

A Revision of Halyine Stink Bug Genus *Sarju* Ghauri (Hemiptera: Pentatomidae: Halyini) and its Cladistic Analysis

Nasreen Memon and Imtiaz Ahmad

Department of Zoology, University of Sindh, Jamshoro (NM) and University of Karachi, Karachi (IA)

Abstract.- Halyine stink bug genus *Sarju* Ghauri is revised with its 12 (9 species and 3 sub-species) world known species by brief distinguished features and zoo-geographical distribution. The characters of each taxon are scanned from the present description and those given in the literature to date. Their apomorphic states are recognized on the bases of out group comparison within the tribe Halyini at large. A key of twelve species is given and a cladogram is constructed based on the principle of parsimony to throw light on the evolutionary relationship of the included taxa.

Key word: Hemiptera, Pentatomidae, Halyini, *Sarju*, cladistic analysis.

INTRODUCTION

Ghauri (1977) described the genus *Sarju* to accommodate the type species *H. obscura* Westwood (1837), *Dalpada eremica* Hoberlandt (1959) and *D. pavlovskii* Kritchenko (1952) on the basis of absence of side lobes on median excavation of the ventral margin of pygophore along with five new species and three subspecies from Bengal, Iran, China and Indo-China. However, the females of *S. farida* and *S. enigma* were not available to him which were later on described by Ahmad and Afzal (1984), *S. enigma* from northern areas of Pakistan like Manor, Kargaha, Gilgit and *S. farida* from Haripur of NWFP and Changamanga of Punjab along with redescription of males of both and the description of their new species *S. angulata* from Gilgit, Pakistan.

Presently here we have given the key of world species highlighting the relationship of all included taxa. The brief description of world known nine species and three subspecies and their zoogeographical distribution are given and in this light a cladistic analysis is carried out and a cladogram is constructed on the principle of parsimony. We have taken the genus *Cahara* of Ghauri (1998) as an out group.

MATERIALS AND METHODS

The work on *Sarju* Ghauri (1977) by Ahmad (1979), and Ahmad and Afzal (1984) were scanned along with the present description for the taxonomic characters. The characters were randomly taken. The polarities of these were not deduced unreasonably. The characters were compared with those found in the out group within their tribe at large. No homoplies had to be invoked. Plesiomorphic conditions showing primitive characters, represented by "ao", "bo" etc have been listed in the Table I on character and characteristics but not included into consideration in cladogram.

Table I.- Characters and character states.

- | | |
|------------------|--|
| a ₀ . | Body large size |
| a ₁ . | Body medium size (all included taxa) |
| b ₀ . | Body above with ochraceous spots |
| b ₁ . | Body, above without metallic green sheen (<i>Sarju obscura</i> , <i>S. farida</i> and <i>S. eremica</i> and <i>S. angulata</i>) |
| b ₂ . | Body, above with metallic green sheen (<i>Sarju burmana burmana</i> <i>S. burmana khasiana</i> and <i>S. taungyiana taungyiana</i> and <i>S. taungyiana chapa</i>) |
| c ₀ . | Antennal segment IV and V ochraceous |
| c ₁ . | Antennal segment IV and V about one third basal portion ochraceous, remaining dark brown (<i>Sarju pavlovskii</i> and <i>S. enigma</i>) |
| c ₂ . | Antennal segment IV and V uniformly reddish brown (<i>S. lata lata</i> and <i>S. lata quadrata</i>) |
| d ₀ . | Apex of scutellum ochraceous brown and thickly punctate |

- d₁. Apex of scutellum clearly luteus and almost impunctate (*Sarju burmana burmana* and *S. burmana khasiana*)
- d₂. Apex of scutellum dark or only obscurely luteus and sparsely punctate (*Sarju taungyiana taungyiana* and *S. taungyiana chapa*)
- d₃. Apex of scutellum uniformly punctate (*Sarju taungyiana taungyiana*)
- d₄. Apex of scutellum with round luteus fascia (*Sarju taungyiana chapa*)
- e₀. Scutellum with uniform colour
- e₁. Scutellum with two ochraceous v-shaped basal spots (*Sarju burmana burmana*)
- e₂. Scutellum with two ochraceous triangular basal spots and apex without metallic green transverse fascia (*Sarju burmana khasiana*)
- o. Fascia on connexivum narrow
- f₁. Fascia on connexivum less wider (*Sarju burmana burmana* and *burmana khasiana*)
- f₂. Fascia on connexivum much wider (*Sarju taungyiana taungyiana* and *S. taungyiana chapa*)
- g₀. Paraclypie unilobed
- g₁. Paraclypie bilobed, outer lobe forming distinct angle with inner lobe (all included taxa)
- h₀. Paraclypie equal to clypeus and away from each other
- h₁. Paraclypie entirely enclosing clypeus (*Sarju burmana burmana*, *S. burmana khasiana* and *S. taungyiana taungyiana* and *S. taungyiana chapa*)
- h₂. Paraclypie not completely enclosing clypeus (*Sarju angulata*, *S. eremica*, *S. obscura* and *S. farida*)
- h₃. Paraclypie partially enclosing clypeus (*Sarju angulat* and *S. eremica*)
- h₄. Paraclypie distinctly wider apart, leaving clypeus free (*Sarju obscura* and *S. farida*)
- i₀. Apex of head broad
- i₁. Apex of head gently narrowed, external lobe of paraclypie narrower than internal lobe (*Sarju pavlovskii* and *S. enigma*)
- i₂. Apex of head almost square, external lobe of paraclypie very prominent almost as wide as internal lobe (*Sarju. Lata lata* and *S. lata quadrata*)
- i₃. Apex of head across external lobe of paraclypie gently diverging, external lobe at an obtuse angle to internal lobe (*Sarju lata lata*)
- i₄. Apex of head squarish across external lobe of paraclypie, external lobe sharply demarcated from internal lobe at almost right angle (*Sarju lata quadrata*)
- j₀. Lateral margins of head sinuate
- j₁. Lateral margins of head, in front of eyes with reduced tooth like projection (*Sarju enigma*)
- j₂. Lateral margins of head, in front of eyes with prominent tooth like projection (*Sarju pavlovskii*)
- k₀. Second antennal segment cylindrical
- k₁. Second antennal segment uniformly straight (*Sarju pavlovskii*, *S. enigma*, *S lata lata* and *lata quadrata*)
- k₂. Second antennal segment bowed and some what swollen at apex (*Sarju obscura*, *S. farida* *S. angulata*, *S. eremica*, *S. burmana burmana* *S. burmana khasiana*, *S. taungyiana taungyiana* and *S. taungyiana chapa*)
- l₀. Humeral angles sub acute
- l₁. Humeral angles more or less produced (all included taxa)
- l₂. Humeral angles produced into relatively short horns (*Sarju farida* and *S. obscura*)
- l₃. Humeral angles produced into long and acute horns forming very distinct angle (*Sarju angulata* and *S. eremica*)
- m₀. Vento posterior margin of pygophore with sub round cavity m₁. Vento posterior margin of pygophore smooth, narrowly sub round with relatively shallow cavity with distinct u-shaped median excavation and lobes on sides (*Cahara*)
- m₂. Vento posterior margin of pygophore more or less sinuate with broad deep or shallow cavity, rarely with indistinct median excavation and without lobes on sides (all species of *Sarju*)
- m₃. Vento posterior margin of pygophore some what sinuate with relatively broad and shallow cavity (*Sarju eremica*)
- m₄. Vento posterior margin smooth with deep v-shaped cavity (*Sarju angulata*)
- n₀. Apical part of lateral lobes of pygophore broadly subround
- n₁. Apical part of lateral lobes of pygophore slightly inwardly produced (*Sarju obscura*).
- n₂. Apical part of lateral lobes of pygophore acutely much produced inwardly like beak (*Sarju farida*).
- o₀. Stem of paramere without inner process
- o₁. Stem of paramere with well developed inner process (all included taxa)
- o₂. Stem of paramere relatively short with poorly developed inner process (*Sarju farida*, *S. obscura*, *S. eremica* and *S. angulata*)
- o₃. Stem of paramere long with well developed thick inner process (*Sarju. burmana burmana*, *S. burmana khasiana*, *S. taungyiana taungyana* and *S. taungyiana chapa*)
- p₀. Inner process of stem thin with sub round apex
- p₁. Inner process of stem thick, thumb like with conical apex (*Sarju taungyiana taungyiana*)
- p₂. Inner process of stem relatively small but broad with sinuate and tapering apex (*S. taungyiana chapa*)
- q₀. Blade medium in size
- q₁. Blade large, with ridge area not so distinctly demarcated and away from upper margin (*Sarju burmana burmana*, *S. burmana khasiana*, *S. tuangyiana tuangyiana* and *S. tuangyiana chapa*)
- q₂. Blade small with ridge area distinctly demarcated and close to upper margin (*Sarju obscura*, *S. farida*, *S. eremica* and *S. angulata*)
- q₃. Ridge area of a blade a little produced (*Sarju farida*)
- q₄. Ridge area much produced, bended down ward at apex

- like beak (*Sarju obscura*)
- r₀. Outer upper margin of blade smoothly straight
- r₁. Outer upper margin of blade sinuate, slightly raised upward (*Sarju pavlovskii* and *S. enigma*)
- r₂. Outer upper margin of blade slightly sinuate but much raised up ward like hump (*Sarju lata lata* and *S. lata quadrata*)
- s₀. Parmere relatively narrow below blade
- s₁. Parmere les swide below blade (*Sarju lata lata*)
- s₂. Parmere much wider below blade (*Sarju lata quadrata*)
- t₀. Aedeagus with single pair of dorsal membranous conjunctival appendages
- t₁. Adeagus with trilobite dorsal membranous conjunctival appendages (all included taxa)
- t₂. Trilobate dorsal membranous conjunctival appendages longer than penial lobes (*Sarju eremica*)
- t₃. Trilobate dorsal membranous conjunctival appendages of Aedeagus shorter than penial lobe (*Sarju angulata*)
- u₀. Posterior margin of first gonocoxae smoothly sub round
- u₁. Posterior margin of first gonocoxae distinctly much produced like-finger mostly reaching to two third of 9th paratergite (*Cahara*)
- u₂. Posterior margin of first gonocoxi variable, may be concave, convex or slightly produced (all species of *Sarju*)
- u₃. Posterior margin of first gonocoxae concave in middle (*Sarju enigma*)
- u₄. Posterior margin of first gonocoxae produced in middle like spine (*Sarju pavlovskii*).
- v₀. Spermathecal bulb with three- four small processes
- v₁. Spermathecal bulb variable with thick, thin, long, short, finger like or tubule like processes (*Cahara*)
- v₂. Spermathecal bulb mostly with three thic, thin finger like medium size processes (most species of *Sarju*)
- v₃. Spermathecal bulb with three long finger like process reaching mid way to first flang (*Sarju pavlovskii* and *S.enigma*)
- v₄. Spermathecal bulb with two, small and thick process (*Sarju lata lata* and *lata quadrata*)

Terminology for the pygophore and inflated aedeagus generally followed that of Ahmad (1986) and Ahmad and McPherson (1998).

SARJU Ghauri

Body thickly punctate; head except eyes, ocelli and antennae, entire pronotum except denticles and humeral angles, entire clavus and corium ochraceous brown thickly punctate with dark bown tinge, most species with black humeral horns

and denticles of pronotum light brown; scutellum shining yellow some species with apex of scutellum and basal angles pale yellow; eyes bright brown; ocelli reddish brown; antennae bright brown except 2nd segment and basal part of 4th and 5th ochraceous; labium streaked with bright brown and ochraceous stripes, except fully brown fourth segment; abdominal sternite dull ochraceous; membrane of hemelytra light brown with dark veins.

Body elongate oval; head rather short, triangular, head apex truncate; paraclypei usually more or less longer than clypeus, inner lobes of paraclypei round at apex, in some species partially and in some completely enclosing clypeus, outer lobe apically acute and at right or obtuse angle to inner lobe, lateral margins sinuate and usually angulate in front of eyes; anteocular region more than remainder of head; antennae five segmented, basal antenna! segment not reaching apex of head, second in most species bowed with apex swollen (seems generic character), specially more in males than in females; labium exceeding posterior coxae, reaching up to 3rd abdominal segment; bucculae a little shorter than first labial segment; pronotum more than 2x as broad as long, a little longer than head, lateral margins of pronotum markedly concave and crenulated, humeral angles produced into long or short horns, in most species diverging outwardly, in some raised almost vertically; scutellum longer than broad at base and acuminate, apex sub-acute; metathoracic scent gland ostiole well-developed with long curved peritreme, and very well-defined evaporatoria; membrane of hemelytra longer than abdomen, connexiva not exposed at repose. In male genitalia ventroposterior margin of pygophore with medial excavation, lateral lobes usually broadly round and in most species inwardly produced like beak; paramere with short stem, setose process well-developed and thumb-like with blunt apex, blade of paramere broad with elongated inner ridge area extended to apex as a finger, outer margin almost straight or gently curved or bisinuate; inflated aedeagus with a pair of small, sclerotized or semisclerotized ear-like appendages, dorsal membranous conjunctival appendages trilobite, lateral lobes comparatively shorter than median lobe, but variable in width; penial lobes long, rod-like, longer than vesica. In female

genitalia posterior margin of first gonocoxae may or may not be produced, in some species produced like lobe or finger, second gonocoxae mostly convex posteriorly, triangulin partially visible; eighth paratergite triangular; ninth paratergites usually longer than eighth, with apex round, in some distinctly lobed at apex, spermathecal bulb small usually with 3-4 processes.

Type species

Halys obscura Westwood, 1837, 22; type locality, Bengal.

Comparative note

The genus *Sarju* Ghauri resemble to the group of *Dalpada* Amyot et Serville, *Cahara* Ghauri, *Izharocoris* Afzal and Ahmad, *Lodosocoris* Ahmad and Afzal, and *Neolodosocoris* Memon and Ahmad in having more or less same coloration, general appearance, specially by having bi lobed paraclypei, apex of inner lobe round, outer lobe form distinct angle with inner lobe and more or less produced humeral angles, but it is different from all, mostly having long horn-like humeral angles and male and female genitalia, externally it differs from a group of genera viz. *Dalpada*, *Lodosocoris* and *Neolodosocoris* by having paraclypie longer than clypleus but shares this trait with *Cahara* and *Izharocoris* and among these two it is more close to the genus *Cahara* by having almost same shaped paramere and more or less same aedeagus, but unlike latter, it is more widely distributed and median excavation of ventral margin of pygophore without side lobes, it also differs in female genitalia particularly posterior margin of first gonocoxi except in few species of *Sarju* the posterior margin is a little produced.

KEY TO THE SPECIES OF THE GENUS *SARJU* GHAURI

1. Second antennal segment bowed and some what swollen at apex, head a little longer than its width across eyes 2
- Second antennal segment straight and not distinctly swollen at apex, head as long as wide across eye..... 9
2. Pronotal horns short, posterior margin of 2nd gonocoxae convex, 9th paratergite distinctly lobed at apex with outer margin sub-round 3
- Pronotal horns long, posterior margin of 2nd gonocoxae almost straight, 9th paratergite not as lobed as above ... 4
3. Ventral margin of pygophore with shallow cavity and with a little median depression, lateral lobes round at apex and a little inwardly produced, paramere with external margin sinuate, inner thumb-like process of stem thick with apical margin notched, outer margin of blade very much sinuate, ridge distinctly produced, turned downward like beak; first gonocoxae distinctly produce like a finger at postero-external angle
..... *S. obscura* (Westwood)
- Ventral margin of pygophore with deep cavity, lateral lobes concave at apex and sharply produced, bended inwardly, paramere with external margin almost straight, inner thumb process of stem a little produced with narrow apex, turn downward, ridge of blade a little produced with apex blunt; first gonocoxae lobed at postero-external angles.....*S. farida* Ghauri
4. Body above with metallic green sheen; paraclypei completely closing clypeus; paramere, external margin almost smoothly curving, blade almost triangular, gradually tapering downward..... 5
- Body without metallic green sheen; paraclypei not closing clypeus; paramere blade narrow, more or less produced at apex with ridge area distinctly demarcated6
5. Scutellum with two small v-shaped basal spots, apex metallic green and without transverse fascia; ventral margin of pygophore smooth with shallow and broad cavity, lateral lobes broad with apex straight, inner thumb process of stem small and narrow; spermathecal bulb with three finger like almost equal process.....
..... *S. burmana* Ghauri
- Scutellum with two quite triangular basal spots, apex with metallic green transverse fascia; ventral margin of pygophore sinuate, relatively with deep cavity, lateral lobes broad with apex a little concave, paramere with inner thumb process of stem thick distinctly produced; spermathecal bulb with two small and one long process
.....*S. burmana khasiana* Ghauri
6. Ventral margin of pygophore with v-shaped cavity, dorsal membranous conjunctival appendages shorter than penial lobe.....*S. angulata* Ahmad & Afzal
- Ventral margin of pygophore with broad cup-shaped cavity, dorsal membranous conjunctival appendages longer than penial lobe..... 7
7. Apex of scutellum ochraceous, impunctate; stem short with a little thumb process, outer margin of blade very much sinuate, apex slightly produced
..... *S. eremica* (Hoberlandt)
- Apex of scutellum punctate; stem comparatively long with very well developed thumb-like process, outer margin of blade less sinuate, apex very much produced8
8. Second antennal segment longer than third; scutellum with two basal small v-shaped spots; thumb process thick, convex on both margins with apex round, ridge

- area of blade narrow with straight inner margin.....
..... *S. taungyiana* Ghauri
- Second and third antennal segment subequal; scutellum with two basal and one apical round spots; thumb process quite thin with apex blunt, ridge area of blade relatively broad with inner margin sinuate
.....*S. taungyiana chapa* Ghauri
- 9. Head narrow in front, antennal segments very fine; paramere stem relatively narrow than blade, outer upper margin of blade almost straight 10
- Head relatively broad in front, antennal segments not as fine as above; paramere stem as broad as blade, outer upper margin of blade distinctly sinuate and hump-like.
..... 11
- 10. Projection in front of eyes very prominent; first gonocoxae less wider posteriorly, and produced narrowly at posterior-external angle.....
.....*S. pavalovskii* (Kiritshenko)
- Projection in front of eyes reduced; first gonocoxae much wider posteriorly and broadly convex at posterior-external angle *S. enigma* Ghauri
- 11. Apex of head across external lobes of paraclypei gently diverging, external lobe of paraclypei at obtuse angle to inner lobe; humeral horns relatively thin.....
.....*S. lata lata* Ghauri
- Apex of head squarish across external lobes of paraclypei diverging, external lobe of paraclypei sharply demarcated from inner lobe at almost right angle; humeral horns long and thick
.....*S. lata quadrata* Ghauri

Halys obscura Westwood
(Figs. 1E, 3A, 4A, 5A, 6A)

- Sarju obscura* (Westwood), Ahmad, 1979: 57;
Ahmad and Afzal, 1984: 131.
Halys obscura Westwood, 1837: 22
Halys nigricollis Westwood, 1837: 22
Dalpada nigricollis (Westwood), Distant, 1902: 111
Dalpada obscura (Westwood), Kirkaldy, 1909, 193.

Colour; ochraceous brown with black arid brown punctures, extensive black patches on head, pronotal horn black with apex yellow, luteous impunctate basal angles of scutellum small, antennae smoky yellow to dark brown with base of 4th segment luteous and a yellow fascia on 1st segment; head short triangular, paraclypie slightly exceeding clypeus and partly covering it, labium reaching middle of 3rd abdominal segment; pronotal horns short, lateral margins of pronotum bisinuate;

male pygophore, ventro posterior margin with wide and shallow, lateral lobes short with inner margin slightly concave; paramere, external margin sinuate, internal process abruptly narrow, very much drawn out, elongate, slightly undulating with transverse ridged area, setose process small; aedeagus, median conjunctival membranous appendage with all three lobes well differentiated, lateral a little shorter than middle; first gonocoxi at postero-external angle produced like a small narrow finger, paratergites 9 narrower at apex, elongate, inner margin not produced medially; spermathecal bulb small with three processes, longest process reaching beyond midway to first flange.

Length of male 13 mm, width across pronotal angles 6.0 mm.

Length of female 16 mm, width across pronotal angles 7.5 mm.

Comparative note

Sarju obscura resemble to *S. eremica* by having almost same coloration of body and to some what bowed 2nd antennal segment but it can easily be distinguished from later by having jet black pronotal horns, head relatively narrow, paraclypei wider apart leaving clypeus free, 2nd antennal segment much thicker than *S. eremica* and ventroposterior cavity of pygophore shallow and broad and female genitalia.

Distribution

India: Bengal, Punjab. Japan. Nepal. China: Guangxi.

Sarju farida Ghauri
(Figs. 1D, 2A, 3F, 4C, 4K)

Sarju farida Ghauri, 1977: 17; Ahmad and Afzal, 1984: 136.

Colour of body ochraceous brown, closely punctate with black and brown punctures, humeral horns of pronotum black, apex of head across paraclypie as wide as vertex between eyes, paraclypie prominent and wider apart leaving

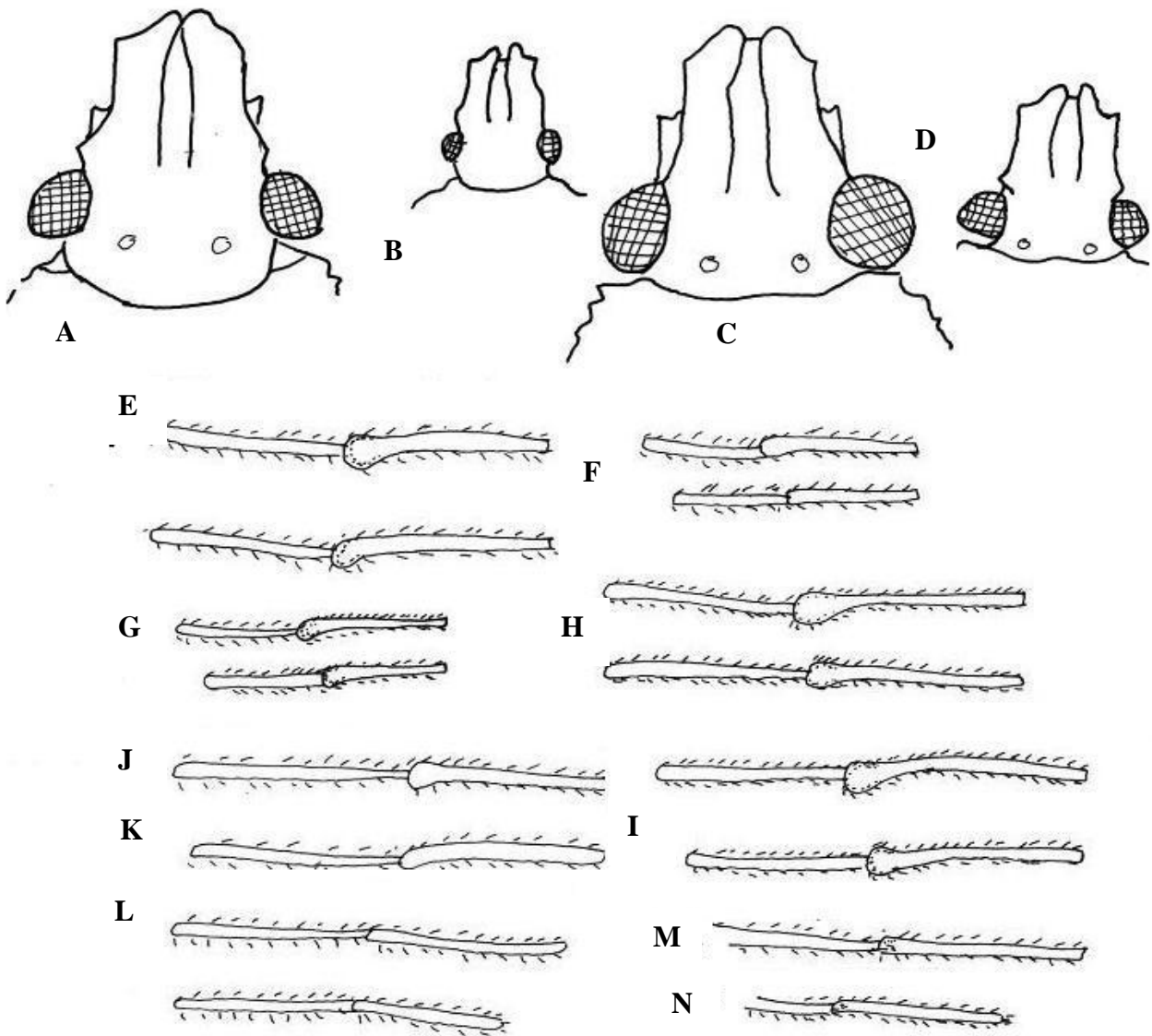


Fig. 1. Apomorphies. Head dorsal view; A, *S. burmana burmana*; B, *s. angulata*; C, *s. farido*; D, *S. pavlovsidi*; E, *M. antennae* lateral view; *S. obscura*; F, *S. angulata*; G, *S. eremica*; H, *S. burmana*; *S. B. khasiana*; J, *S. taungyiana*; K, *S.t. chapa*; L, *S. pavlovskii*; M, *S. enigma*; N, *S. latalata*.

clypeus free, angle in front of eye tooth-like, labium reaching posterior margin of third abdominal segment; pronotal horns short and blunt, lateral margins deeply concave; pygophore, ventral margin with deep and cup-shaped cavity, lateral lobes broad, apex depressed medially and produced at inner angle like beak; paramere, external margin straight along most of its length, curving into blade, almost at a right angle of blade, thick, broad with a

terminal lobe, transverse ridged area culminating in a round globular process, setose process small and conical; aedeagus, vesica small, tubular, vesical appendages elongate, sclerotised, dorsal conjunctival appendages small, sclerotised, ventral conjunctival appendages long, semi-sclerotised, median membranous conjunctival appendages trilobate, median lobe longer than lateral lobes, all three pointed narrowed at apices.

Length of male 12.00 mm, width across humeral angles 6.50 mm.

Length of female 15.7 mm, width across humeral angles 6.6 mm.

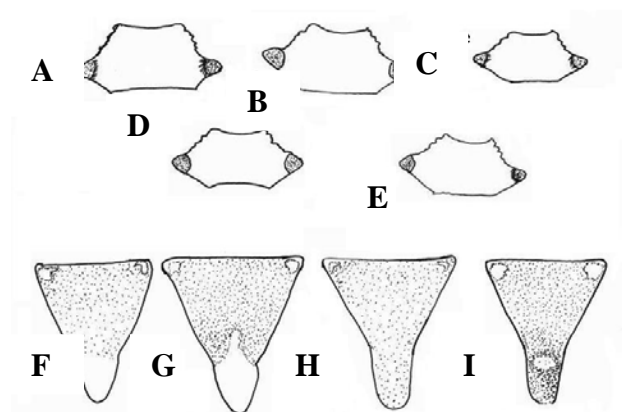


Fig. 2. Apomorphies. Pronotum, dorsal view; A, *S. farida*; B, *S. eremica*; C, *S. pavlovski*; D, *S. lata lat*; E, *S. l. quadrata*; F-I, Scutellum, dorsal view; F, *s. burmana*; G, *S. burmana*; H, *S. taungyiana*; I, *S. t. chapa*.

Comparative note

This species is closely related to *S. eremica* from which it differs by its short and blunt humeral horns, much deeper ventral cavity of its pygophore, much more produced lateral lobes and much wider apex of its paramere. It might be resemble to *S. pavlovskii* because of its shorter humeral horns but the shape of the pygophore and paramere are different in these two species.

Distribution

India: Kulu, Pakistan: NWFP, Haripur, Punjab, Changa Manga,

Sarju eremica (Hoberlandt)
(Figs. 1B, 2B, 3E, 4B, 5B, 6B)

Dalpada eremica Hoberlandt, 1959: 502. Type a female. *Dalpada eremica* Hoberlandt, Beccari and Fenili, 1960: 279-329; Ahmad *et al.*, 1974: 55.

Sarju eremica (Hoberlandt) Ghauri, 1977, 15-16: Ahmad, 1979: 58.

Body colour similar to *S. obscura*, except for

lighter apex of scutellum, lighter marginal fascia on venter of abdomen, yellowish instead of reddish tinge on dorsal surface of body and jet black humeral horns; head relatively broad at apex, second antennal segment bowed and slightly thickened at

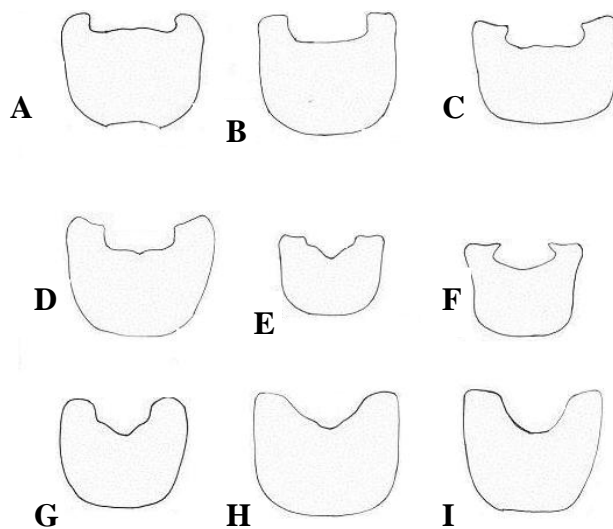


Fig. 3. Apomorphies. Pygophore, v. view; A, *S. obscura*; B, *S. burmana*; C, *S. taungyian*; D, *S.t. chapa*; E, *S. eremica*; F, *S. farida*; G, *S. lata lata*; H, *S.I. quadrata*.

apex, paraclypie partly covering clypeus, in some specimens meeting together at apices, labium reaching middle of third abdominal segment; pronotal horns very long with acute apices, lateral margin of pronotum deeply concave, marginal teeth much smaller; pygophore, ventral cavity quite deep and broadly v-shaped with multi-sinuate margin, lateral lobes broad with apical margin sinuate and an inner angle a little produced, paramere, external margin gently sinuate, blade some what triangular, broad at base, gradually narrowed towards apex, transverse ridged area culminating in a round base, setose process small and conical; aedeagus, vesica short, tubular, vesical appendages sclerotised, long, dorsal conjunctival appendages small, semi-sclerotised, ventral conjunctival appendages long semi-sclerotised, median conjunctival appendage membranous trilobate, median lobe short, broad, lateral lobes longer, narrower; first gonocoxi of female slightly tumid at postero-external angle, paratergite 9 slightly produced medially,

spermathecal bulb small with two short and one slightly longer process, hardly reaching mid-way to first flange.

Length of male 13.00 mm, width across humeral horns 7.00 mm

Length of female 14.50 mm, width across humeral horns 8.00 mm.

Comparative note

Sarju eremica is closely related to *S. angulata* by having pronotal horns long with acute apices which make these species different from all remaining species of *Sarju*, ventral cavity of the pygophore quite v-shaped, lateral lobes broad and to some extent same shape of paramer but it is different from *angulata* in the characters having bowed and swollen 2nd antennal segment, paraclype partly closing clypeus, ventro posterior margin of pygophore sinuate, apical margin of lateral lobes sinuate and produced at inner angle and posterior margin of first gonocoxi and apex of 9th paratergite.

Distribution

Iran: Baluchistan, Sarbaz, Daojirm; Pakistan: Gilgit, Paty field, Punjab, Taxila Islamabad, NWFP, Peshawar, Tarnab, Abbotabad, Mingora.

Sarju burmana Ghauri

(Figs. 1A, 1H, 1S, 2F, 3B, 4D, 5C, 6C)

Ochraceous brown with black and brown punctures and with green metallic sheen, extensive metallic green patches on head, anterior half of pronotum, disc of scutellum, connexivum and narrow ventro-lateral fascia; apex of pronotal horns yellow, apex of scutellum extensively and basal angles narrowly luteous and almost impunctate; connexivum almost completely dark, each with middle brown spot flanked by metallic green; corium without metallic green and reddish patches; head relatively narrow, paraclypei meeting at apex and partly enclosing clypeus, pronotal horns short, lateral margin bisinuate; labium reaching middle of 3rd abdominal segment; male pygophore, ventral margin with shallow and wide cavity but without median excavation, paramere, external margin almost smoothly curved, blade of paramere gradually narrowing internally with transverse narrow ridged

area, inner process of stem thumb-like, small, pointed at apex; aedeagus same as in type species; first gonocoxi a little lobed posteriorly, spermathecal, bulb small with two-short and one longer, processes, longer process reaching midway to first flange.

Length of male 12.5 mm, width across humeral horns 6.00 mm

Length of female 11.5 mm, width across humeral horns 7.00 mm

Comparative note

This species differs from all remaining species of *Sarju* by having metallic green sheen above and very bright luteous apex of scutellum while it resemble to the type species *S. obscura* by having shallow, wide cavity of ventro posterior margin of pygophore but can easily be distinguished from *obscura* by having ventral cavity without median excavation, lateral lobes relatively broader than *obscura* and different shape of paramere particularly that of blade and the posterior margin of first gonocoxae.

Distribution

Burma, Mishimi Hill, delei River.

Sarju burmana khasiana Ghauri

(Figs. 1I, 2G, 4E, 6D)

This is a subspecies of *burmana* therefore apparently looks like it, except by having thick, almost triangular luteous basal spots on angles and luteous apex of the scutellum extends narrowly on the median line and thumb process of stem relatively thick, blade of paramere comparatively broad quite triangular and long with outer upper margin straight.

Distribution

India: Khasiana, Sakia, Assam, Nagra Hills and Bengal; Pakistan: Northern areas

Sarju taungyiana Ghauri

(Figs. 1J, 2H, 3C, 4F)

Body colour same as *S. burmana khasiana* except basal angular spots of scutellum a little v-shaped, apex of scutellum not impunctate and

yellow fascia on connexivum much wider; external body characters similar to *S.b. khasiana*; paramere, apical part of blade much narrower and longly produced along with transverse ridge area, thumb process of stem thick and swollen; aedeagus similar to that of *S. burmana*.

Length of male 12.00 mm, width across humeral horns 6.00 mm

Comparative note

This species closely resemble to *S. obscura* and *S.b. burmana* or *S.b. khasiana*, but the coloration particularly of scutellum along with distinguished shape of its paramere blade differentiate it from all other species of *Sarju*.

Distribution

Burma, Taungyi

Sarju taungyiana chapa Ghauri
(Figs. 1K, 2I, 3D, 4G)

Body colour same as *taungyiana*, except prominent luteous, almost round basal spots of scutellum and a vague spot on apex; it is very close to its nominal species except blade of paramere, slightly thicker than *taungyiana*, apex relatively narrowly produced, thumb process of stem with relatively broad and tapering apical margin; aedeagus similar to *S.b. burmana* Ghauri.

Length of male 12.00 mm, width across humeral horns 6.00 mm.

Comparative note

This subspecies closely resembles *S. obscura*, specially by the presence of impunctate luteous spots at the basal angles of the scutellum and general body coloration and shape of its body, but its paramere particularly the apex of blade including ridge area is quite different.

Sarju pavlovskii (Kirichenko)
(Figs. 1C, 1L, 2C, 4H, 4L, 6E)

Dalpada pavlovskii Kirichenko, 1952: 152
Sarju pavlovskii (Kirichenko) Ghauri, 1977: 17-18.

Body colour similar to *S. eremica* and *S.*

obscura, ochraceous with dark streaks and black punctures, pronotal horns shining black; basal angles and apex of scutellum punctate, venter of abdomen with ill-defined lateral dark fascia, black punctures gradually thinning out towards middle of abdomen, first antennal segment with a longitudinal yellow streak, second and third with bases and apices ochraceous and middle brown, fourth and fifth with about one third basal area ochraceous, remaining dark brown, teeth on lateral margin of pronotum yellow; paraclype exceeding clypeus, not meeting in front; marginal tubercles before eyes not well developed; pronotal horns short, conical rather than spinous, lateral margins of pronotum concave; antennal segments uniformly thin, second segment straight; pygophore, ventroposterior margin with relatively deep and almost semi-circular cavity, lateral lobes broad, slanting on inner angle with smooth upper margin, paramere, external margin gently bisinuate, turning smoothly into blade, internal process gradually produced with transverse ridged area, setose thumb short, blunt and bended down, aedeagus, short, tubular, vesica sclerotised, not very long, dorsal conjunctival appendages short, semi sclerotised, ventral conjunctival appendages long, semi-sclerotised, median appendages membranous, trilobate, lateral lobes short, round at apex, middle much longer, narrow; first gonocoxi, postero-external angle slightly produced, paratergite nine a little longer than eighth; spermathecal bulb small with three long processes, all reaching midway to first flange.

Length of male: 15.50 mm, width across humeral horns 7.50 mm.

Length of female: 18.00 mm, width across humeral horns 8.00 mm.

Comparative note

The most distinctive feature of this species, which distinguishes it from all other species is the straight second antennal segment. The pronotal horns of *S. pavlovskii* relatively shorter than of *S. eremica*, but longer than those of *S. obscura*, the semi-circular cavity, of the ventral margin of pygophore is distinctly different from all other species of the genus *Sarju*, the paramere is quite similar to *S. eremica* by having distinct ridge area but thumb process totally different from it while it

completely distinguished from *S. obscura*.

Distribution

Tadjikistan, Barzobm Konadaram Ushch.

Sarju enigma Ghauri

(Figs. 1M, 5D, 6F)

Sarju enigma Ghauri, Ahmad and Afzal, 1984: 134-136.

General body color same as *S. lata* Ghauri, the distal part of antennal segments IV and V smoky and basal end, one fifth ochraceous; head narrow with indistinct angles in front of eyes, antennal segments fine, humeral horns moderate; first gonocoxi relatively much wider posteriorly, its postero-external angle only broadly convex, paratergite nine produced medially, spermathecal bulb very small (deformed) with two long and one very long tubules, the longest almost reaching to first flange.

Length of female: 15.00mm and width across humeral horns 7.00 mm.

Comparative note

Sarju enigma closely resembles to *S. pavlovskii*, specially in the characters head narrowed in front, fineness of antennal segments particularly 2nd, but it is readily distinguished from the latter by the color of its antennal segments, the reduced projections in front of eyes and very wide posterior margin of first gonocoxi, from *S. lata quadrata* this species differs by its narrowing apex of head and smaller outer lobe of paraclypie and its smaller humeral horns.

Sarju lata Ghauri

(Figs. 1N, 2D, 3G, 4J, 5E, 6G)

Body color dull yellow, heavily punctate with black punctures, even transverse ridges of pronotal horns punctate, except traces of impunctate on scutellar basal angles present, apex of scutellum less punctate; head excluding eyes, almost oblong, apex not narrower than vertex between eyes, paraclypie distinctly longer than clypeus, outer lobes of paraclypie prominent, angle in front of eyes not prominent, antennal segments II and III slightly

thick at apices, labium just passing posterior margin of third abdominal segment; pygophore, ventro-posterior margin distinctly sinuate with deep cavity, lateral lobes sub transversely rounded, paramere, apex of blade produced as a long finger-like process, external margin deeply emerginate hump-like near apex, ridge area transverse, stem with

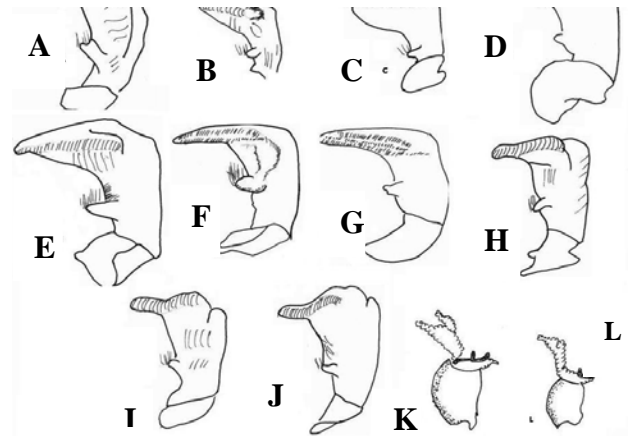


Fig. 4. Apomorphies. Paramere, lateral view; A, *S. obscura*; B, *S. eremica*; C, *S. farrida*; D, *S. burmana*; E, *S. b. khasiana*; F, *S. taungyiana*; G, *S. t. chapa*; H-K, *S. pavlovskii*; I, *S. lata lata*; J, *S. l. quadrata*; K-J, aedeagus; lateral view; K, *S. farida*; K, *S. pavlovskii*

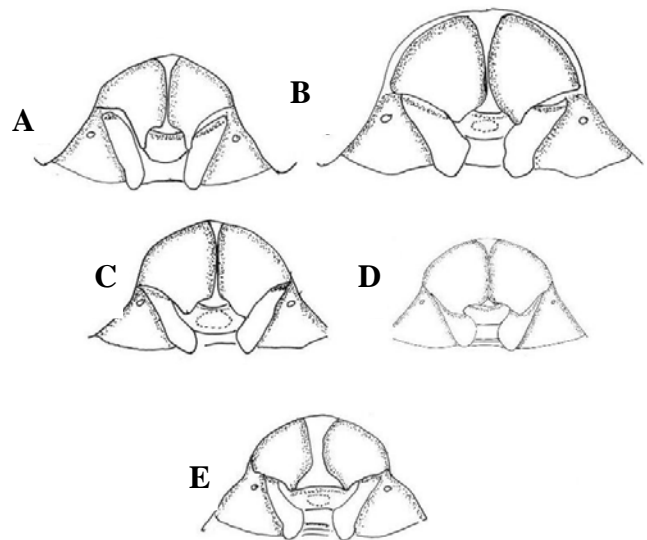


Fig. 5. Apomorphies. Terminalia, dorsal view; A, *S. obscura*; B, *S. eremica*; C, *S. burmana*; D, *S. enigma*; E, *S. lata*.

setoes process short; aedeagus, vesica short, tubular, vesical appendages sclerotised, long, dorsal conjunctival appendage small, semi sclerotised; ventral conjunctival appendages long semi-sclerotised, median conjunctival appendages membranous, trilobite, median- lobe broad, lateral lobes long, narrow, first gonocoxi of female at postero-external angle slightly produced like spine, paratergite nine distinctly longer than eighth; spermathecal bulb small, with two short tubules, hardly reaching to mid-way to first flange.

Length, male 12.50 mm, width across humeral horns 7.00 mm.

Length, female 15.00mm, width, across humeral horns 8.00 mm.

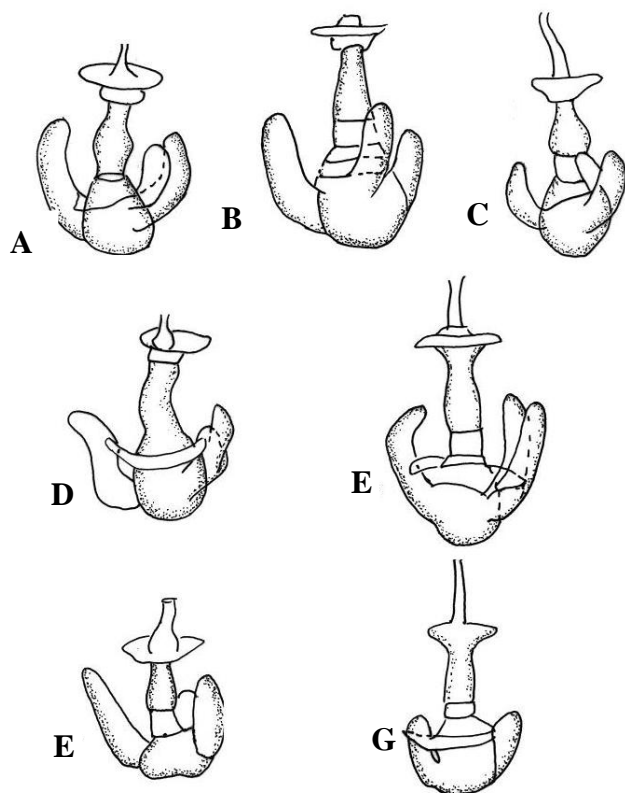


Fig. 6. Apomorphies. Sperm ethical bulb. A, *S. obscura*; B, *S. eremica*; C, *S. burmana*; D, *S.b. khasiana*; E, *S. pavlovskii*; F, *S. enigma*; G, *S. lata*.

Comparative note

Sarju lata closely related to *S. pavlovskii*, but can be differentiated by its punctate humeral horns, apex of head, more-prominent outer lobe of

paraclypie, slightly thicker antennal segments, prominent teeth on the lateral margins of pronotum, narrower apex of its paramere, and by the deep emergination of first gonocoxi on the postero-external angle, spermathecal bulb with only two processes

Sarju lata quadrata Ghauri

(Figs. 2E, 3H)

Body colour same as *lata lata* and *S. obscura*; head excluding eyes, almost rectangular, paraclypie almost as wide as width between eyes, external lobe of paraclypie at right angle to inner lobe, antennal segments relatively thicker, angles in front of eyes very well developed; humeral horns thicker, body relatively looks more heavy; pygophore, posterior margin sinuate with broadly deep cavity, lateral lobes transverse, not produced laterally, paramere, similar as *S. lata lata* except blade relatively wider, aedeagus same as *lata lata*, except lobes of membranous conjunctival appendage not very much differentiated.

Length, male: 15.00 mm, width across humeral horns 8.00 mm.

Comparative note

This subspecies is closely related to *Sarju lata lata* by the shape of its paraclypie and slightly thicker antennal segments but mainly differs by its more squarish apex of head, humeral horns are more prominent, distinctly thicker than *lata lata* therefore body looks more heavy and shape of its paramere.

DISCUSSION

Genus *Sarju* has relationship (Fig. 7) with a big group of genera of tribe Halyini, *Ameridalpa*, *Meridalpa*, *Meridindia*, *Tipulpara*, *Eupaleopada*, *Dalpada*, *Izharocoris*, *Lodosocoris*, *Neolosocoris* and *Cahara* in having characters paraclypie bilobed, outer lobe forming distinct angle with inner lobe (g_1), humeral angles more or less produced into horns (l_1). But genu *Chara* is more close to *Sarju* in having resemblance in body medium size (a_1), male genitalia particularly shape of paramere (o_1) and presence of trilobite dorsal membranous conjunctival appendages of eadeagus (t_1), but it can

easily be distinguished from *Cahara* and has unique position in a group because it has very wide range of distribution and most of its species have 2nd antennal segment bowed and swollen at apex and ventroposterior margin of male pygophore in most of species without median excavation, only few have very indistinct median excavation and absence

of medial lobes in all species (m_2), posterior margin of first gonocoxi variable, may be concave, convex or slightly produced (u_2) and Spermathecal bulb mostly with two to three thick, thin finger like processes (v_2). Therefore *Cahara* plays an out group relationship with *Sarju* by having Ventroposterior margin of pygophore smooth, narrowly sub round with relatively shallow cavity, distinct u-shaped median excavation and lobes on sides (m_1), Posterior margin of first gonocoxae distinctly much produced like-finger mostly reaching to two third of 9th paratergite (u_1) and Spermathecal bulb variable with thick, thin, long, short, finger like or tubule like processes (v_1)

Genus *Sarju* comprises nine species and three sub species, which falls into two groups. First group comprises *S. pavlovskii*, *S. enigma*, *S. lata lata* and *lata quadrata* that play out group relationship with entire remaining clad on the basis of having apomorphies of 2nd antennal segment uniformly straight (k_1) while the whole remaining clad have 2nd antennal segment bowed and swollen at apex (k_2) which is a very unique character in all Halyine species. First group again divided into two sub groups, first sub group includes *pavlovskii* and *enigma* with synapomorphies, antennal segment IV and V about one third basal portion ochraceous, remaining dark brown (c_1), apex of head gently narrowed, external lobe of paraclype narrower than internal lobe (i_1) and spermathecal bulb with three long finger like processes, reaching almost midway of first flang (v_3) while *lata lata* and *lata quadrata* of sub group II play sister group relation ship with each other and out group relationship with *enigma* and *pavlovskii* by having synapomorphies of antennal segment IV and V uniformly reddish brown (c_2), apex of head almost square and external lobe of paraclype very prominent almost as wide as internal lobe (i_2) and spermathecal bulb with two small thick processes (v_4). Group II again divided into two sub groups. Subgroup I consists of *obscura*, *farida*, *angulata* and *eremica* with apomorphies of body above without metallic green sheen (b_1), paraclype not completely enclose clypeus (h_2), stem of paramere relatively short with poorly developed inner process (o_2) and blade small with ridge are distinctly demarcated and close to upper margin(q_2). Among these species *obscura* and

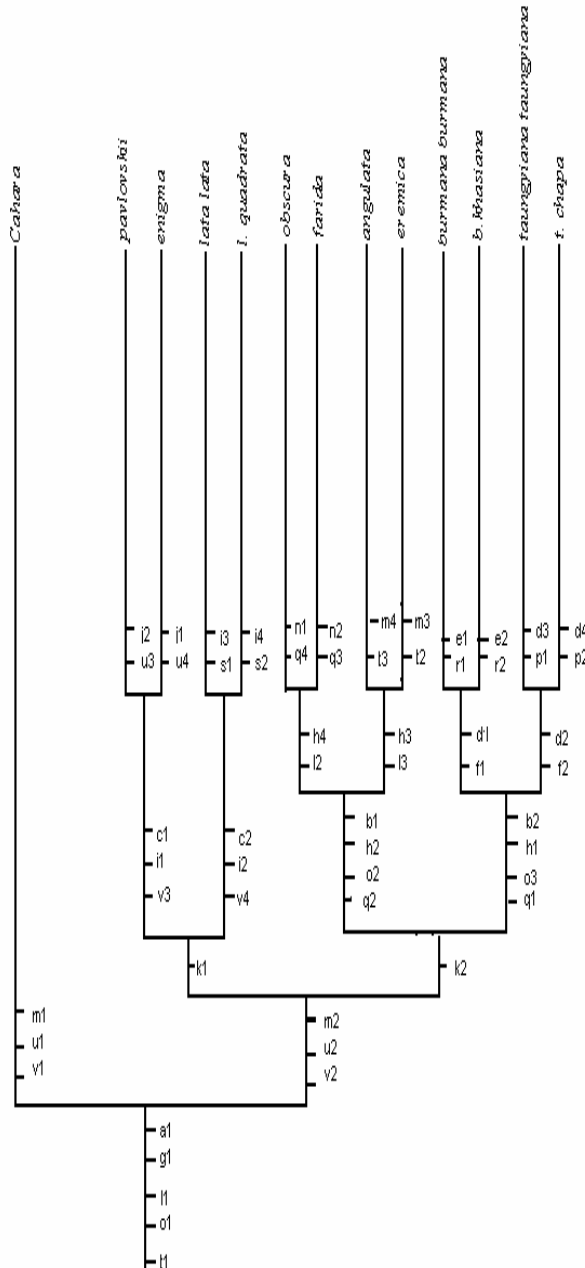


Fig. 7. Cladogram showing relationship of included taxa.

farida play sister group relationship with each other and out group relationship with *angulata* and *eremica* by having synapomorphy of paraclype wider apart (h_4) and humeral angles produced into relatively short horns (l_2) and *angulata* and *eremica* play sister group relationship with each having apomorphies of paraclype partially enclosing clypeus (h_3) and humeral angles produced into long and acute horns forming very distinct angle (l_3). Rest of the clad comprises four species, among these *burmana burmana* and *burmana khasiana* play sister group relationship with each other in apomorphies of apex of scutellum clearly luteus and almost impunctate (d_1) and fascia on connexivum less wider (f_1) while species of *taungyiana taungyiana* play out group relationship with former in having apex of scutellum dark or only obscurely luteus and sparsely punctuate (d_2) and fascia on connexivum much wider (f_2).

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