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INDIAN SPECIES OF THE GENUS *AULACOBOTHRUS* BOLIVAR (ORTHOPTERA : ACRIDIDAE)

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INRTODUCTION

The genus *Aulacobothrus* Bolivar, 1902, which is predominantly an oriental one, has been little studied in recent years. There was confusion regarding the exact number of valid species of the genus in India, and their taxonomy etc. Kirby (1914) in his fauna enlisted six species from India but without providing any key and with few illustrations for their easy identification. As was usual in those days, species were described superficially and mainly on the basis of colouration, and most of the species were described on a single specimen, often on one sex only and without providing any differntial characters. All these lacunae, associated with non-availability of compareble material made their study extremely difficult for Indian scientists.

Lately Bhowmik (1985) gave a list of all valid species from India till date, basing chiefly on literature. In the meantime, he (the present author) collected a good number of Gomphoceriae material and sent some interesting ones to Dr. N.D. Jago, Overseas Development Natural Resources Institute, London, for his opinion and confirmation. As a result of this study, three more interesting species described from outside India, Viz., *A. inclytus* Walker, *A. sinensis* Uvarov and *A. seven-hedini* Sjostedt, are added to our fauna; besides, the description of males of *A. sinensis* and *A. jaganathi* are described for the first time. The study has clarified the systematics of other little known species. In the context of present state of our knowledge, 11 valid species of the genus now represent the genus in India.

The distributional pattern of the species of this genus in India shows that S. India (chiefly T.N.) and Orissa house maximum 5 species each, 2 species being common in both the regions. The eastern and the western Himalayas have one species each, while western, Central and Nothern parts of the country remain virtually unrepresented barring perhaps the most common and wide spread species, *A. luteipes* only.

In this communication, an attempt has been made to give a preliminay working key of Indian species, based both on material studied here and literature. Such an work is not above suffering from certain imperfections but it is hoped, it will provide necessary impetus and stimulation for further fruitful works in this difficult group in future leading to much needed revision of the genus.

Measurements : All measurements are given in millimetres (mm) and of length, unless otherwise stated.

Abbreviations : States of India are abbreviated as follows :

Tamil Nadu — T. N.; Andhra Pradesh — A. P.; Himachal Pradesh — H. P.; West Bengal — W. B. etc.

SYSTEMATIC ACCOUNT

Order Orthoptera

Family Acrididae

Sub-family Gomphocerinae

Genus *Aulacobothrus Bolivar, 1902

Key to Indian species of AULACOBOTHRUS

1. Head and pronotum in part or entirely rugulose; lateral carinae nearly straight i.e., concavity of them hardly appreciable 2

   Head and pronotum not rugulose, almost smooth, or if punctured, then very thinly and finely so 3

2. Head and pronotum (as well as lateral lobes and other parts of the body generally) densely rugulose throughout; post. tibia reddish (a narrow castaneous lateral stripe may or may not run along vertex-occiput and along sides of pronotal dise) (dist. Burma. E. Nepal. Orissa)..... .....*sinensis* Uvarov, 1924

   Only metazona somewhat rugulose; post. tibia red, with a pale ring basad (lateral carinae of pronotum often intersected by a black band) (dist. T. N.) .....*strictus* Bolivar, 1902

3. Lateral carinae more or less parallel-sided, i.e., placed on dorsum of pronotal dise (Post. knees dark brown; post. femur with outer carina brownish or at least with some dark dots along upper margin; a pair of post. ocular brownish stripes may run along head and superior margin of lateral lobes) (dist. Common) .....*luteipes* Walker, 1871.

   Lateral carinae more or less incurved in middle of pronotal disc..... 4

4. Tegmen imperfectly developed, short (7.5 mm), in any case not extending beyond middle of post. femora (dist. T. N.) ....*infernus* Boliver, 1902

   Tegmen perfectly developed, as long as or longer than post. femora.... 5

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* Jago (1971) treated the genus ranking it as a subgenus of the genus *Dnopherula* Karsch, 1986. This should be treated as a provisional one, since there are a lot of overlapping cases in the subgeneric level, and no clear line of demarkation coul dbe established.

5. Middle of head and pronotum with a pale stripe..... 6

   Head and pronotum without a stripe (i.e., concolourous)..... 7

6. Paler stripe of head and pronotum, which extends up to anal field of tegmen, broad (about 1.5 mm in metazona of *female*); lateral carinae strongly convergent before 1st sulcus, then uniformly divergent; lateral pronotal lobes minutely rugulose, with oval impressions in middle of each superior border; tegmen with considerable width of area having an irregular false vein, infumate, with oblique narrow whitish stigma beyond middle; wing slightly sulphureous basad, gradually darkened towards apex (dist. Afghanistan. Bihar. Orissa. T. N.)..... ..... *bolivari* Uvarov, 1921

   Paler stripe over head and pronotum narrower (about 1 mm); lateral carinae not so convergent, but may be waving, approximating in middle and widely divergent behind, carinae narrowly pale; pronotal lobes not rugulose while on metazona, it's minutely so; medial area with a regular false vein; wing hyaline (dist. Maharashtra (Bombay). Manipur. Orissa. T N.)..... *decisus* Walker, 1871

7. Tegmen furnished with some sort of brownish spots..... 8

   Tegmen without any detectable sports or dots.....10

8. Wing sulphureous at about up to one fourth length at base and as far as anal margin behind; entire post. tibia (as well as lower sulcus of post. femur) bright red, its base narrowly brown and with two or three indistinct spots on sides nearing base (Tegmen with white transverse veins beyond middle) (dist. Darjeeling)..... *rubripes* Navas, 1905

   Not as above..... 9

9. Wing hyaline but infumate at apex; post. tibia testaceous (dist. Orissa. H.P.)..... *jaganathi* Bhowmik, 1985

   Wing wholly hyaline; post. tibia orange red in colour (dist. Karnatak. T. N.)..... *collinus* Uvarov, 1929

10. Sides of head and pronotum may be furnished with a pair of post ocular wide, brown stripes; tegmen a little shorter than abdomen; wing may be a little infumate apicad; post. femoral knees dark brownish (dist. ? (tc). Orissa)..... *inclytus* Walker, 1871

    No stripe, concolourous; tegmen surpasses abdomen by about 3 mm; wing wholly hyaline; post. leg broadly testaceous throughout (i.e., its knees not darkened) (dist. China (t.c.) H.P) .... *seven-hedini* Sjostedt, 1933

Aulacobothrus bolivari Uvarov
(Pl. 1, Figs. 1-2)

1921. *A. bolivari* Uvarov, *Ann. Mag.nat.Hist.*, 7 (9) : 483.

Material : 1 ♀; Dhenkikote, Orissa; 1.10.85. 3 ♂♂; Kheorjhar, Orissa; 26.9.85 and 1.10.85; H.K.B. Coll. 2 ♀♀; Joshipur, Kheorjhar dist., Orissa; 7-9.10.85; H.K.B. Coll. 1 ♂, 2 ♀♀; Badrama, Sambalpur dist. Orissa; 25.3.85. 1 ♀ (and 8 nymphs) H.P. (Mandi, Simla, Sundor Nagar); Sept. - Oct. 80; H.K.B. coll.

Remarks : The species was described on the basis of material from Chapra (Bihar), Koilapati (T.N.) and on specimens of unknown locality. Later, in 1969, Cejhan recorded it from Afghanistan (*Acta.Mus.Mor.*, **54** (Supple) : 261). It is now newly recorded from Orissa.

The specimens in hand almost entirely agree with the description given by Uvarov (op. cit) barring that they are a little smaller in size and in *2fem.* specimens the tegmina do not bear and dark spot. But, in tegmina, the presence of an oblique whitish stigma and false vein in medial space are remarkable and unique. Additionally the presence of two to three oval impressions in antero - upper margin of pronotal lobes are diagnostic.

Measurements :	♂	♀
Body	16 - 17	23 - 24
Antenna	7 - 7.5	8
Pronotum (p)	3.25 - 3.5	4.5 - 4.75
Max. width of metazona (mp)	2.25 - 2.5	3.5 - 3.75
Ratio of p/mp	1.4	1.3
Tegmen	12.5 - 13.5	18.5 - 19
Post. femur (f)	9.5 - 10	14 - 14.5
Max. depth of post.femur (mdf)	2.5 - 2.75	4 - 4.5
Ratio of f/mdf.	4	3.4

Aulacobothrus sinensis Uvarov
(Pl.1, Fig. 3, pt.2, Figs. 4-5)

1924. A. sinensis Uvarov, J. Proc. Assiat. Soc. Bengal, (n. s.), 20 (6) : 318-319.

Material : 3 ♂♂ (one with abdomen and post. legs wanting), 5 ♀♀ (and 4 ♀♀ nymphs, probably of 3rd instar stage); Harishankar, Bolangir dist, Orissa; 20.3.86; H. K. B. Coll. 1 ♀ (head and legs wanting); Mothanguri, Manas Sanctuary, Assam; 13.6.75; R. K. Ghosh Coll. 1 ♀, 1 ♀; Badrama, Sambalpur, Orissa; 26.3.86; H. K. Bhowmik coll.

Remarks : The species was described, on a single ♀ specimen, from W of Yangtsien, (8000), Yunnam, Burma and later recorded from Eastern Nepal. The present

series was collected from Orissa at the foothill of Gandharva, which is almost in a plain land, bordered mostly by agricultural lands. The specimens were collected from dry leaves of Teak and Mahua, with almost no green undergrowth, though the area was bordered by nearby winter paddy cultivation. Assam material was collected from deep jungle.

The availability of nymph in March indicates its post-winter breeding season. The species is recorded here for the first time from India-proper.

The series further provides opportunity to revise the characters of female and description of ♂ for the first time.

Additional description (♀) : Antenna decidedly shorter than head and pronotum, 20-21 segmented, 3rd to 11 segments thick, then 4-5 segments attenuated, remaining apical segments somewhat clubbed shaped, acuminate at apex. Face entirely densely rugulose. Foveolus hardly indicated (not distinct in true sense),very shallow, rugulose; bowed transverse sulcus of fastigium of vertex distinct; median carinula of vertex and occiput may or may not be indiated, its lateral carinulae may not be detectable due to dense rugulose conditions. Interocular space wide, about 3 times wider than width of frontal ridge between antennae. Prozona about one and a half times longer than metazona, more irregularly and roughly rugulose than metazona which is more densely but regularly rugulose; median carina crossed by posterior sulcus only; lateral carinae may be of variable emphasis-distinct, or sinuated, or indistinct due to heavy punctuation or rugae; in any case, it is only slightly curved in middle; narrowest area being before 2nd sulcus; lateral carinae often being interrupted, broken due to heavy punctuation, on metazona; it is, however, distinct and divergent. In basal half, tegmen may be provided with irregular and indistinct brownish spots; cells of apical half very much elongated, with brownish tinge in middle. Wing slightly greenish-yellow, infumate at apex, particularly at costal lobes. Posterior femur thick at base, attenuate at apex, its external lobes rounded; post. tibia with 9 external and 10 internal black tipped spines. Supra-anal plate tongue shaped, with broad groove and having a transverse sulcation in middle. Interspace of mesosternum more wider than its lobes, which are transverse, with rounded inner angles and concave lower margins.

♂ (previously undescribed) : Very similar to *m. m.* except smaller in size and differ in some very minor points - its prozona clearly one and a half times as long as metazona; interocular distance not more than double width of frontal ridge between antennae; temporal foveolae may be represented by a few punctuation only. Post. tibia with 8 external and 9 internal spines. Cercus conical. Antennae similar to those of females; 18-19 segmented; as long as head and pronotum taken together.

Nymphs : 21-23 mm. Easily identifiable as being immature stages of adults. All parts including genital ones and excluding tegmina are of adult-type. Median and lateral carinulae of fastigium of vertex somehow recognizable. Antennae more or less

ensiform, form 3rd to 9th joints this pattern is clear. Lateral carinae of pronotum more distinct owing to lesser punctuation of disc; on profile, reguarly curved, i.e., concavity clear; median carina more low than adults. Head and face almost smooth, differing strikingly with adults.

Colouration : Agrees with original description barring presence of castaneous lateral stripes of head and pronotum; which are absent in most cases, (present in only 2 ♀♀ for this study); in one ♂, a brownish stripe exists in superior border of lateral lobes. Nymphs are also devoid of these stripes.

Measurements :	♂	♀
Body	19 - 20	25 - 26
Antenna	6 - 6.5	7.5 - 8
Pronotum (p)	3.5 - 4	4.5 - 5.25
Maxi. Width of metazona (mp)	2.5 - 2.75	3.25 - 3.75
Ratio of p/mp	1.4	1.4
Tegmen	14.5 - 15	17.5 - 20.5
Post. femur (f)	11.5 - 12	14 - 14.5
Maxi. depth of p. femur (mdf)	3.2 - 3.4	4 - 4.25
Ratio of f/mdf	3.5	3.4

Discussion : The present materials show that they are bigger in size than the measurment of the *fem.* holotype (Body 20; pronotum 4; tegmen 16; and post. femur 11). The characterization of the species that they "differ from other known species of the genus by the straight lateral pronotal keels" is not perfectly true. The lateral carinae of the species, A. luteipes, are truely and completely straight, than in other species of the genus. However, the coriaceous type of tegmina associated with non-exapanded costal and cubital areas and entirely rugulosed body give it a unique position among Indian species.

Aulacobothrus inclytus (Walker)
(Pl.2, Fig.6)

1871. *Stenobothrus inclytus* Walker, *Cat. Derm Salt. Br.Mus.*, 5 (supple) : 83.

Material : 1 ♀; Joshipur, Orissa; 7.10.85, H. K. Coll. 1 ♀; (damaged) Rampur, Kalahandi dist., Orissa; 20.10.84; H. K. B. Coll. (1 ♀ retained in Br. Mus. nat. Hist.)

Remarks : The species was described on the basis of a unique a single ♀ specimen, of unknown habitat. The availability of 3 ♀♀ specimens from Orissa indicates that Walker's material might belong to India.

Additional description (♀) : Frontal ridge finely punctured, strongly convex in upper part, on profile. Fastigium of vertex broadly oval, though a little narrowed at apex,

deeply impressed, well marginated, with bow-shaped transverse sulcus a little before middle; tricarinate, but lateral carinulae not detectable over vertex and occiput. Lateral carinae of pronotum slightly incurved at level of 1st sulcus; anterior angle of lateral pronotal lobes truncate; metazona shorter than prozona. Tegmen a little shorter than abdomen and rounded at apex; base of precostal region hardly bulging; precostal vein runs up to about half of tegminal length; costal area moderately developed, with a false vein in basal half and with 16 oblique, sinuated venilets in apical portion; medial area having a fine weak false intercalated vein. First cubital area moderately developed and with a weak longitudinal vein. Wing a little shorter than tegmen, hyaline, with infumate apex. Knees of post. femur dark-brown; post. tibia uniformly testaceous, with 11 external and 12 internal black-tipped spines.

Measurements : (1 ♀)

Body	25
Antennae (broken)	?
Pronotum (p)	5.25
Max. width of metazona (mp)	4
Ratio of p/mp	1.31
Tegmen	16.5
Post. femur (f)	15
Max. depth of post. femur (mdf)	3.5
Ratio of p/mdf	4

Discussion : The present specimen is bigger than the ♀ holotype. The colouration differs markedly from the original description. Two broad, brown stripes of head and pronotum, behind eyes, are lacking; instead, there are two, small horn-shaped colour marking in the middle of metazona, adjacent to post. sulcus, in one example (Joshipur) but in the damaged example (Rampur) even this marking is lacking.

Aulacobothrus sven-hedini Sjostedt

1933. *A. sven-hedini* Sjostedt, *Ark. for Zoologi,* **25** A (3) : 23 (1934).

Material : 2 ♀♀; Noorpur, Kangra dist., H. P. ; 14-18.10.82. 1 ♀ (and 1 *fem.* nymph); Sundargarh, H. P., 2.10.82. All by H. K. B.

Remarks : The species is described, on both sexes, from China, pointing out its very close resemblance to A. gracilis Uvarov, 1921 (*Ann. Mag. nat. Hist.*, 8(9) : 381) from S. Africa. The occurrence of the species in H. P. is very interesting and is not unlikely.

Additional description (♀); Antenna filiform, 28-29 segmented, longer than head and pronotum taken together. Fastigium of vertex pentagonal, impressed, tricarinate which

extends back over vertex and occiput. Foveolae elongated-oval, well marginated. Narrowest point of lateral carinae just after first sulcus, distinctly incurved; median carina linear, distinct, raised, cut by posterior sulcus only; metazona a little shorter than prozona; lateral pronotal lobes finely rugulosed. Tegmen almost transparent; precostal region with a small expansion, and with a false vein; costal area moderately wide basad and traversed by about 15-16 oblique veinlets; medial area with a weak intercalated vein; cubital area slightly expanded; apex rounded; longer than abdomen by 3-3.5 mm and from post. femur by about 1 mm. Wing perfectly translucent; as long as tegmen. Knees of post. femur concolourous with body colour, i.e., rufo-testaceous. Post. tibia with 11 black tipped spines on both margins; a little pilose; uniform rufo-testaceous.

Nymph. 16 mm. Easily identifiable with the adult.

Measurements : (♀ only)	
Body	17.5 - 20.5
Antenna	6.5 - 7
Pronotum (p)	4 - 4.25
Maxi. width of Metazona (mp)	3 - 3.5
Ratio of p/mp	1.27
Tegmen	15 - 16
Post. femur (f)	11.5 - 12
Max. depth of post. femur (mdf)	3.25 - 3.5
Ratio of f/mdf	3.5

Aulacobothrus decisus (Walker)
(Pl. 3, fig. 8)

1871. *Stenobothrus decisus* Walker, *Cat. Derm. Salt. Br. Mus.*, **5** : 80.

Material : 1 ♀ (legs wanting); Churachandpur, Manipur; 20.11.83; S. K. Gupta Coll. 1 ♀ (legs wanting); Barkuda island, Chilka Lake, Orissa; 27.9.83; H. K. B. Coll.

Remarks : The species was described from Bombay on *fem.* sex. In 1921 Uvarov synonymised *Aulacobothrus socius* Bolivar, 1902 (*Annl. Soc. ent. Fr.* **70** ; 599) with it which was described from T. N., on both sexes. The availability of the species now from Manipur and Orissa extends its range of distribution. The specimens in hand agrees wellwith known account and is recognised by the distinguishing characters as mentioned in the key.

Aulacobothrus luteipes (Walker)

1871. *Stenobothrus luteipes* Walker, *Cat. Derm. Salt. Br. Mus.*, **5** : 82.

Material : A.P. : 2 ♂♂, 6 ♀♀; Araku valley; 6.9.83. Orissa : 5 ♂♂, 3 ♀♀

(and 1 ♂ nymph); Jenabil; 9.10.83. 5 ♂♂, 3 ♀♀ (and 1 ♀ nymph); Joshipur; 6.10.85. 5 ♀♀, Koraput (DNK Rest-House) 13-14.9.84. H. P. : 12 ♂♂, 14 ♀♀ (and 4 nymphs); different localities; Sept. 1980. All by H.K.B.

Remarks : It is one of the most common representative of the genus in India and is currently redescribed by Bhowmik (1986) from material of W.B. The long series of specimens, now in hand, however, exhibits some minor variations.

Frontal ridge slightly sulcate in *m.* ; but in *fem.* always flat and convex, with sparse punctuation, at least in basal portion. Fastigium of vertex well grooved, wider than long; middle carinula sometimes very prominent, entire or starting from behind bowshaped sulcus, often separating it into two parts; lateral carinulae often not detectable over vertex, though present anteriorly. Temporal foveolae though somewhat oval, always with lower margin straight, thus sometimes giving it semi-lunar shape. Lateral carinae of pronotum though more or less straight up to 2nd transverse sulcus, variable in metazonal area - sometimes, they are straight here also, but often a little divergent; often in prozonal area also, they are somewhat flexuous in middle; but on the whole, present parallelism, i.e., concavity of them nil or practically nil, particularly in *fem.*; in *m.* they may be a little divergent at anterior margin of pronotal dise. Sometimes lateral carinae indistinct, in *m.*, in posterior border of metazona. In tegminal venation, in *fem.* costal area having about 16-17 oblique, sinuous veinlets, while in *m.* they are regularly oblique and this area more bulging and prominent, specially in middle. In *m.*, medial area may or may not have a false vein. First cubital area (or ulnar), space between cubital and post cubital veins, with a prominent false vein, having transverse, straight veinlets on both sides in *fem.*, while in *m.* this area is more pronounced and is occupied by almost 11-12 transverse (resonators) veinlets. Other *m.* tegminal specialization are radial sector truely biramous; radial and medial veins connected by a number of trasverse veinlets; $vanal_1$ and $vanal_2$ nerves inconspicuous and tranverse veinlets at apical two thirds.

Measurements : As given earlier by Bhowmik (1986).

Discussion : The spceis is highly variable as per as body-colouration in concerned. The most characteristic broad pale stripe, starting from behind eyes and running across head, superior margin of pronotal lobes and up to closed tegmina (whole central longitudinal area) may be lacking or indistinct or hardly visible in most cases. Posterior femora may be with 3 dark bands above or not; the brown knee pigment may be replaced by some blackish dots. Post. tibia testaceous often uniformly but rarely with yellowish area at base.

Aulacobothrus jaganathi Bhowmik, 1985
(Pl. 3, fig. 9)

1985. *Dnopherula (Aulacobothrus) jaganathi* Bhowmik, Bull. *Zool. Surv. India*, 7 (2-3) : 291-293, Fig. 1, plate v, figs 10-11.

Material : 1 ♂; Barkuda, Chilka Lake, Orissa; 27.9.83; H. K. B. Coll. 1 ♀; Kangra, H. P.; 15.10.82; HKB Coll. 1 ♀; Chauwari, Chamba, H.P.; 16.10.82.

Remarks : The species is described from Balugaon, Puri, Orissa, on *fem.* sex. The present material not only extends its range of distribution but also provides opportunity of describing the male.

Description : ♂ (previously undescribed) : Smaller in size but generally tallies with description of *fem.* with some variations.

Antenna a little longer than head and pronotum taken together. Frontal ridge differs from *fem.* by being a little deplenate (but not sulcate in real sense) in middle, resulting edged lateral carinulae. Tegmen more pronounced than *fem.*; costal vein reaches almost four fifth of total tegminal tength, with 11 oblique but irregular shaped veinlets; subcostal area a little expanded and with 9 transverse veinlets; cubital area moderately developed, with six apical curved (resonator) veinlets and four insignificant ones at basal half. Supra-anal plate broadly tongue shaped, apex widely rounded. Cercus conical, spine-like, surpasses supra-anal plate; subgenital plate navicular, pilose. Posterior tibia with 11 external and 12 internal spines.

Measurements : (♂ only)

Body	16
Antenna	7
Pronotum(p)	4
Maximum width of metazona (mp)	2.5
Ratio of p/mp	1.6
Tegmen	14.5
Post. femur (f)	10
Max. depth of post. femur (mdf)	3.25
Ratio of f/mdf	3.2

Discussion : The male specimen was collectef from the type locality on the same date as the types, but was not available for study at the times of the description of the species. H. P. is a new record for it.

The species seems to be very close to *A. collinus*, from which it differs in a few minor features. Study of both the sppecies, with more examples of specimens may clear up their taxonomic status.

SUMMARY

The study of seven little known species of the genus *Aulacobothrus* (Gomphocerinae) reveals the previously undescribed male of two species, *A. sinensis* & *A. jaganathi*, with new reports of occurrence of three exotic species, *A. sinensis*, *A.*

inclytus & *A. sven-hedini*, in India; besides, some new intraterritorial records. A working key of Indian species of the genus is prepared and presented herewith, for the first time, on the basis of this study.

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