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EXTERNAL MORPHOLOGY OF *CYBISTER TRIPUNCTATUS ASIATICUS* SHARP (COLEOPTERA : DYTISCIDAE)

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(With 4 Text-figures)

INTRODUCTION

The family Dytiscidae consists of about 3000, species and is distributed all over the world. We have in India about 200 species which have been recently revised/reviewed in a series of papers by Vazirani (1965-1971.)

The genus *Cybister* Curtis is generally considered to be the most highly evolved member of the family Dytiscidae. Sharp (1882) pointed out that the genus *Cybister* replaces the well known palaearctic genus *Dytiscus* Linnaeus, in the Oriental Region.

Considerable work has been done on the morphology, and life history of the well known palaearctic species, *Dytiscus marginalis* Linn. Several authors have contributed to the publication of a two volume monograph Korschelt (1923-24) which deals with life-history, morphology, anatomy, systematics etc. of the adult and larvae of this species. In this famous work the portion dealing with chitinous structure of the adult has been contributed by Buhlmann (Vol. 1 : 16-79) Balfour-Browne. (1932) has also dealt with the same subject incorporating findings of earlier workers.

There is however lack of corresponding work on our commonest species viz. *Cybister tripunctatus asiaticus* Sharp. The author undertook this problem as a part of his M. Sc. dissertation which was submitted in 1956, for the award of degree, by the University of Bombay. The account of the morphology of the larva was published by the author (1964). Since, then some work has been done such as, on the suckers of the anterior tarsi of male by Datta Gupta and Sindhu (1958); the morphology of the organs of oviposition and copulation in this species was dealt with by Sindhu (1960); while Khattar

(1962) has dealt with the morphology of the head capsule in a related species viz. *Cybister confusus* Sharp.

It will be apparent from the above survey of literature, that there is no detailed account of the morphology of the whole insect as such though attempt has been made by others to make a study of some parts, including the musculature etc. The scope of the present study is to serve the purpose of better understanding of the characters used for systematic studies of the group. A small amount of overlapping or repetition is thus unavoidable, to achieve this object, of the present studies.

The individuals of *Cybister tripunctatus asiaticus* Sharp are large, being 22·0-29·0 mm. and 12·0-15·0 mm. broad. This subspecies is distributed throughout the Oriental Region and is commonly found in ponds and slow running water, that is rich in vegetable and animal matter. It is carnivorous, in both the adult and larval stages, and is predatory on the fish fry in fish nursery ponds where its presence is considered highly undesirable. Eighteen species occur in India. Vazirani (1969) has given a key to the species of this genus known from India. Since then, 2 species previously placed in the synonymy have been re-validated. A revised key to these eighteen species is given at the end.

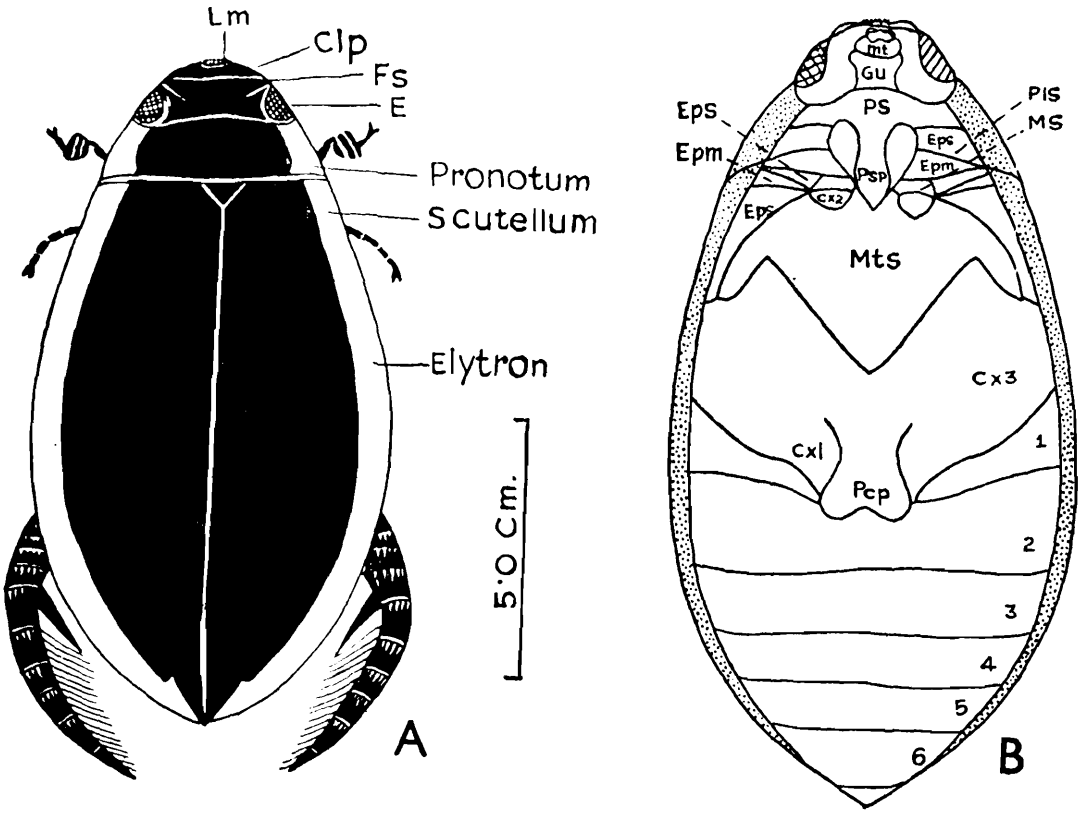
Snodgross (1935) has been followed for the terminology of various parts except for genitalia, as indicated in the text.

Head

(Text-figs. 1A, B, 2A--E.)

Capsule (Text-fig. 1, A, B)—The head is transverse, slightly convex above, subrounded and slightly sloping in front. The anteriormost sclerite, is the labrum (*Lm*), a small transverse plate articulating with the clypeus (*Clp*) by a narrow membrane (anteclypeus or preclypeus of some authors). The anterior edge of this sclerite is slightly concave in the middle, while the lateral edges are convex. Dorsally the labrum is moderately punctured and the concavity of the anterior edge ciliated. The Clypeus (*Clp*) is a well demarcated, small transverse plate, placed behind the labrum. In between the lateral end of the Clypeus and the anterior margin of the eye, there is present a suture on either side which converge backwards but do not meet. These sutures are called the frontal suture (*Fs*) which hypothetically demarcate 'Frons' Thus the respective areas of frons and epicranium are not clearly demarcated. The compound eyes (*E*) are large, subtriangular, broader posteriorly and slightly convex laterally and occupy a greater part of the lateral walls of the capsule. On the back of the head when

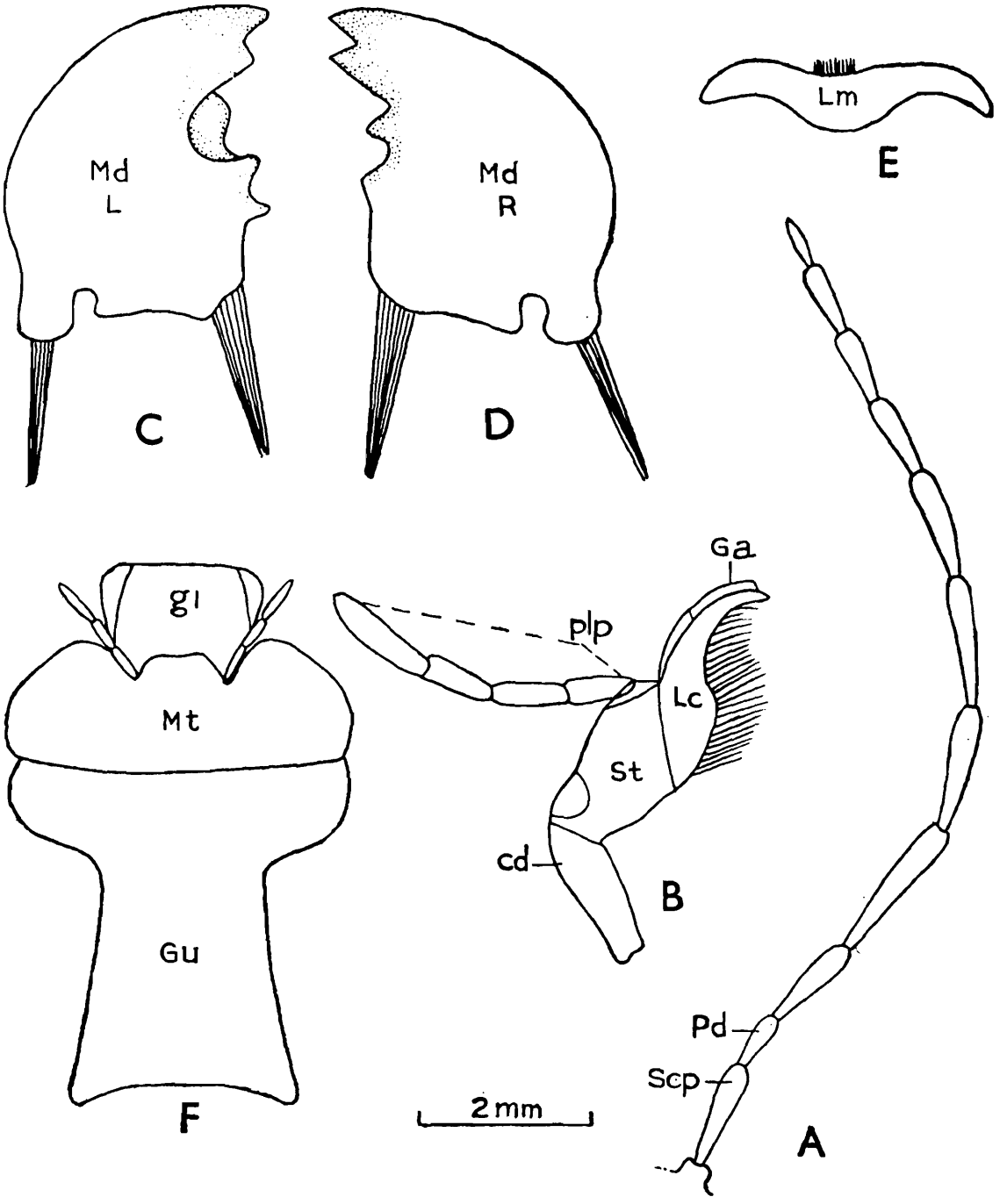
separated from the body, the most prominent feature is the large rectangular occipital foramen. On the ventral side it is bounded by the median large gular sclerite and laterally by the genae.



Text-fig. 1.—*Cybister tripunctatus asiaticus* :
a. dorsal view, b. ventral view (legs removed).

Antennae (Text-fig. 2A)—Each antenna (*Ant*) is a filamentous, 11 segmented organ situated infront of each eye; in state of rest it lies backwards beneath the sides of the head. Each arises from an oval antennarium situated in front of the compound eye and the corner of the labrum. A membrane connects the basal segment with the head capsule. Scape (*Scp*) is the longest basal segment and the pedicel (*Ped*) is about half of its length; the remaining nine segments of the flagellum are longer than the pedicel. All the segments of the antenna are cylindrical.

Mandibles (Text-fig. 2C, D)—The mandibles (*Md*) are heavily sclerotised, triangular and strongly toothed on the inner side. They lie closely above the lacinia and galea. They close upon eachother within the preoral food cavity of the head. The mandibles are attached to the head by an articular membrane all round its base, but it is specially hinged to the cranial margin by dorsal and ventral points of articulation. These articulations are of ball and socket type of structures, the condyle of the dorsal articulation being on the cranium and that of the ventral articulation on the mandible.



Text-fig. 2.—*Cybister tripunctatus asiaticus* :
a. antenna, b. maxilla, c. left mandible, d. right mandible, e. labium, f. labium and gular sclerite.

Maxillae (Text-fig. 2B)—They lie in a deep groove on each side of the labium and large mandibles. Each maxilla articulates with the cranial margin on the back of head by means of a single process on the base of cardo (*Cd*). The cardo is an elongate sclerite, slightly broader at the distal end. The joint between the cardo and stipes (*St*) is elbow shaped. The stipes is subquadrate in shape and bears on its anterior lateral end, a 4 segmented palpi (*Plp*). The stipes bear two endites, lacinia (*Lc*) and galea (*Ga*), on the inner side of the palpus. The lacinia is a rigid moderately flattened lobe, tapering distally. It lies above the ligula, forming a roof to it. The inner margin bears a fringe of long hairs. The galea (*Ga*) is a relatively soft, thick bilobed

structure with a hood like apical pad. Both lacinia and galea are individually movable.

Labium (Text-fig. 2E)—Lying above the gular sclerite, it is a simple structure. The basal part, the Mentum (*Mt*) is implanted on the gular sclerite, is a transverse plate, about 4 times as wide as long, bisinuated long the anterior margin. The distal part, the Prementum consists of a pair of 3 segmented palpi (*Plp*) and the ligula. The ligula is about twice as wide as long, and a little convex infront; it is composed of the median subrounded lobe glossae (*Gl*) and the lateral subtriangular lobes, paraglossae (*Pgl*).

THORAX

(Text--figs. 1A, B, 3A, B.)

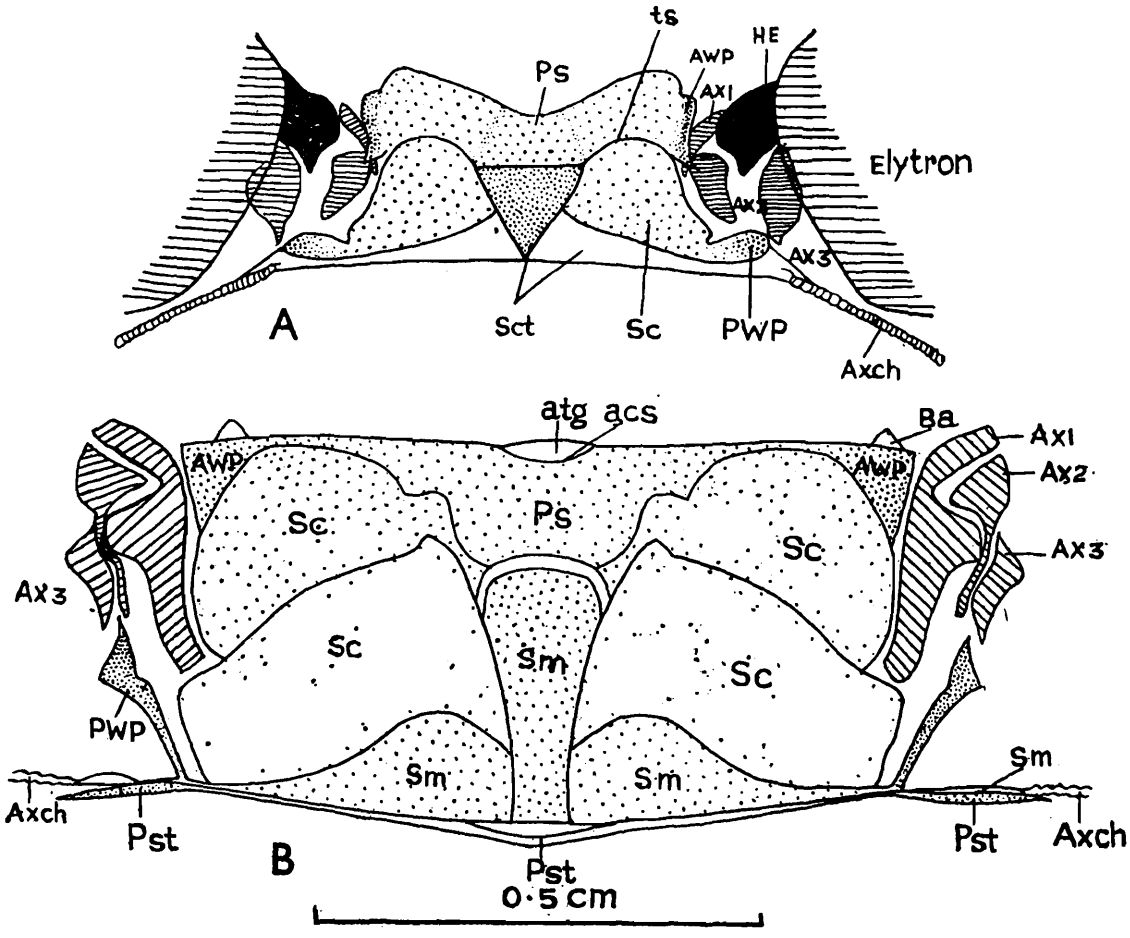
Prothorax (Text-fig. 1A, B)—Pronotum is a large transverse plate, a little more than twice as wide as long and also anteriorly a little narrower. Antero-lateral angles of the pronotum are slightly produced, accomodating the large compound eyes in the lateral concavities of the anterior margin. Posterior angles are also produced backwards over the shoulder of the elytral. On the ventral side, Prosternum (*Ps*) is a transverse plate, produced backwards into a median spathulate shaped, flat, process, 'The Prosternal process' (*Psp*). Lateral to the coxal articulation, the Plural sulcus (*Pls*), is an oblique line dividing the episternum (*Eps*) and the epimeron (*Epm*). The episternum is, roughly a rectangular sclerite, while epimeron is almost triangular.

Mesothorax (Text-figs. 1A, B, 3A,)—On the dorsal side, the visible part of the mesothorax, is a small triangular sclerite, mesoscutellum (*Sct*) commonly called the scutellum. The rest of the mesonotum lies hidden under the elytra and can be seen only after their removal. It is smaller than the pronotum or the metanotum. Besides the scutellum, the mesoscutellum is composed of two lateral sclerites, which are less chitinised. Each of the lateral sclerites carries on its outer extremities the Axillary Chord (*Ax ch*). Anterior to the mesoscutellum, separated by prescutal suture (*ts*), lies a less chitinised transverse sclerite, called the Prescutum (*Ps*), which is thickened laterally to form the anterior wing process (*AWP*). On each side of the mesoscutellum is the scutum (*Sc*), with its posterior lateral angle forming the posterior wing process (*PWP*).

Below each elytron, at its base and the median suture, there is a small wing like structure, called the 'alula' (*HE*). It is merely the basal lobe of the elytron.

The elytron and the alula are attached to the mesothorax, through the anterior and posterior wing processes and 3 small irregular sclerites

(Ax_1, Ax_2, Ax_3), lying embeded in the membrane connecting the two. This membrane, called the axillary membrane, permits free articulation.



Text-fig. 3.—*Cybister tripunctatus asiaticus*:
a. mesothorax, b. metathorax.

Of the three sclerites, two lie partly below the scutum and the third is closely attached to the elytron.

Mesosternum (*Ms*) is a small irregularly shaped sclerite, lying in between the anterior coxa and posterior coxa on either side of the prosternal process. The episternum (*Eps*) is situated laterally to the mesosternum, progressively narrowing and the epimeron (*Epm*) is a triangular sclerite meeting the mesocoxa of the respective side, on the inner side in a point.

Metathorax (Text-figs. 1B, 3B)—At the anterior margin, in the middle of the metanotum, there is a small tergite, the acrotergite (*atg*) and the groove separating it from prescutum, is the antecostal sulcus (*acs*).

Anteriorly, the tergum of the metathorax is transversely divided by a prescutal suture (*ts*). This area, the prescutum (*Ps*), is a transverse sclerite, narrowed laterally where it is more strongly sclerotisd into a triangular, Anterior wing process (*AWP*).

Situated posterior to the prescutum and occupying the median position on the mesonotum is an elongate sclerite, Scutellum (*Sm*), with laterally projecting arms at the base. These arms extend upto the lateral margin of the metanotum, where it is forked into two branches. The anterior branch extends obliquely upwards and is gradually broadened to form the posterior wing process (*PWP*). The other branch gives origin to the axillary chord (*Ax ch*).

The scutum (*Sc*), is divided by the scutellum in the middle and is the largest area on its either side. Each lateral area of scutum is further demarcated by the transverse intrascutal suture.

Postscutellum (*Pst*) is the narrow transverse sclerite, lying behind the scutellum and stretching on either side. This transverse sclerite is lancet-shaped, laterally. They are connected with the epimera of the pleura of the respective segment, which appear in dorsal view.

The wings are attached to the metathorax through the axillary membrane, having three Axillary sclerites embedded in it. Axillary sclerite (Ax_1) is the largest in area, elongate, with two lateral prolongations and lying closely connected with the anterior-wing process and scutum; Ax_2 lies outside it and fits closely to its lateral side; *Ax* is an irregular sclerite connected with Ax_1, Ax_2 and the posterior wing process. Situated almost on the top of anterior wing process but a little to the inner side, is a small lip like projecting sclerite, the basalare (*Ba*). Almost directly below the basalare and situated in the membrane is a spiracle, a slit like opening in a small island of chitin.

On the ventral side, metasternum is a large plate (*Mts*), pointed behind in the middle, and extending out laterally into wing shaped structure with parallel sides and then tapering to a point. Anteriorly the metasternum is grooved in the middle to receive the pointed tip of the prosternal process. The metathoracic episternum (*Eps*) is a triangular sclerite, its internal arm reaching the midcoxal cavities. The epimeron (*Epm*) in this case lies above the episternum and is hidden by the epipleurae and is not visible from the ventral surface.

Thoracic appendages

Elytra—Each elytron is a strongly chitinised plate hinged on to the side of the mesothorax. It is superficially with small tubercles in both the sexes and sometimes these tubercles are obsolete. The basic sculpture of the elytra consists of reticulation of more or less regular polygonal cells. When in repose, the elytra meet perfectly along the mid dorsal line, elytral suture. They cover the whole of the abdomen besides the mesothorax and metathorax.

Wings (Text-fig. 4E)—Close to the articulation of the elytron, and hinged with the metathorax on either side, is the membraneous wing

which is used for flight. In repose the wing remains folded under the elytron and can not be seen unless the latter is moved outwards. In the unfolded state the outline of the wing is an elongate subtriangle and three margins are discriminated in it namely the anterior or costal margin, outer or external margin and hind or posterior margin.

The wings are firmly attached to the base by means of a complicated articular mechanism, which consists of the anterior most sclerite humeral plate (*HP*), 3 axillary sclerites (Ax 1, 2, 3), and less chitinised median plate. The relationship of these articular sclerites with the wing veins is explained below.

The *humeral plate* is a small sclerite giving attachment to the costal vein (*C*).

First Axillary (Ax_1) provides attachment to the subcostal vein at its distal end.

Second Axillary (Ax_2) is posterior to the Ax_1 and irregularly shaped, the anterior distal margin of which provides attachment to the Radius (*R*) and Media (*M*) veins.

Third Axillary (Ax_3) is also irregularly speded and provides attachment to the vennal and jugal veins.

Median plate—Proximally the main stem of the Cubitus (*Cu*) is associated with the distal median plate (*m*) of the wing base.

Venation

Venation in Remigial Region—The principal veins of this region are Costa (*C*) Subcosta (*Sc*), Radius (*R*) and Media (*M*).

Costa is a short vein, the base of the wing's anterior margin, and is moderately chitinised. Subcosta is also a short vein, moderately chitinised and connected to the costa along the middle region. Radius is a very strongly chitinised vein, forming the anterior margin of the wing, with it are fused the costa and subcosta. It divides into two veins R_1 and *Rs*. R_1 is a long and strongly chitinised vein and forms at its apical part a characteristic pterostgmatic area which consists of a peculiar cell, the Radial cell (*Rc*). Radial cell is connected with R_1 by means of short vein *r*. The proximal part of *Rc* has disappeared and is represented in the distal region. There branches, R_2, R_3 and R_{+5}, originate from the Radial cell which forms the Radial Sector (*Rs*) and extend upto the apex of the wing. R_2 and R_3 form a cell in between and are joined to form R_{2+3}, distally, along the costal margin.

Media (*M*) is a long and well chitinised vein, running obliquely on the median part of the wing. Near the base it bifurcates into M_{1+2} and M_{3+4}. M_{1+2} is discernible only near its distal and by

means of a very small vein, meeting the Median cell. It is connected with *Rs* by means of a short and curved cross-vein *m—m*. From the Median cell two veins extend to the wing margin. The anterior one may be called the fused M_{1+2} and posterior one M_{3+4}.

Venation in the Vannal Region—Two main veins are referrable to this region of the wing, namely, *Cubitus* (*Cu*) and Postcubitus (*Pcu*). The *Cu* is a moderately chitinised vein and primarily divided near the base into two branches viz. Cu_1 and Cu_2. At its proximal end, Cu_2 is fused with *Pcu*. Cu_1 is more chitinised than Cu_2 and is divided into two branches Cu_{1a} and Cu_{1b} are connected through the distal margin of the cubital cell, and Cu_1 and Cu_2 are connected with each other through the proximal margin of the cubital cell (*CC*).

Pcu is a very moderately chitinised, long and simple vein. Posterior fold runs along just behind the postcubitus and separates the Vannus from Jugum.

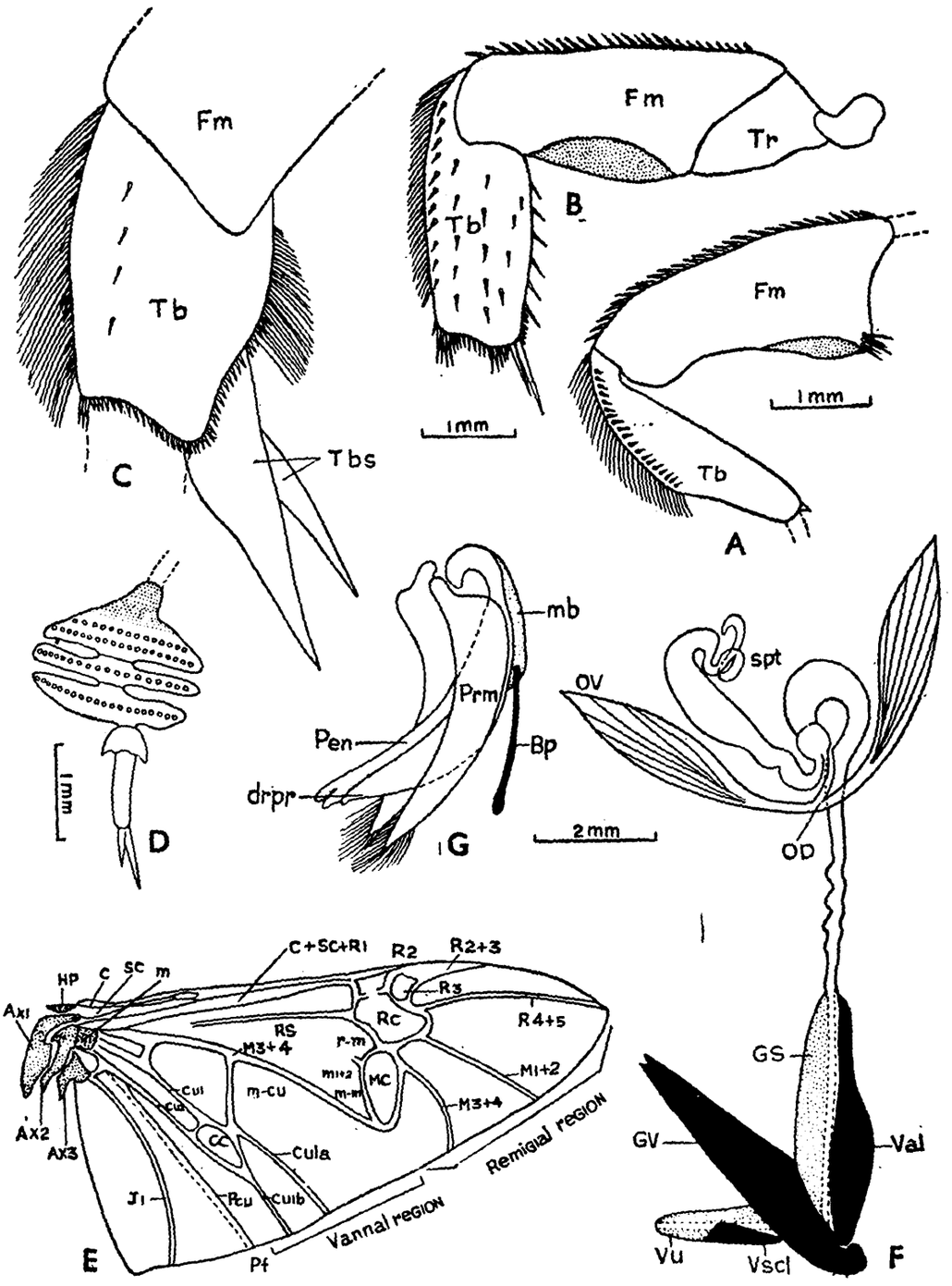
Venation in Jugal region—There is only one Jugal vein, independent, distinct and placed on the median part of Jugal region.

Legs

Anterior leg (Text-fig. 4A, D)—The coxa is globular and fitted into the coxal cavity, trochanter is a small sclerite attached to the posteriorlateral angle of the femur. The femur (*Fm*) is rather flattened with a small group of spines at its base along the inner proximal margin of the anterior face. Along the anterior margin of the anterior face, it is fringed with small hair. There is also another group of small spines along the distal margin of the anterior face.

Each tibia is fringed with sufficiently long hair along the proximal three fourths of the outer margin of anterior face, below and parallel to this row of hair, runs a line of small simple spines. Along the inner margin of the anterior face, is a row of minute hair. The tarsi are five segmented with two unequal tarsal claws. The basal three segments of the male anterior tarsi (Text-fig. 4D) are widened and bear on the ventral side, numerous suckers for holding tight the female. The shape of the expanded three segments together, is rather triangular, convex from above and concave from below. It is fringed with fine long hair on all sides. Each basal tarsal segment of the male is provided with two rows of pedicellate suckers on the underside in the distal half, while the proximal half is provided with fine pubescence. The two subsequent segments are also provided with one row each of pedicellate suckers. Datta Gupta and Sindhu (1958) have studied the suckers in anterior tarsi of male and called them 'papillae' They have also counted their number and given their measurments.

Middle legs (Text-fig. 4, B)—The coxae (*cx*2) are more or less globular fitting closely in the coxal cavities. Attached to the coxa of each side is the femur (*Fm*) which is strengthened at the base by a



Text-fig. 4.—*Cybister tripunctatus asiaticus* :
a. anterior leg (without tarsi), b. middle leg (without tarsi),
c. tibia and tarsi of hind leg, d. tarsi of anterior leg in male,
e. right wing, f. female genitalia, g. male genitalia.

Explanation of Letterings in Figures

acs—antecostal suture, *atg*—acrotergite, *Ant*—antenna, *Ax*—axillary sclerite of wing base 1, 2 and 3, *AWP*—anterior wing process, *Ax ch*—axillary chord, *Ba*—

supplementary piece, the trochanter (*Tr*), which forms an intermediate segment between coxa and femur. The femur has a small group of spines at its base along its inner proximal margin of the anterior face and is also provided with a row of spines along the length of the anterior margin of the anterior face. Each Tibia (*Tb*) is fringed with sufficiently long hair along the entire length of the anterior outer margin of the anterior face; below and parallel to this, runs a row of small and simple spines. The distal end of the tibia has strong and sufficiently long spines, along its entire length. Tibia are provided with two long and pointed spurs, the inner one longer than the outer. On the posterior face of each tibia, there is a row of bifid spines. The tarsi are five segmented with two subequal tarsal claws, almost equal in length to the apical tarsal segment. In the male, the basal segments of the mid-tarsi, are provided with a patch of 'sexual' pubescence. This pubescent patch extends to the 2nd segment also but is less broad.

Hind legs (Text-fig. 4C)—Coxae are very wide and flattened, covering a good deal of area between the metasternum and the abdominal sternites, with coxal processes (fig. 2 *Pcp*) dividing the 1st abdominal sternite. The femur (*Fm*) is strongly built and flattened in its distal part over the proximal part of the tibia. The tibia (*Tb*) are provided with hair on either sides (outer and inner); the anterior face is with a row of small scattered spines along its distal end. Tibia are provided with two long and strong subequal spurs; the longer spine is strongly widened at base. Hind tarsi are pentamerous with a dense fringe of hair on both (outer and inner) sides in the male, but only on the inner side in female. There is a single apical tarsal claw in both sexes.

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basalare, *C*—Costa, *CC*—cubital cell, *Cd*—Cardo, *Clp*—Clypeus, *Cu*—Cubitus, *Cx*—coxa, *dr pr*—dorsal processes, *E*—Compound eye, *Epm*—epimeron, *Eps*—episternum, *Fs*—frontal suture, *Fm*—femur, *gl*—glossae, *Ga*—galea, *GS*—genital sac, *GV*—genital valves, *HE*—basal piece of elytron, *HP*—humeral plate of wing base, *Lc*—lacinia, *Lm*—labrum, *m*—median plate of wing base, *M*—media, fourth vein of wing, *Md*—mandible, *Mts*—metasternum, *Mt*—mentum, *OD*—oviduct, *Pcp*—posterior coxal process, *Ped*—pedicel, *Pcu*—Postcubitus, *Pen*—penis, *Pgl*—paraglossa, *Plp*—palpi, *Pls*—Pleural sulcus, *Prm*—paramere, *Ps*—prescutum, *PSP*—prosternal process, *Pst*—postscutellum, *PWP*—posterior wing process, *R*—radius, third vein of the wing, *Rs*—radial sector, *Rc*—radial cell, *Sc*—subcosta, second vein of the wing/scutum, *Sct*—meso-scutellum, *Scp*—scape, *Sm*—Scutellum, *Spt*—sper matheca, *St*—stipes, *ts*—prescutal suture, *Tb*—tibia, *Ts*—trochanter, *V Scl*—vulva sclerite, *Val*—valvifer, *Vu*—Vulva.

Terminology used has been adopted from Lindroth and Palmen, 1956 in Taxonomists's Glossary of Genitalia of Insects', edited by S. L. Tuxen, pp. 69-76.

ABDOMEN

After the removal of elytra, 8 segments are visible on the dorsal side, progressively reducing in size posteriorly. The terga are bonded on the lateral side by the plural membrane and connected with each other by intersegmental membrane. The plural membrane is provided with a stigmata on either side, corresponding to each segment. The epipleurites of the sternum are also visible from the dorsal side and serve for receiving the elytra.

On the ventral side, six abdominal sterna are visible. The first visible sternite is divided in the middle by coxal processes of the metacoxae. The 1st visible sternite in fact represents the 2nd abdominal segment.

Male genitalia (Text-fig. 4 G)—The penis (*Pen*) or the median lobe is a very strongly curved structure. It tapers a little to the apex, when it is slightly flattened and convex at the tip. Two thin, moderately chitinised dorsal processes (*dr pr*) lie above the penis and terminate just before the apex. The apices of the dorsal processes are flattened and divergent. The parameres (*Prm*) are triangular in shape, less chitinised than the penis and fringed with sensorial bristles on the distal margin. The basal piece is degenerated and represented by a thin strut connected with the membrane between the bases of the parameres; resulting into direct articulation between the parameres and the penis through true condyles. Towards the base, the parameres are connected dorsally by a membrane.

Female genitalia (Text-fig. 4 F)—Ninth segment and the sternum of the eighth segment are modified to form the female genital armature.

The sternum of the eighth segment is split down the middle line and the two halves of it constitute the cloacal valves.

The ninth segment is modified to form the ovipositor, which consists of two moderately chitinised lateral lobes, called the Valvifers (*Val*). They are narrow at the proximal end, broadened post medially and rounded at the distal end, where they are hinged to the more strongly chitinised pair of equally long genital valves (*GV*). The valvifers give support to the genital sac (*GS*), which is connected with the genital valves, from the base about the half of its length. The genital valves are fused together on the dorsal side antemedially, tapering to the apex, where the apices are pointed and notched in the middle.

The vulva (*Vu*) or the vulval lobe, is a small elongate globular structure, consisting largely of expansible membrane, with a median opening at its apex. Towards the base it is supported by a small triangular sclerite, the vulval sclerite (*Vscl*) on each side.

The spermatheca (*Spt*) is a moderately long convoluted tube, joined to the vagina at the point where the median oviduct (*OD*) also opens into it. The vaginal tube opens at the anterior end of the genital sac (*GS*).

Key to Indian species of the genus **Cybister** Curtis

1. Middle tarsi in male with sexual pubescence on the underside (1) Dorsal side of penis with two chitinous laminate plates. Hind tarsi in female fringed with hairs on the superio-internal side only. .2
   Middle tarsi in male without any sexual pubescence on the underside. Dorsal side of penis with a single chitinous plate, pointed or flat. Hind tarsi in female fringed with hairs on both the sides.. *Cybister (s. str.) laterimarginalis*

2. Pronotum and elytra without distinct yellow border (2) at the most tinged with ferruginous on the sides of pronotum. Penis in male with dorsal chitinous plate narrowed and forming a stem. Hind tarsi in female with one or two claws.
   3 subg. *Melanectes* ...
   Pronotum and elytra with a distinct yellow border. Dorsal chitinous plates of penis in male, not narrowed but generally dilated. Hind tarsi in female with a single claw. .8. subg. *Megauecte*

3. Pronotum & elytra with yellow border (size 14.0 - 16.0 mm) *.cardonis*
   Pronotum & elytra without yellow border .4

4. Size small, 13·0 - 15·0 mm *dehaani*
   Size large, more than 16.0 mm .. 5

5. Pronotum with lateral reddish margin 6
   Pronotum without lateral reddish margin .. 7

6. Tibial spurs of the hind leg reaching the apex of second basal segment of the tarsi; stem of the penis in male more elongate & blunt at apex *convexus*

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1. *Cybister concessor* is an exception.
2. *Cybister cardoni* with yellow border is an exception.

Tibial spurs of the hind leg not reaching the apex of the second basal segment of the tarsi; stem of the penis in male less elongate and rounded at apex . . *posticus*

7. Length 18.0 - 24.0 mm, rather elongate; stem of penis in male distinctly less than half its own length, gonopore smaller (Sri Lanka) *prolixus*

Length 18.0—21.0 mm, rather oval; stem of penis in male nearly half its own length, gonopore elongate (India, China etc.) *sugillatus*

8. In male, mesotarsi without any sexual pubescence ..... *concessor*

In male, mesotarsi with sexual pubescence 9

9. A peculiarly deep and coarse series of punctures running parallel to the inner margin of the midcoxal cavities 10

No such series of punctures 11

10. Metasternum distinctly swollen in the anterior half, length 22.0 – 25.0 mm .... *rugulosus*

Metasternum not swollen in the anterior half, length 20.0 – 22·0 mm .... *dejeani*

11. Elytra with yellow stripe, extending to and including the epipleurae; female without any sexual sculpture on elytra (longitudinal or zig-zag striations) .... *Tripunctatus asiaticus*

Elytra with submarginal, yellow lateral stripe but not extending to the epipleurae except at base; female generally with sexual sculpture on elytra 12

12. Ventral side concolorous or nearly so .. . 13

Ventral side variegated with yellow and black .15

13. Yellow submarginal elytral stripe, broad, nearly 1½ times as wide as on the pronotum, uniformly wide. Male elytra with obsolete tubercles ..... .14

Yellow submarginal elytral stripe narrower, declining in width towards the apex. Male elytra with distinct tubercles. Size 31.0—36.0 mm. (femora of the anterior and middle legs piceous with black patches on the middle) .... *guerin*

14. Midclaws, in male, longer than the apical tarsal segment; dorsal laminate plates not reaching the apex of penis. Female with the sexual sculpture consisting of deep irregular short longitudinal striations covering nearly five-sixths of the elytral length and missing along the sutural line except at the base ... *limbatus*

	Midclaws, in male, equal to the apical tarsal segment; dorsal laminate plates reaching the apex of penis. Female with the longitudinal striations covering three-fifths of the elytral length and missing along the sutural line, leaving larger smooth space along the suture than in *limbatus*.	*confusus*
15.	Abdominal sternites 3-6 black along anterior border	16
	Abdominal sternites 3-6 concolorous	17
16.	Tip of penis, in male, more concave, not constricted behind the apex; striations on elytra occupying the three-fourths of its own length in female	*ventralis*
	Tip of penis, in male, less concave, more or less constricted behind the apex; striations on elytra occupying one-fourth of its length in female	*gracilis*
17.	Form oval; sexual pubescence, in male, covering not more than basal one and half segments of midtarsi; dorsal laminate plates of penis pointed; striations on the elytra in female extending from base to half its length	*..cognatus*
	Form narrower, sexual pubescence, incove ring basal two segments of midtarsi; male, dorsal laminate plates of penis rounded; striations on the elytra in female extending from base to five-sixths of its length.	*.javanus*

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