haliday in the subfamily Blacinae. He placed the genus *Tetrasphaeropyx* Ashmead in the subfamily Rogadinae and synonymized the genus *Allodorus* Forst. with *Eubadizon* Nees von Esenbeck belonging to the subfamily Calyptine. Hellen (1958) transferred the tribes Chelonini and Triaspidini in the subfamily Helconinae.

Tobias (1967) placed the genera *Acampsis* and *Sigalphus* in the subfamily Sigalphinae. The genera *Forsteria* Szepl. (= *Foersteria* Szepl.) and *Polydegmon* Forst. have been placed in the subfamily Triaspininae (Shenefelt, 1970). Capek (1970) again placed the genera *Acampsis* and *Sigalphus* with other chelonine genera in the subfamily Cheloninae, on the basis of larval morphology. Achterberg, 1976 pointed out that the larvae of *Acampsis* and *Sigalphus* have "slender mandibles with a very wide base, while that of Cheloninae have mandibles without or only with a small base" which was overlooked by Capek as well as the differences in the adult morphology i.e. Cheloninae having complete postpectal carina and cu-a not broken. Later, Tobias (1971) placed the genera *Ascogaster*, *Chelonus* and *Phanerotoma* in the subfamily Cheloninae and the genera *Sigalphus* and *Acampsis* in the subfamily Sigalphinae. He differentiated Cheloninae from Sigalphinae on the basis of: "metasomal tergites 1 and 2 immovably articulated, sutures not developed; fore wing has longitudinal veins which, significantly do not reach the tip; in hind wing the vein SR diverges from the lateral; apical portion of the vein 1A barely visible and unpigmented; plical cell clearly separate; parasites in eggs and larvae of Lepidoptera". Shenefelt (1973) in his 'Hymenopterorum Catalogus' placed the tribes Chelonini and Sigalphini in the subfamily Cheloninae. He followed the system of De Saeger (1948) and arranged the chelonine genera in three subtribes viz., (i) Chelonina, including *Ascogaster* Wesm., *Bitomus* Szepl., *Chelonus* Panz., *Cubochelonus* Baker, *Diodontogaster* Brues (fossil), *Eobracon* Cockerell (fossil), *Megascogaster* Baker, *Microchelonus* Szepl. (ii) Minangina, including *Minanga* Cameron, *Odontosphaeropyx* Cameron, *Pachychelonus* Brues and (iii) Phanerotomina, including *Bracotritoma* Csiki, *Phanerotoma* Wesm. and *Phaner^otomella* Szepl. However, the genera *Acampsis* Wesm., *Neoacampsis* Szepl. and *Sigalphus* Latr. were placed in

the tribe Sigalphini . Achterberg (1976) , on the basis of following characters i.e. “stout stipital sclerite , very wide base of mandible of the larvae with its apical half slender and toothed , adults with cu-a broken , rather short marginal cell , first discal cell petiolate and ovipositor sheath wide” , placed the genera *Acampsis* and *Sigalphus* in the subfamily Meteorideinae . Papp (1978) transferred the genus *Bitomus* Szep. to the subfamily Opiinae , as it possesses hypoclypeal depression .

Recent studies on the internal morphology and phylogeny of the family Braconidae shows that the subfamily Cheloninae and Sigalphinae belongs to two different groups of non-cyclostomous braconids. The Cheloninae has been placed in the microgastroid assemblage , characterized by increased number of ovarioles (4-30 pairs) and the shortened terminal regions of the ovarioles , while the subfamily Sigalphinae belongs to the helconoid assemblage , characterized by plesiomorphic arrangement of two pairs of ovarioles with shortened vestibule relative to the terminal portions of the ovarioles and, in addition , swollen distal end of ovarioles to some extent (Wharton , 1993 ; Whitfield & Mason , 1994) . Achterberg (1993) differentiated the subfamily Sigalphinae from the other subfamilies on the basis of following characters : “Fourth and following tergites largely or completely retracted below third tergite ; vein 2-CU of hind wing situated near lower level of vein 2A , far below middle of vein cu-a ; dorsal carinae of first metasomal tergite usually strongly developed ; marginal cell of fore wing short”. The genera *Acampsis* Wesm. , *Minanga* Cameron and *Sigalphus* Latr. have been placed in the subfamily Sigalphinae , in the tribes Acampsiini , Minangini and Sigalphini , respectively . However , the subfamily Cheloninae is represented by two tribes viz. , Chelonini and Phanerotomini . Recently , Achterberg (1990) added three characters for the separation of these two tribes viz., “lateral carina of mesoscutum lamelliform or weak , occipital carina separated or just meeting hypostomal carina and prepectal carina attaining level of ventral third or middle of pronotal sides or exceptionally reduced”.

In the present work , however , set of stable characters have been used at different levels of hierarchy in order to present the undue intergradation of characters for the sake of maintaining clarity of classification and easy understanding. The following characters viz. , convexity and presence or absence of transverse sutures at metasoma,

color of mesosoma , presence or absence of vein 1-SR of fore wing and eyes glabrous or setose are considered suitable for the separation of tribes Chelonini and Phanerotomini .

The characters which are found suitable for the separation of genera are : presence or absence of veins 1-SR+M , 2-R1 , CU1b , 3-SR and shape of second submarginal cell of fore wing , ratio of length of vein M+CU and 1-M in hind wing, number of antennal segments , presence or absence of foramen at the apex of metasoma of males and ratio of length to height of metasoma . Achterberg (1990) , in the key to Western Palaearctic genera of the subfamily Cheloninae added a character for the separation of the genus *Ascogaster* and *Chelonus* i.e. vein r usually arising far distad (in *Ascogaster*) or near middle (in *Chelonus*) of pterostigma . However , among the four known Indian species of *Ascogaster* the two i.e. *acrocercophagus* Shujauddin & Varshney and *indica* sp.n. shows vein r arising almost near middle of pterostigma .The character could not be ascertained in the other two species i.e. *armatoides* Tang & Marsh and *formosensis* Sonan due to unavailability of material . The genera *Chelonus* Panz. and *Microchelonus* Szepl. of the tribe Chelonini can be separated from all the other genera of the tribe mainly on the basis of absence of vein 1-SR+M of fore wing . However , *Siniphanerotomella* He *et al.* is the only genus of the tribe Phanerotomini which has vein 1-SR+M of fore wing absent .

The genus *Microchelonus* has undergone various taxonomic changes since the time of its creation . The genus was first proposed by Szepliget (1908a), in order to separate the species where males bear a foramen at the apex of metasoma and females having 16-segmented antennae . Apart from these characters the features of these insects were identical to that of *Chelonus*. Viereck (1913) established the genus *Arichelonus* for the species of *Chelonus* where the apex of metasoma not incurved and presenting an emargination . Baker (1926) created the genera *Cubochelonus* and *Megachelonus* , of which the latter having the characters similar to that of *Arichelonus* Viereck . The two genera i.e. *Arichelonus* Viereck and *Megachelonus* Baker were synonymized with *Chelonus* Panzer by De Saeger (1948) . Fahringer (1928) followed Szepliget (1908a) and treated *Microchelonus* as a genus. Muesebeck & Walkley (1951) considered the genus *Microchelonus* as a subgenus of *Chelonus* . McComb (1968) gave a revision of the subgenus *Microchelonus* for North American species . Tobias (1971) placed the

subgenera *Chelonus* s.str. , *Neochelonella* Hinks and *Stylochelonus* Hellen along with subgenus *Microchelonus* Szepl. under the genus *Chelonus* . Shenefelt (1973) considered *Microchelonus* as a genus in 'Hymenopterorum Catalogus'. Tobias (1995a) revised the species of the genus *Microchelonus* with more than 16-segments in female antennae and males with apical foramen . He further revalidated the subgenus *Stylochelonus* Hellen and placed it in the genus *Microchelonus* along with a new subgenus i.e. *Parachelonus*. The recognition of the subgenera of the genus *Chelonus* have also been discussed by Achterberg & Polaszek (1996) . Recently , He *et al.* (1997) considered *Microchelonus* as a subgenus of *Chelonus* and added a new subgenus *Scabrichelonus* , which can be easily distinguished by the temples strongly swollen with 3 distinct ridge like carinae .

The distinction between *Chelonus* and *Microchelonus* on the basis of traditional characters is very confusing since a number of species have intermediate characters such as more or less increasing number of female antennal segments e.g. *M. carinatus* Provancher , *M. convexus* McComb , *M. cylindricus* McComb , *M. graciliariae* McComb , *M. gravenhorstii* Nees , *M. incosmae* McComb , *M. mucronatus* Thomson , *M. nitens* Reinhard , *M. pedator* Dahlbom , *M. pusillus* Szepligeti , *M. quadriceps* McComb , *M. starki* Telenga , *M. suturalis* McComb , the males of these species always bear a foramen at the apex of metasoma . On the other hand there are species in which males are without apical foramen e.g. *C. chailini* (Walker & Huddleston), *M. cushmani* McComb , *M. insolitus* McComb , *M. punctipennis* McComb , females of these species have 16-segmented antennae . Papp (1995) proposed two new characters for the separation of *Chelonus* and *Microchelonus* viz., the ratio of length and height of metasoma and ratio of length and breadth of hind femur . The first character holds true for the separation of majority of taxa with the exception of *M. lygropiae* sp. n. However , the latter is highly variable as , the females of *M. cycloporus* (Franz) and *M. raoi* Kurhade & Nikam has hind femur 3.3 x as long as broad medially and *C. deogiri* Kurhade & Nikam has hind femur 3.0 x as long as broad medially .

The remarkable spine at the apex of metasoma in a few species of *Microchelonus* viz., *chailini* (Walker & Huddleston) , *cordiae* sp.n. and *spinigaster* sp.n. , complicates the situation as two species of *Ascogaster* i.e. *fullawayi* (Baker) and *acrocercophagus* Shujauddin & Varshney also possess apical spine (or tubercle) . As all these species

which bear spine have been reared from leaf miners , it is possible that these insects might form a different natural group within the subfamily . However, it can be considered only after further study of a long series of such spine-bearing species .

The genus *Phanerotoma* Wesm. comprises two subgenera viz., *Bracotritoma* Csiki and *Phanerotoma* s. str. Snoflak (1951) identified the subgenus *Unica* with the type-species *Phanerotoma (Unica) moravica* . He separated the subgenus *Unica* from the subgenus *Phanerotoma* s. str. on the basis of “fore wings whitish with two brown bands , parastigma small and clypeus reticulate , bidentate”. Tobias (1971) divided the genus *Phanerotoma* into three subgenera viz. , *Unica* Snoflak , *Phanerotomina* Shest. and *Phanerotoma* s. str. He separated *Unica* from the other two subgenera mainly on the basis of vein 3-SR of fore wing very short , equal to r or shorter than it . Further , the subgenera *Phanerotomina* and *Phanerotoma* were separated on the basis of ratio of length of temple and transverse diameter of eyes . Achterberg (1990) merged the subgenera *Unica* and *Phanerotomina* with the subgenus *Bracotritoma* .

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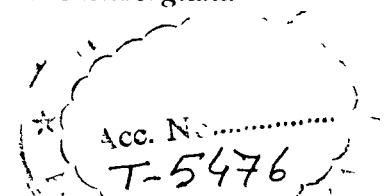
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