

**A REVISION OF THE SUB-GENUS BAGRADA STÅL,
1862 (HETEROPTERA, PENTATOMIDAE) FROM PAKISTAN
WITH REFERENCE TO ZOOGEORAPY AND PHYLOGENY¹⁾²⁾**

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Abstract

The type species of the subgenus *Bagrada* sensu-stricto and sensu Horváth 1936, *hilaris* (Burmeister, 1835) is redescribed with special reference to male and female genitalia. Three new species from various localities of Pakistan are described and are compared with their closest ally the type species and the only species known to-date within the subgenus. In the light of the above characters and the notes on their zoogeography, the phylogenetic positions of the subgenus within the genus *Bagrada* Stål, 1862 and of the included species within the sub-genus are also briefly discussed. A key to the included species alongwith a short description of the sub-genus is also given.

Introduction

The taxonomic status of the species of the genus *Bagrada* Stål 1862 of the Indo-Pakistan subcontinent has remained disputed even after the thorough revision of the genus on a world-wide basis by Horváth (1936). Stichel (1960—1962) listed *picta* (Fabricius) and *cruciferarum* Kirkaldy together with *connectans* Horváth and *modesta* Horváth as synonyms of *hilaris* (Burmeister).

Kumar (1962) in his morphotaxomic studies of the genitalia and salivary glands of some Pentatomoidea showed the inflated aedeagus, ejaculatory reservoir and parameres of *cruciferarum* but obviously his diagrams referred to *hilaris* as would be discussed later, on the basis of those of horn-like apical sclerotization of dorsal membranous conjunctival appendage of the inflated aedeagus.

Rai and Trehan (1964) in their external morphology of the species *cruciferarum* showed in their diagram of dorsal view of head, the paraclypei slightly shorter than clypeus, a condition which presently has never been observed within *hilaris*. The above authors, also attempted the study of male and female genitalia but their diagrams and their descriptions are ambiguous and confusing.

1. Supported financially by a USDA Research Project No. A17-ENT-37 (FG-Pa-181), Department of Zoology, University of Karachi.
2. Miss Aqueela Inayat Ali of the above Dept. is sincerely acknowledged for helping in the dissection & Mrs. G. M. Black of British Museum Natural History, London & Dr. L. Hoberlandt of Praha Museum Prague for identification and for sending material and the latter for also reading the manuscript.

Abbasi (1974) in his unpublished Ph. D. thesis on the generic and supergeneric categories of the subfamily Pentatominae from Pakistan included the present genus and described in detail *hilaris* with special reference to male and female genitalia but he neither showed the colour variation found in the representatives of the species from various regions of Pakistan nor did he show horn-like apical sclerotization of the dorsal membranous conjunctival appendage in the inflated condition.

The sub-genus *Bagrada* and the present new species alongwith the type species are described with special reference to the range of their variations with reference to the colour patterns, various components of the body and appendages and male and female genitalia and in the light of their zoogeographical distribution, the phylogenetic positions of the subgenus *Bagrada* within the genus and of the included species within the subgenus are also briefly discussed.

Material and methods

About 2000 specimens on mustard (*Brassica campestris*) and on other cruciferous plants were collected in various expedition programmes during the past 8 years (1967–1975). The type species *hilaris* was found occasionally rising to pest levels, destroying with species of aphids about 1/2 to 3/4th of the seasons crop in Sind and areas of the lower Punjab.

For studying the male genitalia the pygophore was removed in 10 % caustic potash (KOH) solution and was then warmed on a bench lamp for nearly 15 minutes. It was then thoroughly washed in tap water and was dissected and inflated in the same medium, and after passing it through different grades of alcohol, it was kept on thin cotton pad immersed under glycerine in cavity plates for examination & illustration.

For studying the female genitalia the entire abdomen was removed and warmed on a bench lamp in 10 % caustic potash (KOH) solution for about 20 minutes. It was then washed thoroughly in tap water. Spermatheca was dissected out and was stained in acid fuchsin after passing it through various grades of alcohol and the examination was made under glycerine. For making the diagrams Leitz binocular microscopes and eye piece graticules were used.

After studying the male inflated aedeagus including the parameres and female terminalia including the spermatheca these were placed in microvials with a drop of glycerine and were pinned with the specimens. The abdomen of the female was thoroughly dried and then was reattached with the specimens. The measurements of at least 5 male specimens and 5 female specimens of each species, where available, were taken using micromillimeter slide for studying the ratios and proportions of various components of the body and of the appendages.

Sub-genus *Bagrada* Stål, 1862 sensu stricto

Bagrada Stål 1862, Stett. Ent. Zeit. 23 : 105.

Subgenus *Bagrada* Stål, Horváth, 1936, Ann. nat. hist. Mus. Hung. Zool. 30 : 28.

Type species: *Bagrada (Bagrada) hilaris* (Burmeister, 1835)

Head: Anterior portion excluding eyes subequal to posterior portion including eyes, paraclypei either only slightly shorter, more or less equal to or distinctly longer

than clypeus, sometimes enclosing the latter in front, apices rounded, fused or separated and laminated with posterior portion reflexed, markedly concave and anteriorly smoothly convex. Antenniferous tubercles visible from above, basal antennal segments just or hardly reaching or distinctly passing beyond head, 4th antennal segments about twice length of basal segments, labium reaching hind coxae, 1st segment only slightly extending beyond bucculae, eyes prominent, somewhat stalked.

Thorax: Anteriorly, posteriorly and laterally deflected, distinctly more than twice as broad as long, with lateral margins reflexed. Scutellum less than twice the head length with apical lobe sub-acute and much narrower than the base, mesosternum carinate, metathoracic scent gland ostioles without peritreme and with ill defined evaporating area.

Male genitalia: Pygophore subrounded, broader than long, proctiger somewhat quadrangular semi-sclerotized, parameres simple with blade curved at base. Aedeagus bilobed with dorsal membranous conjunctival appendage sclerotized at apex, vesica not extending beyond penial lobes.

Female genitalia: Posterior margin of 7th abdominal sternum deeply emarginate, 'V' or somewhat U-shaped with sides rounded, 8th paratergites small, somewhat triangular, medially fused and extending beyond 9th paratergites, 1st gonocoxae much broader and highly developed, spermathecal bulb simple, elongated, saclike with apical portion sub-rounded, longer than the pump region, without processes.

Key to the species

- 1 Paraclypei distinctly longer than clypeus, sometimes enclosing the latter, basal antennal segments hardly reaching the apex of head; in females the posterior margin of 7th abdominal sternum of inverted 'V' shape with 1st gonocoxae always reaching beyond the posterior margin of 9th paratergites, in males the inner lobe of parameres absent 2
- Paraclypei slightly shorter or subequal to clypeus never enclosing the latter, basal antennal segments usually distinctly reaching or passing beyond the apex of head; in females the posterior margin of 7th abdominal sternum more or less U-shaped with 1st gonocoxae never reaching beyond posterior margin of 9th paratergites, in males the inner lobe of parameres always present 3
- 2 Females usually measuring at least 8.00 mm; apices of 1st gonocoxae somewhat acute (Fig. 42), blades of parameres sickle-shaped without inner knob (Fig. 35), inflated aedeagus with horn-like sclerotization at the apex of dorsal membranous conjunctival appendage (Figs. 33, 34) *hilaris* (Burmeister, 1835)
- Females usually measuring less than 6.50 mm; in females the apices of 1st gonocoxae distinctly rounded (Fig. 44), males not available *intermedia* sp. n.
- 3 Basal antennal segments distinctly reaching beyond apex of head (Fig. 18), anterior of head excluding eyes distinctly longer than posterior of head including eyes; 8th paratergites larger than 9th (Fig. 48), blades of the parameres saw-shaped, (Fig. 41), dorsal thecal lobes prominent *serrata* sp. n.
- Basal antennal segments never reaching distinctly beyond apex of head (Fig. 11), anterior of head excluding eyes much shorter than posterior of head including eyes; 8th paratergites smaller than 9th (Fig. 46), blades of the parameres (Fig. 38), convex with only one inner tooth prominent, dorsal thecal lobes indistinct *trilobata* sp. n.

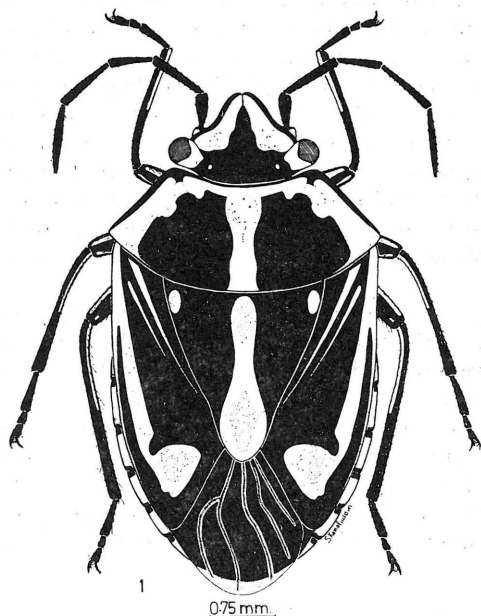


Figure 1: *Bagrada (Bagrada) hilaris* (Burmeister, 1835): dorsal view.

***Bagrada (Bagrada) hilaris* (Burmeister, 1835)**

hilaris Burmeister 1835, Handb. Ent., 2 : 368; Stoll, 1780.

Natural. Afbeeld. Cicaden en. Wantzen, 2 : 133, t. 34, f. 237 et A.: Kp. A. Regio aethiop.
Ae. Ab. Ar. Sy. I. Ir. VI.

picta Fabricius, 1775, Syst. Ent. 715 (n. pr.).

picta Fabricius, 1775; Atkinson 1888, J. Asiat. Soc. Beng. 2 (1) : 58—59.

picta Fabricius, 1775; Hoberlandt 1954, Acta ent. Mus. Nat. Pragae 29 (433) : 133.

f. *connectens* Horvath, 1936, Ann. nat. hist. Mus. Hung. 30 : 47.

connectens Horvath, 1936, Ann. nat. hist. Mus. Hung. 30 : 29.

f. *cruciferarum* Kirkaldy, 1909, Cat. Hem. 1 : 108.

f. *modesta* Horvath, 1936, Ann. nat. hist. Mus. Hung. 30 : 29.

cruciferarum Kumar, 1962, Nec. Rai & Trehan 1964, Entomol. Ts. Arg. 83 (1—2) : 52, 81.

Colouration: Body shining black, pale yellow with orange spots (Fig. 1), venter pale yellow except shining black wide median and lateral patterns of head, wide median and lateral patterns on pro-, meso- and metapleuron, median and lateral patterns including spiracles of abdomen, ocelli reddish, eyes reddish brown with black tinge.

Head: Anterior of head excluding eyes subequal to length posterior of head including eyes, paraclypei anteriorly fused enclosing the clypeus, bucculae with inner margins anteriorly concave and posteriorly distinctly rounded, antennae with basal segments reaching the apex of head, 4th segments distinctly less than twice the length of basal segments, length of segment, 1 0.43 mm (0.43—0.45), 2 0.70 mm (0.70—0.85),

3 0.57 mm (0.57–0.70), 4 0.70 mm (0.70–0.85), 5 0.75 mm (0.75–0.85), antennal formula: $1 < 3 < 2 = 4 < 5$, length of labial segments, 1 0.70 mm, 2 0.90 mm, 3 0.30 mm (0.30–0.35), 4 0.40 mm, labial formula: $3 < 4 < 1 < 2$, length of anterior portion of head excluding eyes 0.55 mm (0.55–0.70), width including eyes 1.70 mm (1.70–1.95), interocular distance 0.80 mm (0.70–0.90), interocellar distance 0.70 mm (0.60–0.80).

Thorax and abdomen: Pronotum anteriorly, posteriorly and laterally deflected, more than twice as broad as long, margins slightly recurved, anterior margins slightly concave without a distinct collar, length of pronotum 1.30 mm (1.30–1.75), width 3.10 mm (3.05–3.00), scutellum about as long as broad, length 1.90 mm (1.90–2.45), width 1.95 mm (1.95–2.45), metathoracic scent gland ostioles ovate, opening into a transverse moderately long groove, membrane of hemelytra longer than abdomen in males and usually slightly shorter than abdomen in females, distance base scutellum-apex clavus 2.50 mm, apex clavus-apex scutellum 0.90 mm, apex scutellum-apex abdomen including membrane 1.80 mm, connexiva clearly exposed at repose, total length 6.10 mm (6.10–8.10).

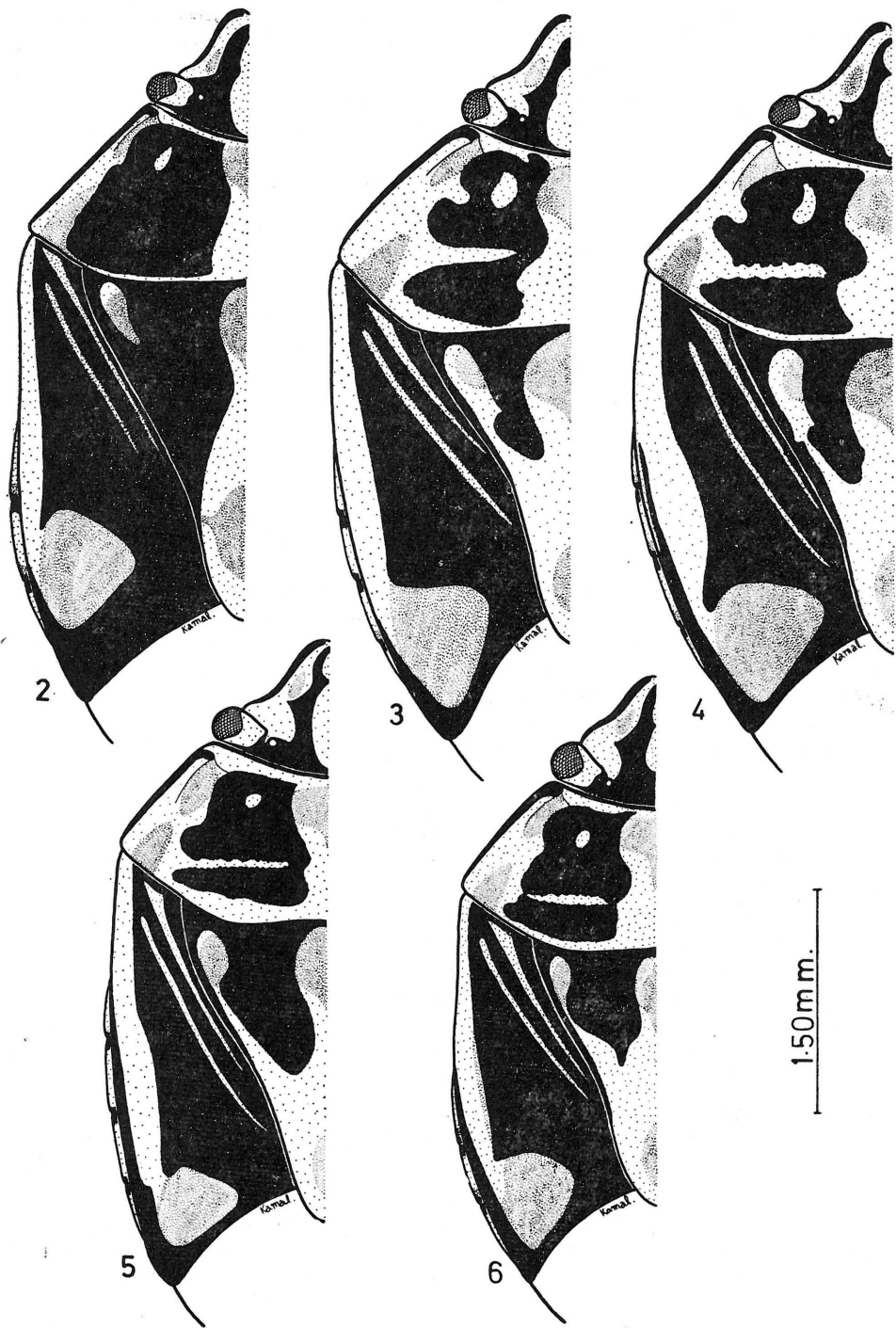
Male genitalia: Pygophore (Figs. 24–26) with dorsomedian surface medially deeply concave and laterally projecting into prominent lobes with tips pointing upwards, ventro-median surface with rounded conical projections, sides of the latter projecting backward into elongated symmetrical projections, parameres (Fig. 35) having comparatively short knife-like blade, smoothly tapering distad, slight conical projection present medially on the inner margin of the blade, median inner lobe sharply acutely pointed, theca (Figs. 33 & 34) with distal margin medially concave, dorsal membranous conjunctival appendage somewhat constricted near the base and not at all tapering distad, apex sclerotized, horn-like, a pair of membranous ventrolateral conjunctival appendages present without median lobe, vesica with penal lobes fused all-around, former distinct only between the prongs of the later, with wide gonopore, a pair of U-shaped fused medially supporting appendages present.

Female genitalia (Fig. 42): Posterior margin of 7th abdominal sternum deeply emarginate, of V-shape, 1st gonocoxae with apical margins deeply concave, with apices rounded, latter widely apart, 9th paratergites much smaller than 1st gonocoxae and 8th paratergites, spermatheca (Fig. 43) with bulb smoothly tapering distad somewhat elongated, pump region somewhat shorter, proximal duct with prominent collar and comparatively with a shorter swollen portion.

Colour variation and sexual dimorphism: The colour pattern of this species from various localities of Sind, Punjab, NWFP and Baluchistan are given in Figures 2 to 6. The males are distinctly shorter than females with membranes of hemelytra passing distinctly beyond abdomen while in females apex of membrane just reaches or slightly passes the apex of abdomen.

Material examined: Homotype ♂, Pakistan, Sind: Tandojam; *Brassica campestris*; 1–2—1974; leg. Ali Khan, det. Mrs. G. M. Black, in Natural History Museum, Department of Zoology-Entomology, University of Karachi.

Other materials: 1011 ♂, 94 ♀, Pakistan, Sind: Mirpursakro, Karachi (Malir), Thatta, Sujawal, Hyderabad, Tandojam, Mianiforest, Matiari, Mirpurkhas, Hala, Khipro, Sakrand, Masarjeewah, Moro, Sukkur and Jacobabad; Punjab: Rahimyarkhan, Multan, Changamanga, Lahore, Lyallpur, Shahdra, Sargodha, Chakwal,



Rawalpindi, Cambelpur and Murree; Baluchistan: Loralai, Ziarat and Fortsandimen; NWFP: Abbotabad, Balakot, Naran, Madyan and Behrin; on *Brassica campestris*, grass, *Medicago sativa*, *Amaranthus viridis*, *Triticum vulgare*, *Raphanus sativus*, *Desmostechnia bipinnata*: 1 to 30—1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 — 1968, 69, 70, 71, 72, 73, 74 and 1975. leg. A. A. Khan, A. Khan, I. Ahmad, F. Ahmad, M. Saleem, A. Raheem, K. Syed, M. Uddin; in the above museum in Ahmad's Coll. in Hamburg Mus. and Inst., in Prague Museum, Praha and in USNM.

Comparative Notes: This species is most closely related to *intermedia* new species in having the characters of paratype enclosing the clypeus and other characters as in the key but can easily be separated from the same by having acute apices of the 1st gonocoxae and 7th abdominal venter distinctly V-shaped as compared to somewhat U-shaped in *intermedia*.

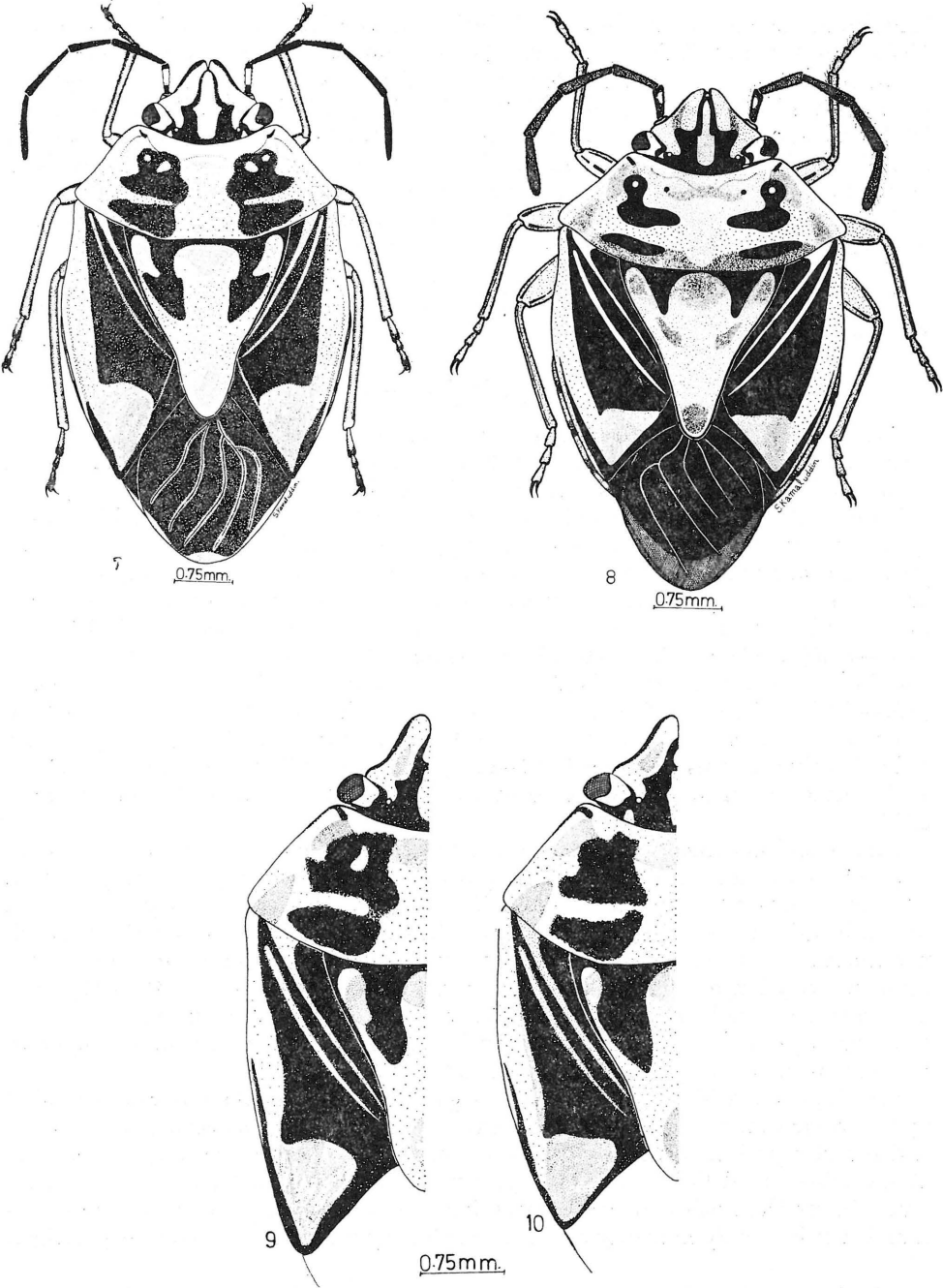
***Bagrada (Bagrada) intermedia* sp. n.**

Colouration: Body dark castaneous, pale white with orange spots (Figs. 7 & 8), venter pale white except dark castaneous thin portion on antero-lateral and median parts, ocelli reddish, eyes brownish black with reddish tinge,

Head: Anterior of head excluding eyes equal to length posterior of head including eyes, paratype meeting just above the clypeus but anteriorly appearing somewhat separated, bucculae with inner margins anteriorly concave and posteriorly truncate, antennae with basal segments hardly reaching the apices of head, 4th segments distinctly less than twice length of basal segments, length of segments, 1 0.40 mm (0.35–0.45), 2 0.70 mm (0.60–0.70), 3 0.50 mm (0.50–0.55), 4 0.70 mm (0.60–0.90), 5 0.70 mm, antennal formula: $1 < 3 < 2 = 4 = 5$, length of labial segments, 1 0.60 mm (0.55–0.60), 2 0.80 mm, 3 0.30 mm, 4 0.40 mm, labial formula: $3 < 4 < 1 < 2$, length of anterior portion of head excluding eyes 0.60 mm (0.55–0.60), length of posterior of head including eyes 0.60 mm (0.55–0.60), width including eyes 1.70 mm (1.50 to 1.70), ocular distance 0.80 mm (0.70–0.80), inter-ocular distance 0.70 mm (0.60 to 0.70).

Thorax and abdomen: Pronotum anteriorly and posteriorly deflected more than $2\frac{1}{2}$ as broad as long, margins slightly but distinctly recurved, length of pronotum 1.25 mm (1.00–1.25), width 3.30 mm (2.80–3.30), scutellum slightly longer than broad, length of the scutellum 2.20 mm (1.80–2.20), width 2.00 mm (1.70–2.10), metathoracic scent gland ostioles with very small slit-like opening into transverse comparatively longer groove, membrane of hemelytra slightly longer than abdomen in female, distance base scutellum-apex clavus 2.80 mm, apex clavus-apex scutellum 1.10 mm, apex scutellum-apex abdomen including membrane 1.70 mm, connexiva partially exposed at repose, total length 6.35 mm (5.70–6.35).

Female genitalia (Fig. 44): Posterior margin of 7th abdominal sternum remarkably arched, somewhat V-shaped, 1st gonocoxae with apical margin markedly emarginated and roundly projected, inner margins at apices widely apart, converging anteriorly at the mid-ventral line. 9th paratergites much smaller than 1st gonocoxae, latter much larger than 8th and 9th paratergites combined, 9th paratergites with sub-rounded apices, only narrowly apart, separated by remarkably narrowed proctiger,



Figures 7—10: *Bagrada (Bagrada) intermedia* sp. n.; 7: dorsal view; 8—10: variations.

spermatheca (Fig. 45) with bulb heart-shaped smoothly tapering distad, lateral margins sinuated, proximal collar-like portion somewhat smaller, swollen portion of proximal duct adjacent to the collar remarkably shorter.

Colour variations and sexual dimorphism: The colour patterns of *intermedius* from various localities of Sind are given in figures 8 to 10. Females are larger in size with membrane of hemelytra just reaching or slightly passing the apex of abdomen.

Material examined: Holotype ♀, Pakistan, Sind: Nabisar; on *Cynodon dactylon*; 16. 4. 1971; leg. A. Khan; in Natural History Museum, Department of Zoology-Entomology, University of Karachi. Paratypes 3 ♀, Pakistan, Sind: Tandojam, Malir and Nabisar, on Wheat (*Iriticum vulgare*), wild bush and *Cynodon dactylon*; 23. 3. 1969, 16. 4. 1970 and 21. 6. 1970; leg. S. Ahmad and A. Khan; lodged at USNM, at Hamburg Mus. & Inst. and in Ahmad's Coll.

Comparative Note: This species is most closely related to *hilaris* in having anterior of head excluding eyes equal to posterior of head including eyes and other characters as noted in the key but can easily be separated from the same by having the paraclypei at least partly opened and proximal sclerotizations of the spermathecal duct before median dilation rounded.

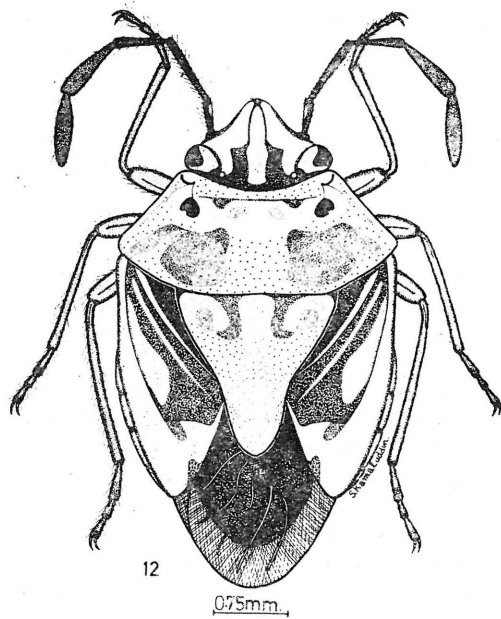
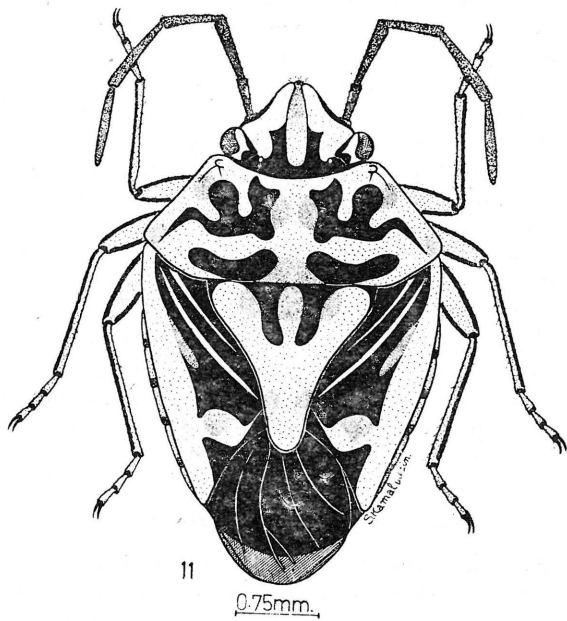
***Bagrada (Bagrada) serrata* sp. n.**

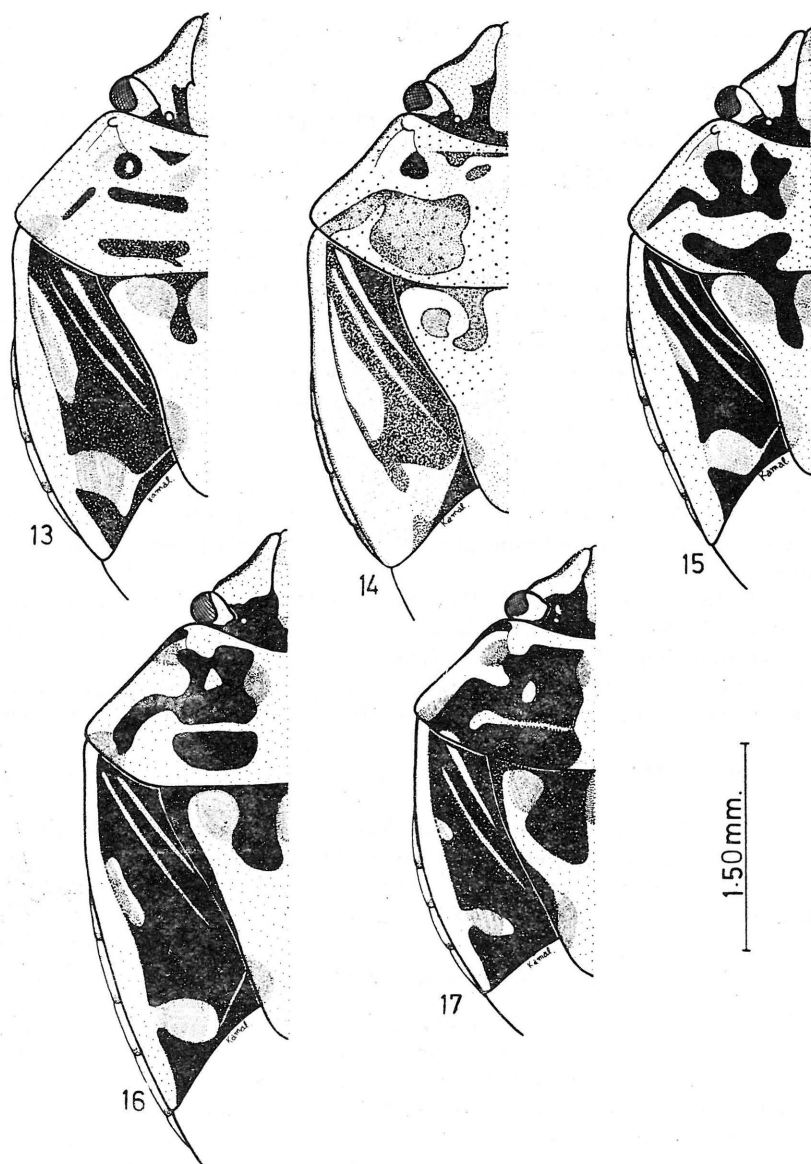
Colouration: Body shining black, dull white with pink spots (Fig. 18), venter dull white except shining black thin portions on antero-lateral parts of pro-, meso and metasternum and pleuron, ocelli light pink, eyes reddish with brownish tinge.

Head: Anterior of head excluding eyes slightly longer than posterior of head including eyes, paraclypei separated from each other and terminating behind and above the clypeus, bucculae with margins anteriorly concave and posteriorly truncate, antennae with basal segments almost passing the apices of head, 4th segments hardly twice length of basal segments, length of segments, 1 0.45 mm (0.75–0.80), 2 0.80 mm (0.75–0.80), 3 0.60 mm (0.55–0.60), 4 0.85 mm (0.80–0.85), 5 0.85 mm (0.85–0.90), antennal formula: $1 < 3 < 2 < 4 < 5$, length of labial segments, 1 0.65 mm (0.60–0.65), 2 0.80 mm (0.80–0.85), 3 0.30 mm (0.25–0.30), 4 0.45 mm (0.40–0.45), labial formula: $3 < 4 < 1 < 2$, length of anterior portion of head excluding eyes 0.60 mm (0.60–0.70), length of posterior of head including eyes 0.50 mm (0.50–0.60), width including eyes 1.65 mm, interocular distance 1.00 mm, interocellar distance 0.60 mm.

Thorax and abdomen: Pronotum anteriorly and posteriorly deflected, margins slightly recurved, more than twice as broad as long, length of pronotum 1.45 mm (1.30–1.70), width 3.10 mm (2.90–3.60), scutellum as long as broad, length scutellum 2.00 mm (1.90–2.40), width 2.00 mm (1.90–2.40), metathoracic scent gland ostioles with a very small slit-like opening into a transverse moderately long groove, membrane of hemelytra much longer than abdomen in males and only slightly longer than abdomen in females, distance base scutellum-apex clavus 2.55 mm, apex clavus-apex scutellum 1.10 mm, apex scutellum-apex abdomen including membrane 1.70 mm, connexiva partially exposed in repose.

Male genitalia: Pygophore (Figs. 30–32) with dorso-median surface medially smoothly concave and laterally projecting into symmetrical lobes, ventro-median surface medially arched with a distinct depression, ventro-lateral surface having rounded projections, parameres (Fig. 41), saw-like blade elongated tapering posteriad,





Figures 11–17: *Bagrada (Bagrada) trilobata* sp. n.; 11: dorsal view; 12: teneral adult; 13–17: variations.

outer margins slightly depressed in middle, inner margins serrated, median inner lobes spine-like, theca (Figs. 39 & 40) with distal margins bilobed, dorsal membranous conjunctival appendage tapering posteriad, apex sclerotized cap-like, a pair of membranous ventro-lateral conjunctival appendages present somewhat reduced with median lobes, penial lobes fused allaround, apex T-shaped, elongated with medially small but well marked gonopore, a pair of thin elongated curved supporting appendages present.

Female genitalia (Fig. 48): Posterior margin of 7th abdominal sternum smoothly emarginate, 1st gonocoxae with apical margins smoothly concave with slightly rounded projections, inner margin sub-straight, distally slightly convex, 9th paratergites much smaller than 1st gonocoxae and 8th paratergites, widely apart with remarkably rounded apices, connected by sclerotized proctiger, spermatheca (Fig. 49) with bulb somewhat elongated, apex rounded with comparatively uniform pump region, proximal funnel-like sclerotization clearly marked, proximal duct following the funnel, forming a short swollen portion.

Colour variation & sexual dimorphism: The colour patterns of *serrata* from Gilgit (northern region of Pakistan) are given in figures 19 to 23. The males are distinctly shorter than females with membrane of hemelytra distinctly passing beyond abdomen while in females apex of membrane just reaches or slightly passes beyond the apex of abdomen.

Material examined: Holotype ♂, Pakistan: Northern region Gilgit; on *Brassica campestris*; 13. 7. 1974; leg. A. A. Khan; in Natural History Museum, Department of Zoology-Entomology, University of Karachi.

Paratypes 14 ♂, 9 ♀; of the same data as holotype, in the above museum and also at USNM, Hamburg Mus. & Inst., Zoological Museum Prague, Praha and in Ahmad's Coll.

Other materials: 23 ♂, 14 ♀; of the same data as holotype, in above museum and in Ahmad's Coll.

Comparative Note: This species is most closely related to *trilobata* in sharing the character of tip of clypeus covered with silvery black-scattered hairs or bristles and characters as listed in the key but can easily be separated from the same by having the shining black body colour and by its comparatively larger size.

***Bagrada (Bagrada) trilobata* sp. n.**

Colouration: Body of chocolate colour, pale white with orange spots (Fig. 11), venter pale white except castaneous posterior half of head and antero-lateral margins of abdominal sternites, ocelli reddish, eyes brownish black with reddish tinge.

Head: Anterior of head excluding eyes slightly less than posterior of head including eyes, paraclypei separated from each other terminating behind and above the clypeus, bucculae with inner margins anteriorly concave and posteriorly truncate, antennae with basal segments almost equal to the apices of the head, 4th segments distinctly more than twice length of basal segments, length of segments, 1 0.25 mm (0.25–0.30), 2 0.55 mm (0.50–0.70), 3 0.40 mm (0.40–0.50), 4 0.60 mm (0.60–0.70), 5 0.65 mm (0.55–0.70), antennal formula: $1 < 3 < 2 < 4 < 5$, length of labial segments, 1 0.55 mm (0.55–0.60), 2 0.70 mm (0.60–0.80), 3 0.30 mm (0.20–0.30), 4 0.35 mm (0.30–0.45), labial formula: $3 < 4 < 1 < 2$, length of anterior portion of head excluding eyes 0.40 mm (0.40–0.50), length of posterior portion of head

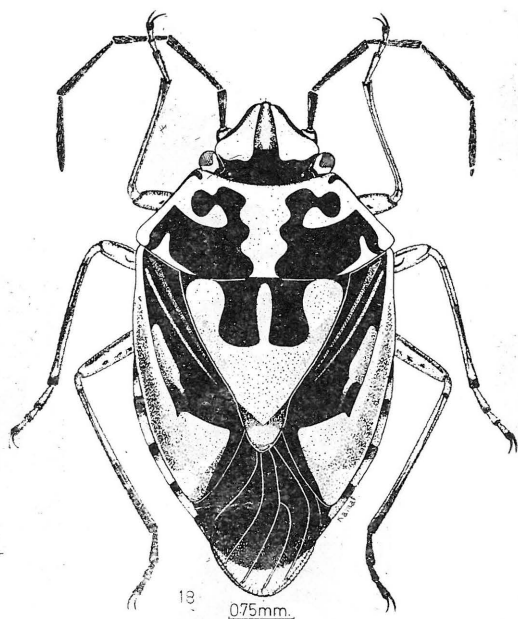
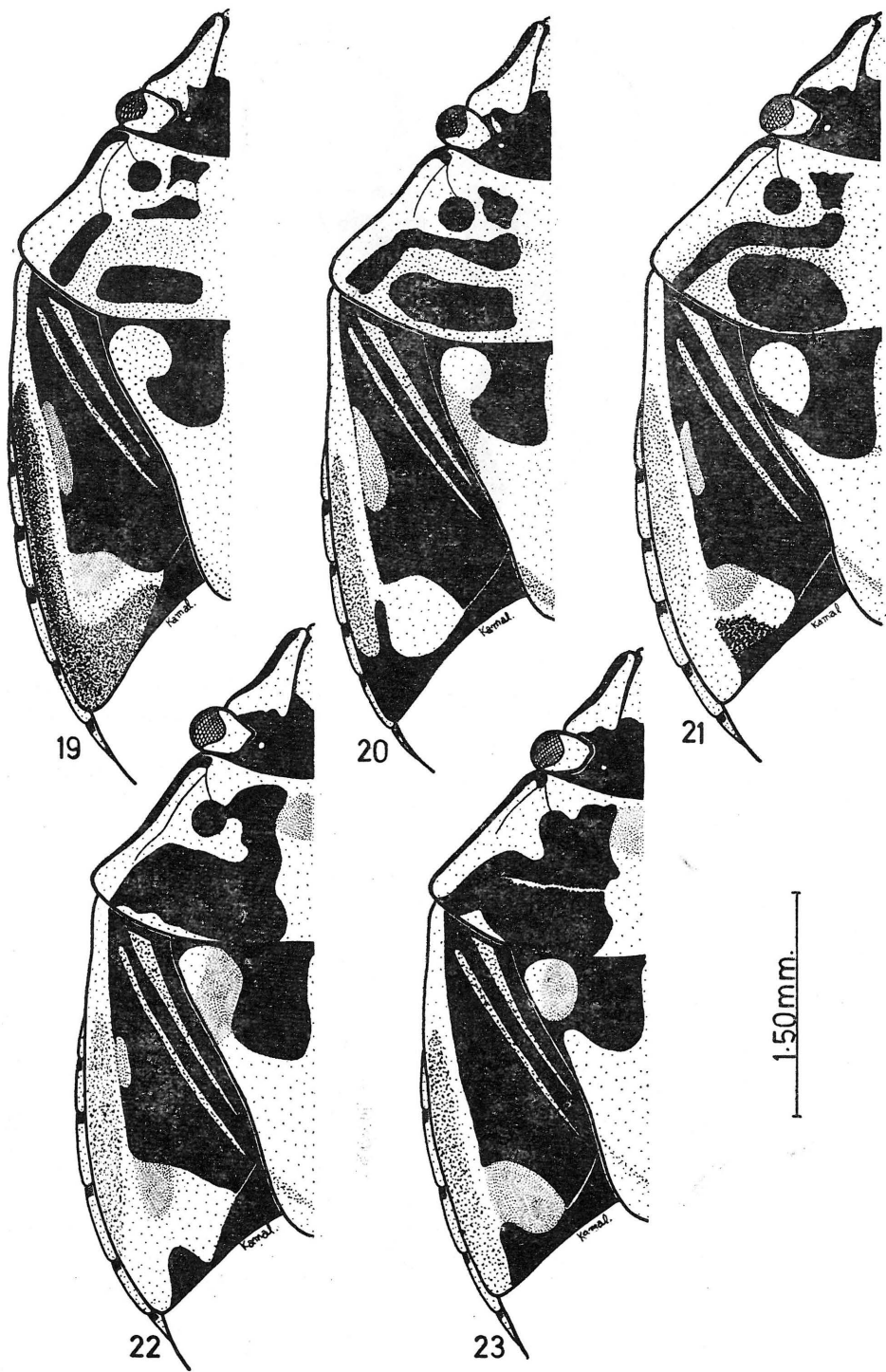


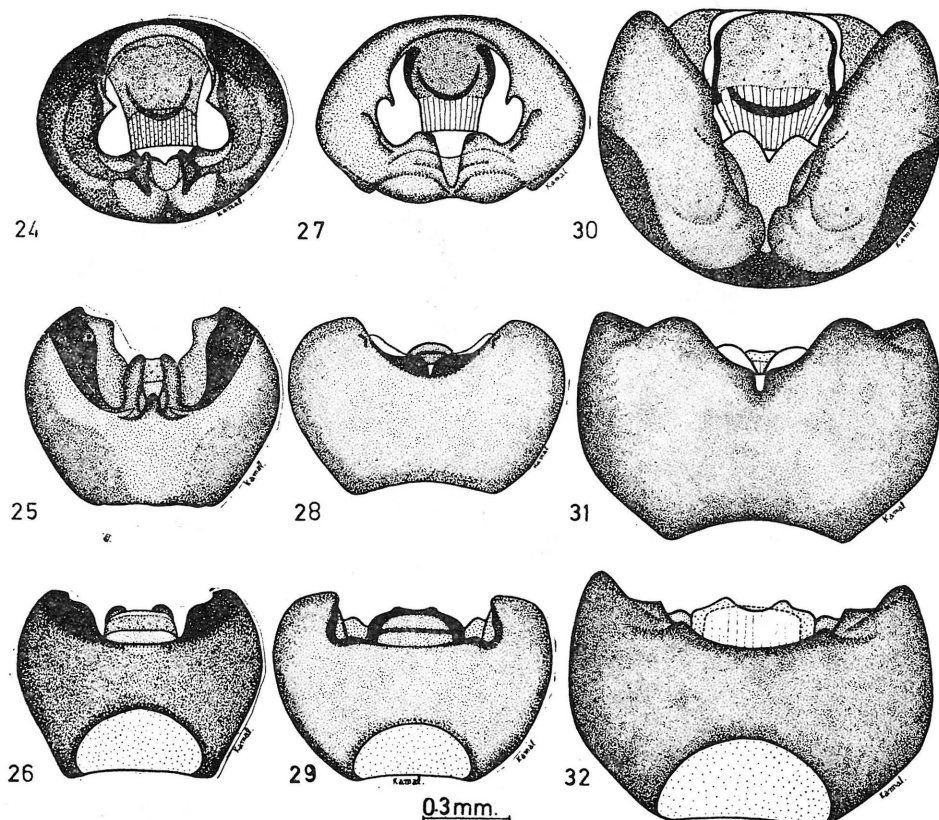
Figure 18: *Bagrada (Bagrada) serrata* sp. n.; dorsal view.

including eyes 0.50 mm (0.50–0.60), width including eyes 1.40 mm (1.35–1.65 inter-ocular distance 0.65 mm (0.65–0.70), inter-ocular distance 0.55 mm (0.55–0.60).

Thorax and abdomen: Pronotum anteriorly and posteriorly deflected, margins distinctly recurved, more than twice as broad as long, length of pronotum 1.20 mm (1.10–1.60), width 2.60 mm (2.60–3.50), scutellum as long as broad, length of scutellum 1.60 mm (1.55–2.20), width 1.60 mm (1.55–2.20), metathoracic scent gland ostioles with a very small slit-like opening into a transverse comparatively shorter groove, membrane of hemelytra much longer than abdomen in females, distance base scutellum-apex clavus 2.00 mm, apex clavus-apex scutellum 0.95 mm, apex scutellum-apex abdomen including membrane 1.40 mm, connexiva hardly exposed at repose, total length 5.10 mm (4.00–6.90).

Male genitalia: Pygophore (Figs. 27 – 29) with dorso-median surface medially slightly concave with sides rounded, laterally remarkably prominent sub-acute and pointing inwardly, ventro-median surface medially distinctly and prominently bilobed, median lobes laterally curving smoothly into lateroposterior lobes, paramere (Fig. 38) sickle-shaped with a slight median projection on the transverse inner side of the blade, apex of the blade sharply pointed, outer margin smoothly convex, median inner lobe finger-like, directing towards blade, theca (Figs. 36 & 37) with distal margins medially concave, dorsal membranous conjunctival appendage tapering posteriad with small sclerotized thumb-like projection, trifurcated membranous ventral conjunctival appendage appearing like fused ventro-lateral and median conjunctival lobes, penial lobes fused, all around, comparatively much smaller, with

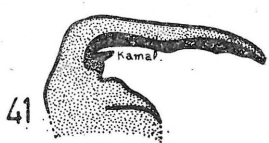
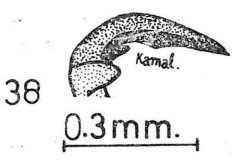
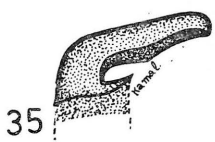
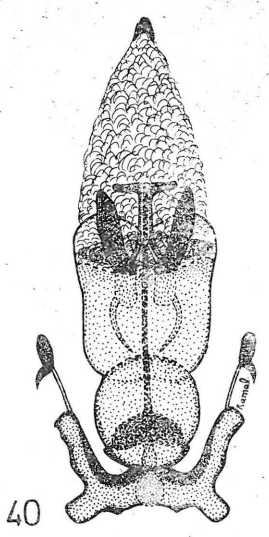
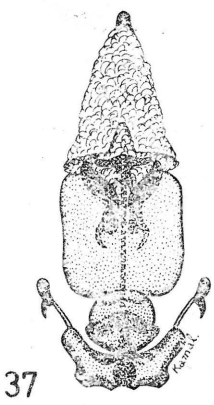
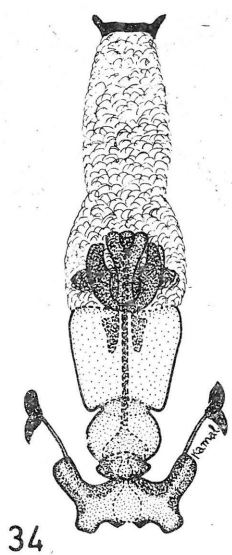
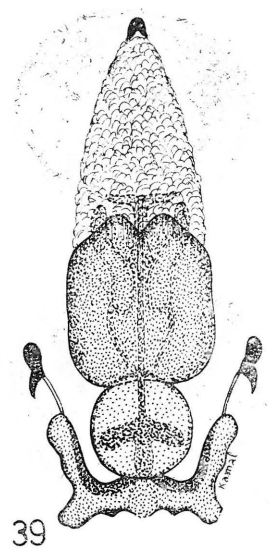
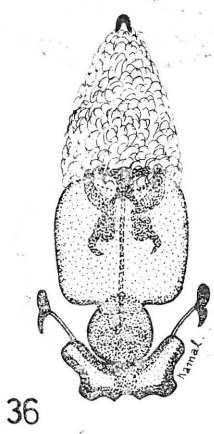
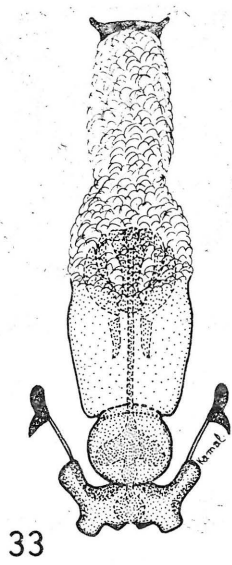




Figures 24—26: *Bagrada (Bagrada) hilaris* (Burmeister, 1835); pygophore; 24: horizontal view; 25: ventral view; 26: dorsal view. Figures 27—29: *Bagrada (Bagrada) trilobata* sp. n.; pygophore; 27: horizontal view; 28: ventral view; 29: dorsal view. Figures 30—32: *Bagrada (Bagrada) serrata* sp. n.; pygophore; 30: horizontal view; 31: ventral view; 32: dorsal view.

the apex somewhat T-shaped with medially very small sub-distinct gonopore, a pair of curved sclerotized supporting appendages present.

Female genitalia (Fig. 46): Posterior margin of 7th abdominal sternum medially emarginate and laterally somewhat sinuate, 1st gonocoxae with distal margins remarkably narrow and convex, sharply curving inwardly then smoothly roundly curving antieriad, 9th paratergites about equal to 8th paratergites and much smaller than 1st gonocoxae, comparatively narrowly separated with rounded apices, connected by somewhat narrow sclerotized proctiger, spermatheca (Fig. 47) with bulb



somewhat elongate tapering distad with apex pointed, pump region comparatively shorter and somewhat thinner, proximal duct following the funnel forming a short smoothly tapering and swollen portion.

Colour variation and sexual dimorphism: The colour patterns of *trilobata* from various localities of Punjab Baluchistan including Ziarat are given in figures 12 — 17. The males are distinctly shorter than females with membrane of hemelytra distinctly passing beyond abdomen while in females apex of membrane just reaches or slightly passes the apex of abdomen.

Material examined: Holotype ♂, Pakistan, Punjab: Chakwal; *Amaranthus viridis*; 20. 5. 1974; leg. A. A. Khan in Natural History Museum, Department of Zoology, University of Karachi.

Paratypes, 11 ♂, 12 ♀, Pakistan, Sind: Tandojam, Malir, Lakhmir goth and Sakrand; Punjab: Changamanga and Bahawalpur, Baluchistan: Ziarat; on *Brassica campestris*, grass; 7. 4., 15., 27. 6. 1968, 1. 2., 8. and 12. 3. 1974, 9. 5., 3. 6. 1974; leg. A. Khan, M. Rahim; in the above museum, at USNM, at Hamburg Mus. & Inst., Zoological Museum, Prague, Praha and in Ahmad's Coll.

Other materials: 29 ♂, 14 ♀, Pakistan, Sind: Sakrand, Tandojam, Kotsajan, Sukkur; Punjab: Rahimyarkhan, Changamanga, Chakwal and Shahdra; Baluchistan: Ziarat; on *Brassica campestris*, grass, *Amaranthus viridis*, *Desmostechnia bipinnata* and *Medicago sativa*: 17. 4., 20. 11. 1968, 22., 23. 3. 1969, 1. 2., 8. 9., 10. 3., 20. 5. 1974; leg. A. A. Khan, A. Khan, I. Ahmad, F. Ahmad, M. Saleem and M. Uddin; in the above museum and in Ahmad's Coll.

Comparative Note: This species is most closely related to *serrata* in sharing long clypeus which is slightly longer than paraclypei and other characters as noted in key but can easily be separated from the same for having remarkably smaller size and other characters noted in the description.

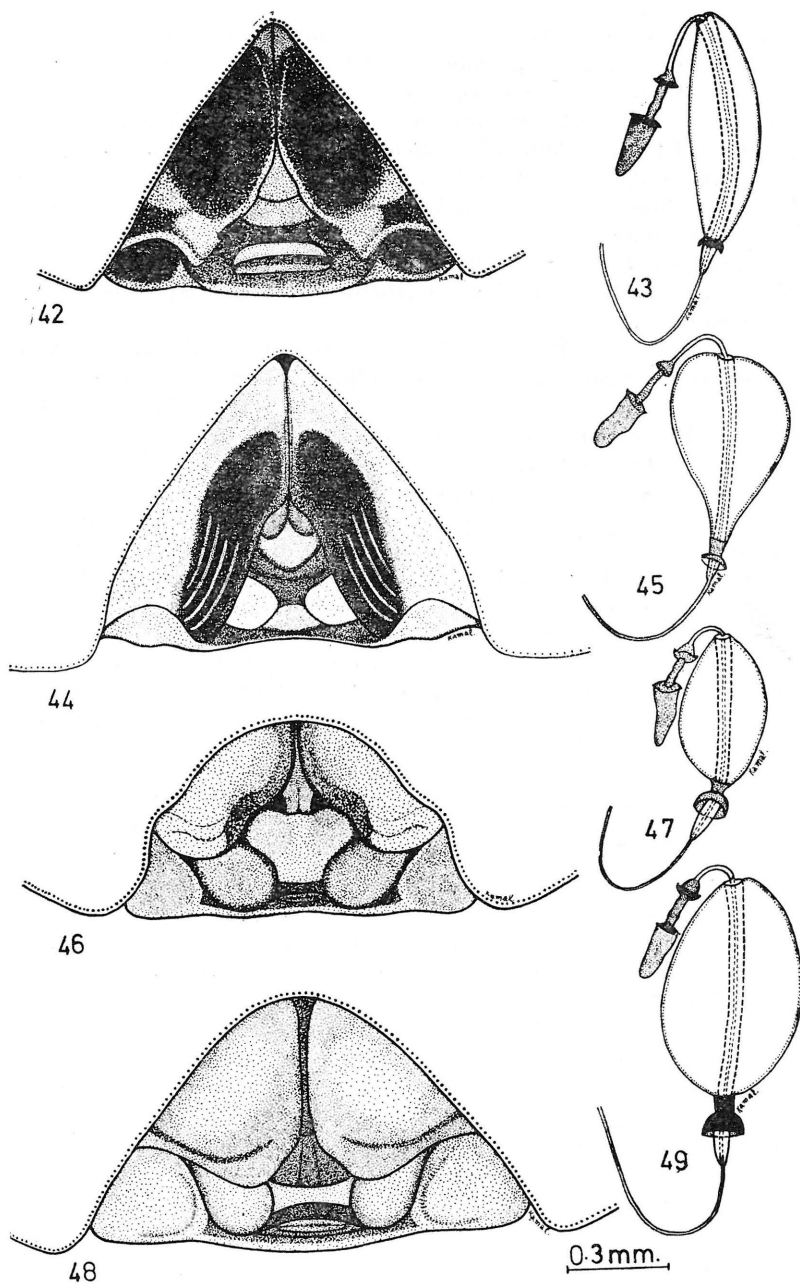
Zoogeography and phylogeny

The type species *hilaris* is reported by Horváth (1936) from the Indo-Pakistan sub-continent, Saudi Arabia, Madagascar, Aretaria, Abyssinia, Central Africa, Moazambique, Pretoria and South Africa. On the other hand Hoberlandt (1954) reported it from Iran but did not report it in the following year from Turkey. Stichel (1960—1962) and Puchkov (1961 and 1965) have not reported it from their working areas, including Turkey, Ukraine and other European countries.

The present record of this species from various localities of Sind, Punjab, NWFP and Baluchistan with the last mentioned locality forming the overlapping zone within the Palaearctic region and another species *serratus* from Gilgit in the northern region strongly suggests that the distributional range of the present subgenus extend within the areas of Palaearctic region and Ethiopian-Oriental border line areas.

The other subgenera *Ayeshella* Horváth 1936 and *Nitilia* Mulsant and Rey 1866 are distributed in the Ethiopian and Palaearctic regions. The male and female

Figures 33—35: *Bagrada (Bagrada) hilaris* (Burmeister, 1835); aedeagus; 33: dorsal view; 34: ventral view; paramere; 35: lateral view. Figures 36—38: *Bagrada (Bagrada) trilobata* sp. n.; aedeagus; 36: dorsal view; 37: ventral view; paramere; 38: lateral view. Figures 39—41: *Bagrada (Bagrada) serrata* sp. n.; aedeagus; 39: dorsal view; 40: ventral view; paramere; 41: lateral view.



terminalia of only *stolata* Horváth of the subgenus *Nitilia* and none of the subgenus *Ayshella* is known in the existing literature.

Kumar (1962) gave the diagrams of parameres and partly inflated aedeagus of *cruciferarum* but as described above his sickle-shaped parameres with rounded apex and horn-like sclerotization of the apex of the dorsal membranous conjunctival appendage clearly referred to *hilaris*.

Whereas the diagrams of the male genitalia given by Rai and Trehan (1964) of *cruciferarum*, appear confusing and in the literature this species is treated as sub-species of *hilaris*. Their dorsal view diagram of head with paraclypei shorter than clypeus, and pointed parameres clearly separate *cruciferarum* from *hilaris*, and broadly rounded paraclypei and clypeus in their diagrams separate their species from all other presently included species of the present sub-genus.

The only available diagram of paramere with remarkably elongated and acute blade and rather shorter 1st gonocoxae in comparison to very long and rounded 9th paratergites in *stolata* of the subgenus *Nitilia* by Puchkov (1965) show the subgenus more generalized as compared to the present subgenus *Bagrada* with variable sizes of the blades usually with median tooth or serration on the inner margins and comparatively very large 1st gonocoxae usually passing beyond the posterior margin of 9th paratergites.

The markedly reflexed lateral margins of the pronotum in the species of the present subgenus and smooth in the species of the other two sub-genera support the above conclusion and in this light it also could be probably assumed that the centre of origin of the genus was somewhere in the Ethiopian region and the species of the present subgenus have probably evolved through their Ethiopian-Palaeartic ancestors.

The above conclusion also suggests that *trilobata* with distributional ranges extending into Baluchistan is probably the most generalized species of the present subgenus with light coloured body, paraclypei more or less equal to clypeus, 1st gonocoxae comparatively shorter in length not at all reaching beyond 9th paratergites and rather shorter and acute blades of parameres.

The other species *serrata* extending, its distributional ranges in Gilgit appears most closely related to *trilobata* retaining light-coloured body, paraclypei nearly equal to clypeus and 1st gonocoxae reduced not at all reaching beyond 9th paratergites. However the above species appears more advanced in having saw-shaped blades of parameres with serrated inner margins and more prominent sclerotization before median dilation of spermathecal duct. The absence of the median lobe of the ventral conjunctival appendage supports the above conclusion.

B. hilaris and *intermedia* appear more advanced within the present subgenus with paraclypei distinctly longer and sometimes enclosing the clypeus, prominently coloured body and females with very long, 1st gonocoxae distinctly passing beyond the posterior margins of the 9th paratergites and the latter usually reduced in comparison to 9th paratergites.

Figures 42–43: *Bagrada (Bagrada) hilaris* (Burmeister, 1835); 42: female terminalia; 43: spermatheca. Figures 44–45: *Bagrada (Bagrada) intermedia* sp. n.; 44: female terminalia; 45: spermatheca. Figures 46–47: *Bagrada (Bagrada) trilobata* sp. n.; 46: female terminalia; 47: spermatheca. Figures 48–49: *Bagrada (Bagrada) serrata* sp. n.; 48: female terminalia; 49: spermatheca.

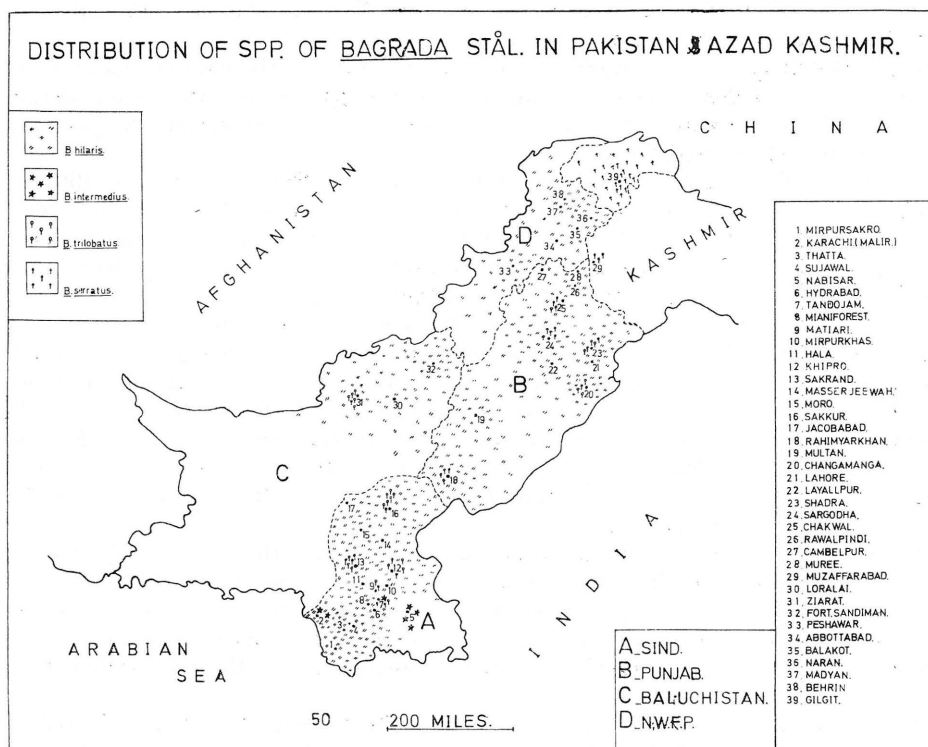


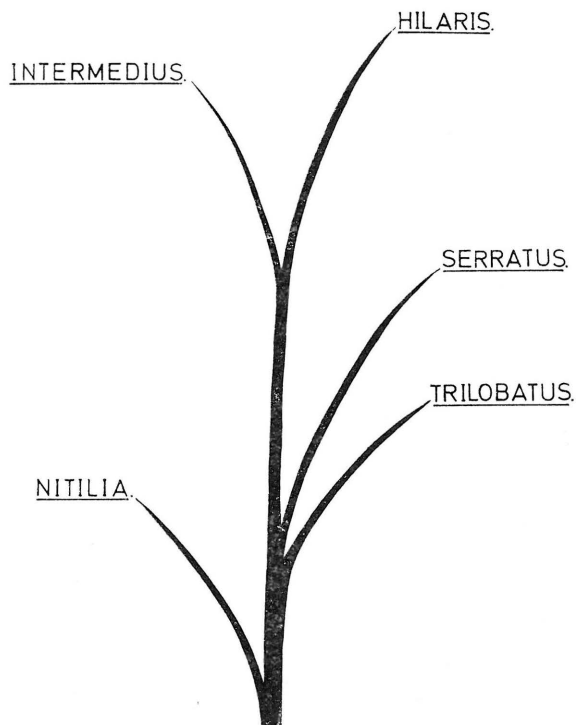
Figure 50: Distribution of species of the subgenus *Bagrada* Stål, 1862 in West Pakistan & Azad Kashmir.

However *hilaris* is probably more advanced in having acute apices of the 1st gonocoxae, absence of the inner lobes in the parameres, proximal sclerotization of the spermathecal duct before median dilation acutely pointed at sides, hornlike apical sclerotization of the dorsal membranous conjunctival appendage and longer and darker body.

The common dominance of the type species occasionally rising to pest level in Sind and lower Punjab with widely distributional ranges in the Oriental, Palaearctic and also apparently in the Ethiopian-Palaearctic border line (also reported from Ethiopian region by Horváth (op. cit.) confirms the above view point and shows its adaptability to different habitats (polyphagous) which is probably the key to its success.

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51. HYPOTHETICAL ANCESTOR.

Figure 51: Diagrams showing the phylogenetic tree of *Bagrada* Stål, 1862.

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