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Redescription of a rare assassin bug *Lophocephala guerini* Laporte (Hemiptera: Heteroptera: Reduviidae: Harpactorinae) from Pakistan

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Abstract. The harpactorinae assassin bug, *Lophocephala guerini* Laporte, 1833 recorded from Pakistan is redescribed in detail for the first time. In the present paper, the dorsal habitus and unique diagnostic morphological characters of this rarely reported species are illustrated along with details of morphometric, which will help future workers to further explore about this special assassin bug.

Key words: Reduviidae, Harpactorinae, *Lophocephala*, redescription, Pakistan.

Introduction

The assassin or reduviid bugs are economically important group of insects as more than 150 species belonging to their subfamilies are categorized beneficial (Ambrose 1999) except the subfamily Triatominae (Rosa et al. 2017; Dorn et al. 2018; Oliveira et al. 2018; Poinar 2018). The subfamily Harpactorinae, first recognized by Amyot & Serville in 1843 as Harpactorides, is one of the largest and the most diversified subfamily of Reduviidae with more than 2,800 species (Weirauch et al. 2014), with 7 tribes and about 327 genera (ITIS 2021). Members of the subfamily Harpactorinae are cosmopolitan but can be frequently found in tropical and subtropical regions, especially on vegetation (Miller 1971; Schuh & Slater 1995). Many species of Harpactorinae are used as biocontrol agents (Grundy & Maelzer 2002, 2003; Grundy 2007; Sahayaraj 2014), as they pin and jab the prey with their long labium (Ambrose 1999); some species show a close association with specific plants and are rarely reported as phytophagous (Bérenger & Pluot-Sigwalt 1997) or coprophagous (Ambrose & Livingstone 1979).

Ambrose (2006) catalogued 156 species of Harpactorinae under 41 genera from India and stated that most of the harpactorines are endemic to scrub jungles, semi-arid zones and adjacent agroecosystem, while some are found in tropical rainforests. Unfortunately, the faunistic research on Reduviidae from Pakistan is insufficient and needs considerable attention (Afzal & Ahmad 2019). The first record of the subfamily Harpactorinae was *Rhynocoris reuteri* (Distant 1879), recorded by Distant in 1904, from Sindh, Kashmir and Baltistan regions of Pakistan; subsequently, he described *Rhaphidosoma tuberculatum* Distant, 1904 from Baluchistan province.

The coprophagy phenomenon is reported in the rare Oriental harpactorine *Lophocephala guerini* Laporte, 1833, which feeds on fermenting cow dung (Ambrose & Livingstone 1979). This rare species was known only from Sri Lanka and India (Distant 1903; Ambrose & Livingstone 1979; Maldonado Capriles 1990; Ambrose 2006). During our recent survey for Reduviidae in Pakistan, we came across only with a few specimens of *L. guerini* in District Swabi of Khyber Pakhtunkhwa Province. *Lophocephala guerini* is special not only in morphology (straight needle-like thinned labium, pronotal region, and lacking paramere) but, also in ethology (dung-feeding and myrmecophily). In the present article, we redescribe this species with digital images of the habitus, male genitalia as well as important morphological characters to facilitate the identification and further studies about this bug.

Materials and methods

This study is based on the materials preserved in the Pakistan Museum of Natural History (PMNH), Islamabad. The dissected parts of the specimens were mounted with glue on triangular cards. One male specimen was polished with 50% aqueous ethanol with the help of a fine brush for more clarity of the illustrations, as the species is heavily clothed with white adpressed tomentose. External morphology was examined using the Nikon SMZ-745 dissecting microscope.

Dried males specimens were softened by keeping in wet tissue, while later the pygophores were removed with the help of forceps and further soaked in lactic acid at room temperature. After six hours at room temperature, the pygophores were boiled with 20% lactic acid for 20 minutes to remove soft tissues, rinsed with distilled water, and dissected in lactic acid under the microscope.

After a thorough examination, the genitalia were stored in glycerine-filled vials and pinned under the corresponding specimens. Photographs were taken by using Canon 7D Mark II digital camera on Olympus BX51 fluorescent and Olympus SZX7 microscopes. Helicon Focus (version 5.3) was used for image stacking. Measurements were obtained by using a micrometer eyepiece. Morphological terminology mainly follows Davis (1969) as well as Lent & Wygodzinsky (1979).

Taxonomy

Family: Reduviidae Latreille, 1807

Subfamily: Harpactorinae Amyot & Servile, 1843

Tribe: Tegeini Villiers, 1948

Genus: *Lophocephala* Laporte, 1833

Lophocephala Laporte, 1833: 12; Amyot & Serville, 1843: 385; Stål, 1865: 54; Stål, 1874: 14; Distant, 1904: 331; Maldonado Capriles, 1990: 226; Ambrose, 2006: 2399.

Type species: *Lophocephala guerini* Laporte, 1833 (by monotypy).

Distribution: Oriental and Ethiopian Regions.

Lophocephala guerini Laporte, 1833 (Figures 1–8)

Lophocephala guerini Laporte, 1833: 12; Burmeister, 1835: 244; Amyot & Serville, 1843: 386; Distant, 1904: 331; Maldonado Capriles, 1990: 227; Ambrose & Livingstone, 1979: 581; Ambrose, 2006: 2399.

Redescription

Coloration: Generally sanguineous, with black markings. Head, neck and scape sanguineous; second to fourth antennal segments violaceous-black; ocellus and clypeus light yellowish; second visible labial segment light brown, third violaceous-black. Anterior pronotal lobe slightly dark sanguineous as compared with hind lobe; pro-, meso- and metasterna violaceous-black except epimeron of propleura and acetabulum; prosternal stridulatory furrow light to dark sanguineous; scutellum violaceous-black, its tip dark sanguineous; wing shinning, anteriorly clavus and corium sanguineous, leg sanguineous, tarsi light yellowish. Abdomen dorsally violaceous-black, ventrally shinning violaceous-black with dark reddish-brown stripes; dorsal scent glands sanguineous; connexivum above and beneath sanguineous with yellowish spiracle; pygophore violaceous-black, while female valvifer sanguineous and valvulae black.

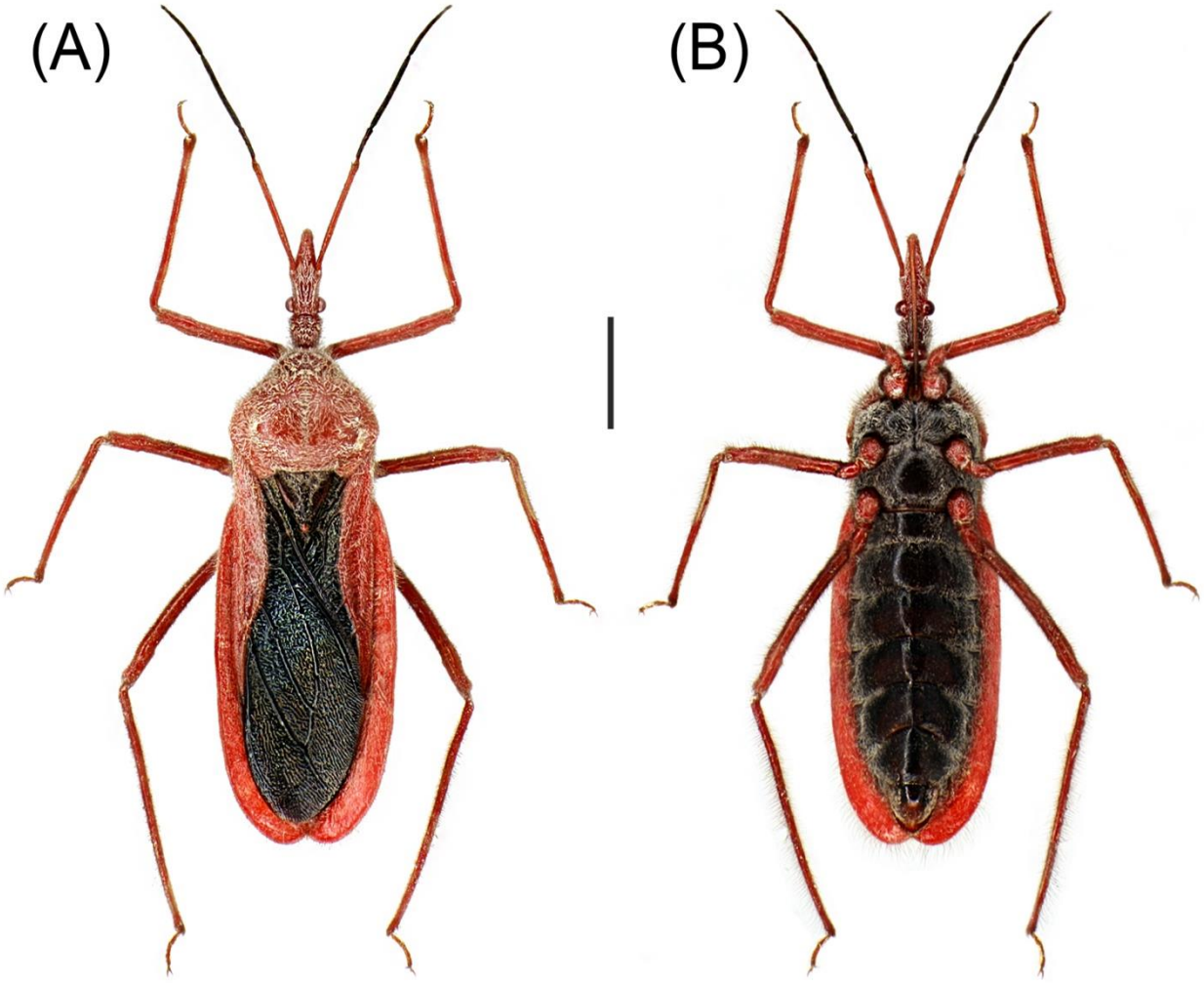

Fig. 1. *Lophocephalaguerini* Laporte, 1833, male habitus. (A) Dorsal habitus; (B) ventral habitus. Scale bar of A–B = 3.00 mm.

Vestiture: Head (Fig. 2A, C), dorsoventrally pronotum (Fig. 3A), corium, ventrally abdomen covered with white adpressed tomentose and light brown short hairs; antennal first and second segments having yellowish to light brownish pilosity (Fig. 2A), third with medium-sized setae, where fourth sparsely beset with scattered oblique setae; labium and scutellum furnished with long yellowish to light brown hairs; abdomen dorsally covered with violaceous black and long brown hairs.

Structure: Head elongate, slender with three distinctly recognizable areas and prominent mandibular plates (Fig. 2A–B), dorsally it is strongly and ventrally feebly depressed, subequal to or slightly longer than scape but shorter than second visible labial segment; anteocular portion longer than postocular; eye conical, projecting outside; ocellus conspicuous and widely apart from each other; neck indistinct dorsally while ventrally prominent; antenna in male longer than female, basal portion of scape impressed; labium straight, elongate, needle-like thin (Fig. 2C) and slightly longer in male than in female, its second visible segment longest.

Pronotum wider than long; in male anterior lobe of pronotum 2.78–2.98 times shorter than the posterior lobe, and in female 2.84–2.97 times; in both sexes, anterior lobe of pronotum declivous, isosceles trapezoid-shaped and partially sculptured; medial longitudinal sulcus of pronotum deep (Fig. 3B); a distinct transverse sulcus separating anterior lobe of pronotum from posterior lobe, posterior lobe of pronotum convex, humeral angles simple and round; thoracic sterna (Fig. 3D) depressed; scutellum triangular (but appears "Y-shaped") with bulbous sanguineous tip (Fig. 4C); prosternal stridulatory furrow not narrowed (Fig. 2D), oblong, its apex just reaching to forecoxae; mesosternum more depressed than metasternum.

Legs in male slightly longer than in female, while in female more thickened than in male; all femora more incrassate than tibiae and subnodulose near base; hind legs considerably longer than fore and middle legs; tibial brush present (Fig. 4D), tarsus three-segmented.

Hemelytron in female slightly surpassing abdominal tip (Fig. 5C), while in male hardly reaching to tergum IX (Fig. 1A); costal margin almost straight; clavus anteriorly broader than posterior part; cubital cell distinct with robust veins (Fig. 4A); membrane with irregular wrinkles; third lobe of hind wing short, hamus long (Fig. 4B).

Abdomen oblong in male, in female with slight dilation; medially intersegmental sutures of terga III-VI convex; scent glands conspicuous at terga III-V (Fig. 5A); in male sternite VIII invisible, ventromedian ridge present; in female sterna II-VI nearly identical, VII sternum largest, sterna IX-XI fused.

Male genitalia: Pygophore elliptic (Fig. 6A–B), laterally with yellowish to light brownish pilosity and covered by connexival angulation; median pygophore process present and parameres absent; phallus compact (Fig. 6C), inner details can only be visible by everting; basal plate robust with distinct "V-shaped" processus of capitatus; basal plate extension triangular (Fig. 6F); base of struts strongly sclerotized with small rounded lumps, its rods widely separated at base and fused in middle, apically with bulbose concave tip (Fig. 6D); both distal dorsal sclerite of endosoma and distal ventral sclerite of the endosoma robust and bifurcated (Fig. 6D, F).

Female first valvifer is broad and subtriangular, while the first valvula is thin and longly triangular (Fig. 5C).

Measurements (in mm): male (n= 2)/female (n= 2). Body length: to apex of connexivum 19.04–19.21 / 17.03–17.70; to apex of abdomen 17.87–17.91 / 17.20–17.95; length of abdomen 9.00–9.12 / 8.00–8.30; greatest width of abdomen 5.10–5.21 / 6.21–6.72; head length 3.00–3.35 / 3.25–3.30; greatest width of head 1.02–1.11 / 0.92–1.00; length of anteocular part 1.70–1.88 / 1.90–1.90; length of postocular part 0.90–1.00 / 0.90–0.92; eye length 0.65–0.67 / 0.55–0.55; eye width 0.42–0.44 / 0.38–0.49; distance between eyes 0.50–0.76 / 0.55–0.59; distance between ocelli 0.59–0.60 / 0.71–0.78; length of antennal segments I-IV= 3.23–3.27 / 2.81–2.93, 0.92–1.01 / 0.99–1.12, 2.24–2.50 / 1.86–2.05, 1.95–2.01 / 1.71–1.95; length of visible labial segments I-III= 0.63–0.69 / 0.63–0.63, 3.65–3.69 / 3.40–3.65, 0.46–0.47 / 0.49–0.51; length of anterior pronotal lobe 0.92–1.01 / 0.84–0.94; greatest width of anterior lobe of pronotum 2.00–2.11 / 1.98–2.08; length of posterior pronotal lobe 2.75–2.81 / 2.50–2.67; greatest width of pronotum 4.25–4.35 / 4.00–4.10; length of scutellum 1.35–1.55 / 1.55–175; basal width of scutellum 1.72–1.75 / 1.73–1.75; length of hemelytron 11.69–11.74 / 11.19–11.86; greatest width of hemelytron 3.50–3.75 / 3.85–4.25; length of hind wing 8.30–8.40 / 8.12–8.51; greatest width of hind wing 2.70–2.78 / 2.98–3.20; lengths of fore leg trochanter 1.00–1.16 / 0.92–1.05, femur 3.35–3.75 / 3.32–3.70, tibia 4.70–4.90 / 4.50–4.95, tarsus 0.85–0.95 / 0.90–0.92, pretarsus 0.25–0.25 / 0.25–0.25; lengths of middle leg trochanter 1.00–1.05 / 0.95–1.15, femur 3.45–4.05 / 3.55–4.50, tibia 4.30–4.60 / 4.20–4.50 tarsus 0.80–0.90 / 0.90–0.92, pretarsus 0.25–0.25 / 0.25–0.25; lengths of hind leg trochanter 1.00–1.16 / 0.95–1.05, femur 4.45–5.00 / 4.48–4.80, tibia 6.50–6.90 / 6.10–6.20, tarsus 0.95–0.95 / 0.85–0.92, pretarsus 0.25–0.25 / 0.25–0.25.

Material examined

PAKISTAN: 2♂, 1♀, viii.2017, Khyber Pakhtunkhwa, Swabi, Baja Wildlife Park, leg. Syed Ishfaq Ali Shah and Azaz Ahmad, PMNH; 2 ♂, 1983, Islamabad-Capital, leg. Abro, PMNH-3257, PMNH-3335; 1♀, 1984, Islamabad-Capital, leg. Faiz, PMNH-39451.

Distribution

Pakistan [Khyber Pakhtunkhwa, Islamabad-Capital, (Fig. 7)]; India (Ambrose, 2006); Sri Lanka (Distant 1904; Maldonado Capriles 1990; Ambrose 2006).

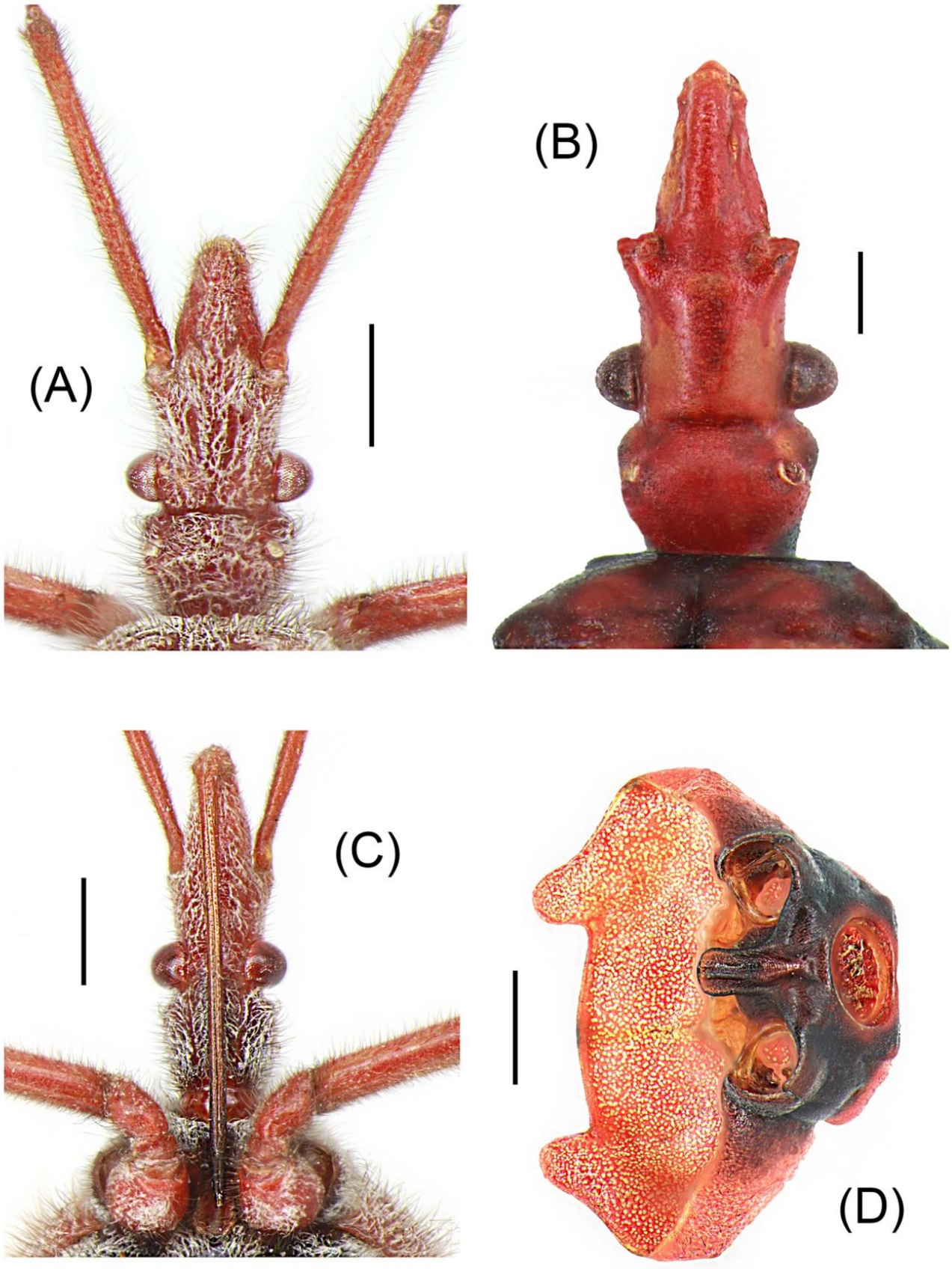

Fig. 2. *Lophocephala guerini* Laporte, 1833, male head, anterior lobe of pronotum and prosternal region. (A) Dorsal view unpolished head with sanguineous scape; (B) dorsal view of the polished head with distinct three lobes of the head, mandibular plate and anterior lobe of pronotum; (C) ventral view of the unpolished head with globular eyes, thinned labium, distinct neck and stridulitrum between the sanguineous acetabula; (D) ventral view of polished stridulitrum. Scale bar of A, C–D = 1.00 mm; B = 0.50 mm.

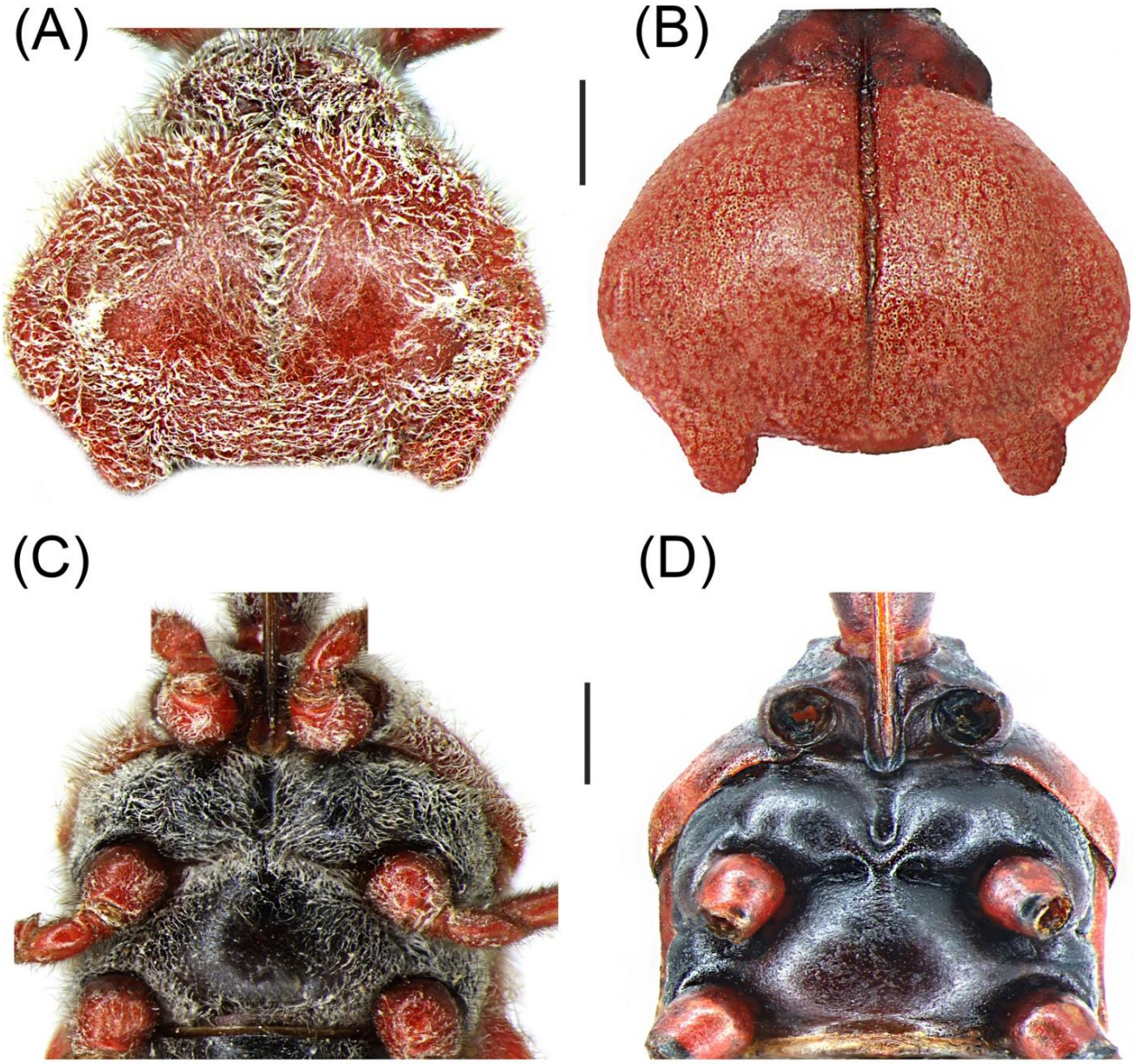

Fig. 3. *Lophocephala guerini* Laporte, 1833, male pronotal region and thoracic sterna. (A) Dorsal view of unpolished pronotal region; (B) dorsal view of polished pronotal region; (C) ventral view of unpolished thoracic sterna; (D) ventral view of polished thoracic sterna. Scale bar of A–D = 1.00 mm.

Discussion

Distant (1904) placed the genus *Lophocephala* Laporte under the division Harpactoraria, whereas Davis (1969) placed it in tribe Tegeini in the subfamily Harpactorinae. Currently, Tegeini Villiers, 1948 is the smallest tribe of Harpactorinae and comprises *Lophocephala* and *Tegea* Stål, 1863. The genus *Lophocephala* includes only two species i.e. *Lophocephala guerini* and *L. vicina* Signoret, 1860.

The coprophagous and myrmecophilous phenomena have been collectively reported in the Oriental harpactorine *Lophocephala guerini*. Microhabitat and feeding behavior of *L. guerini* on fermented cow dung was studied by Ambrose & Livingstone (1979). Both the adult and nymphs were observed under the stones near the formicine ant, *Anoplolepis longipes* (Jerdon). The early morning, they followed ants to the fermented cow dung. After congregational feeding, the adults mate on the way back to their habitat (Ambrose & Livingstone, 1979). We did not see them personally, however during the survey of Khyber Pakhtunkhwa Province, we collected a few specimens of this species only near the breeding places of wild deer at Baja Wildlife Park in District Swabi (Fig. 8). This park is located in the center of many adjacent villages, where the cattle population is very large, especially the buffalos and cows, the primary source of local dairy farming. The villagers very commonly store dung for fuel and farmyard manure.

Lophocephala guerini can easily be recognized by its sanguineous and black color habitus, clothed with white adpressed pubescence, narrowed characteristic head with long and thin labium. We surveyed eleven districts in Khyber Pakhtunkhwa Province, nine in

Punjab Province, three in Azad Jammu and Kashmir State and Islamabad-Capital for the reduviid fauna. Interestingly, this rarely located species has only been collected from district Swabi in Khyber Pakhtunkhwa Province (Fig. 8) late in the morning.

Acknowledgments

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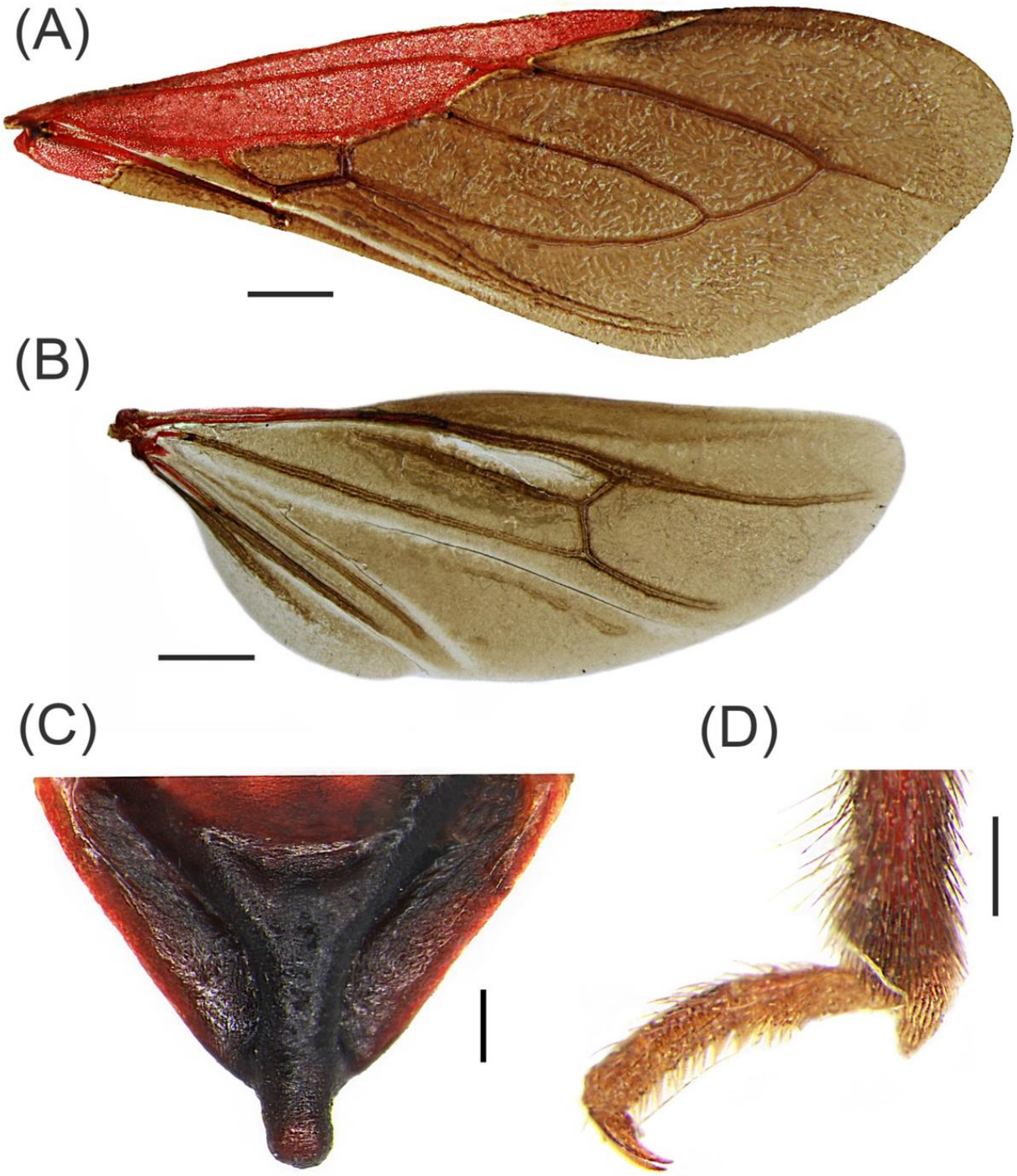

Fig. 4. *Lophocephala guerini* Laporte, 1833, male hemelytron, hindwing, scutellum and tarsus. (A) dorsal view of hemielytron; (B) dorsal view of hindwing; (C) dorsal view of polished scutellum; (D) posterior leg tarsus with the tibial brush. Scale bar of A–B = 1.0 mm; C–D = 0.25 mm.

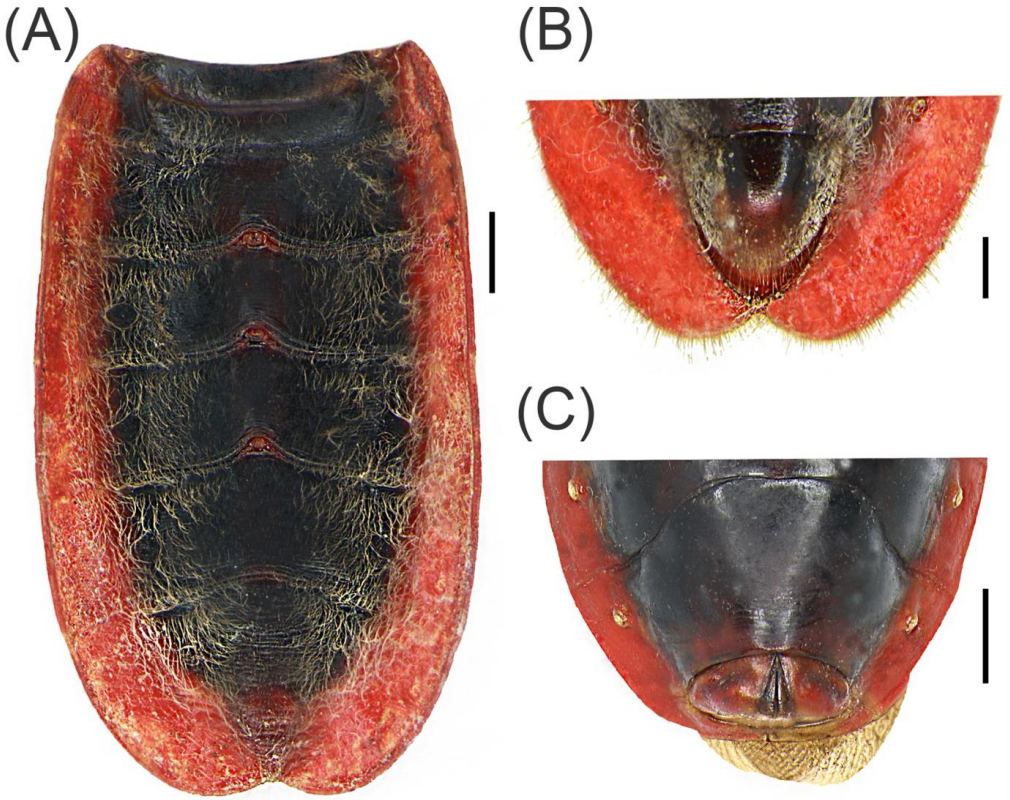

Fig. 5. *Lophocephala guerini* Laporte, 1833, male and female abdomens. (A) dorsal view of male abdomen with distinct scent glands; (B) ventral view of male pygophore; (C) ventral view of female venter with distinct spiracles. Scale bar of A = 1.00 mm; B–C = 0.5 mm.

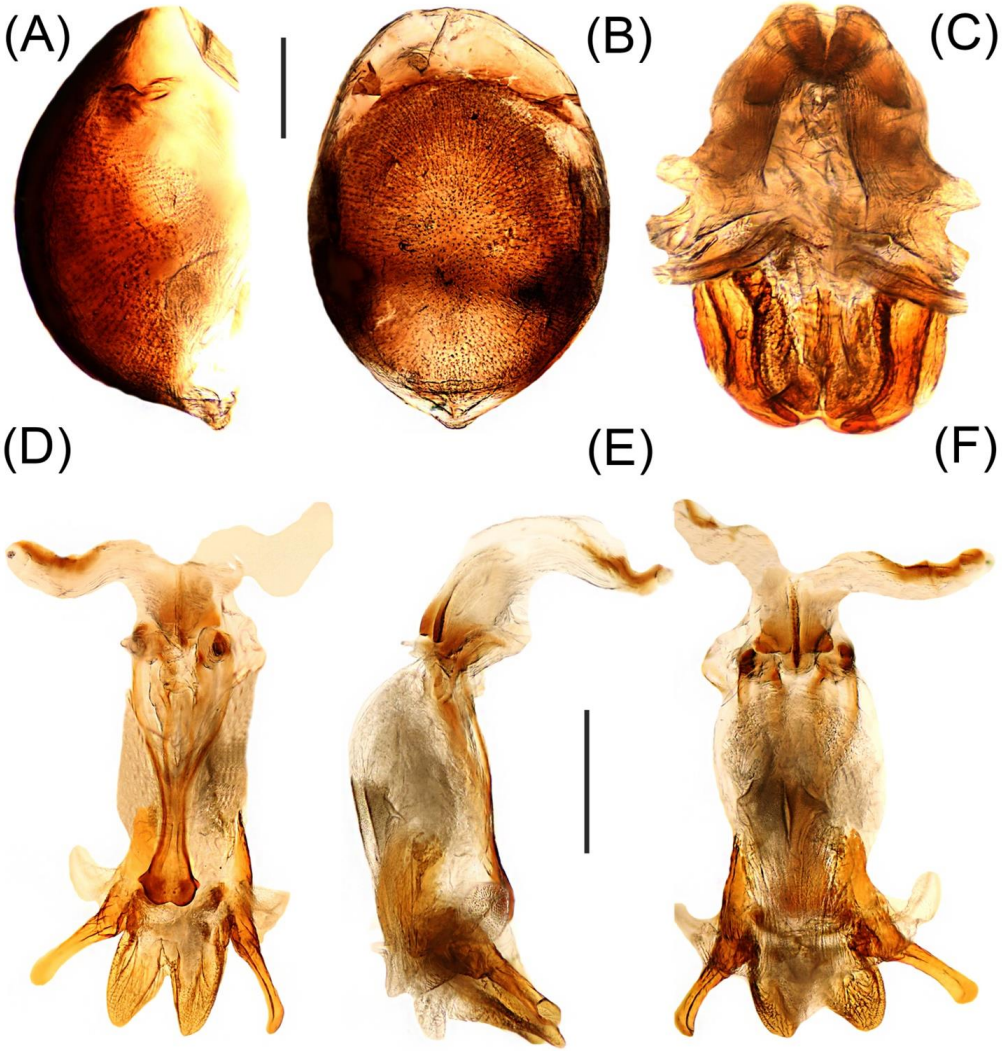

Fig. 6. *Lophocephala guerini* Laporte, 1833, male genitalia. (A) Lateral view of pygophore; (B) Ventral view of pygophore; (C) dorsal view of fused phallus; (D) dorsal view of everted phallus; (E) lateral view of everted phallus; (F) ventral view of an everted phallus. Scale bar A–E = 1.00 mm.

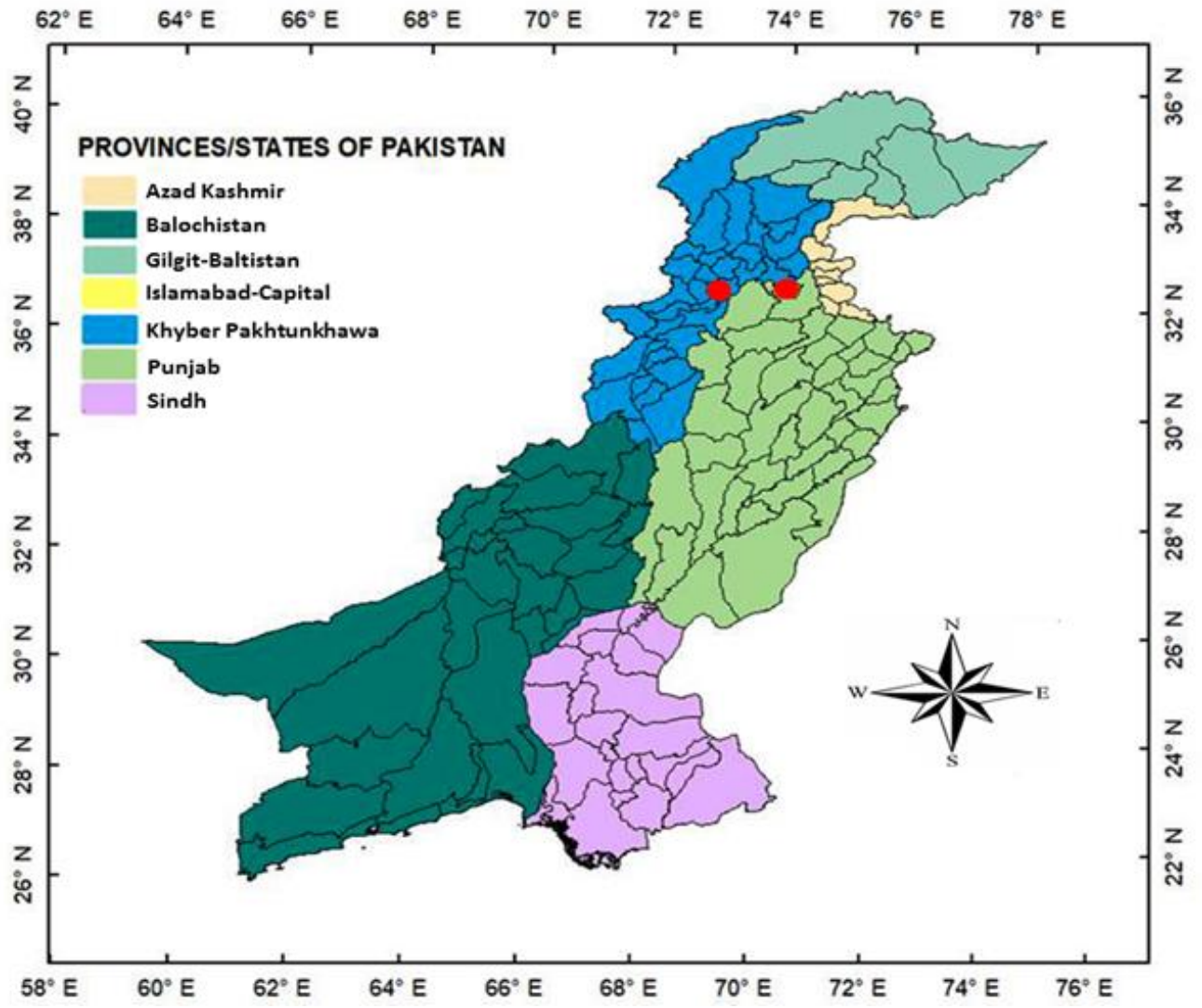

Fig. 7. Distribution of rarely reporting *Lophocephala guerini* Laporte, 1833 in Pakistan.

Fig. 8. View of the Baja Wildlife Park, Swabi, Khyber Pakhtunkhwa province, where *L. guerini* was collected.

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