Research Article

# A Contribution to the Asopinae (Hemiptera: Pentatomidae) With one New Record of Predatory Stink Bug *Zicrona caerulea* (Linnaeus 1758) from District Khairpur Sindh, Pakistan

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**Abstract** | The current findings on stink bugs were placed together from different sites of the Khairpur district. Moreover, investigation and recognition are conceded at the Insect Systematic Postgraduate Laboratory, Department of Zoology, Shah Abdul Latif University Khairpur. Specimens were gathered by traditional hand net and on the light trap from different sites and are killed in a jar having potassium cyanide and mounted via entomological pins. Samples are recognized up to the species level through the support of keys available for the region in different publications. Photographs of the adult and genitalia were taken with cameras fitted on the microscope. This revealed the occurrence of 46 specimens and identified 05 species under the subfamily Asopinae. *Z. caeruleas* (Linnaeus 1758) predatory stink bug is premalinary described from the district Khairpur Sindh province of Pakistan. Photographs of the adult as well as male and female aedeagus, conflicting on the biodiversity table are provided.

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## Introduction

Family Pentatomidae is the fourth largest family of the Hemiptera order, they are well known as stink bugs, and they are emitted bad smell through aroma glands which are located in the part of the metacoxae. Work on the fauna of stink bugs is presented by different authors from various countries (Zhonghua *et al*., 2012; Candan *et al*., 2014).

There are 1,250 genera and 7,200 species scattered worldwide (Ali, 2021). The Pentatomidae family contains fifteen subfamilies: Asopinae, Podopinae, Cyrtocorinae, Discocephalinae, Phyllocephalinae,

Edessinae, Pentatominae, and Serbaninae (Henry, 2017). From Palaearctic region contains 37 genera, and 953 species from five subfamilies (Aukema *et al.*, 2013). In the Nearctic region 450 species are in 80 genera (Henry, 2009), and in the Oriental region, 180 species (Lis, 2013; Pluot and Lis, 2008). Presently 32 species have been reported from the Neotropical regions (El-Bouhssini *et al.*, 2002; Claver and Jiaswal., 2013).

The different authors explained the Pentatomidae fauna in deep from different countries. Although Pentatomidae stink bugs were described from the areas of Karachi, Jamshoro, and Swat, Pakistan (Distant, 1918; Nasreen *et al.*, 2006; Ahmad, 1974; Ahmad and Afzal, 1979, 1984; Afzal and Ahmad, 1981; Siddique *et al.*, 2000, Westwood 1837; Ahmad and Kamaluddin, 1988; Siddiqui, 2000; Zahid and Ahmad, 2009; Azim 2001, 2002, 2008, 2011, Pluto 2008, Swanson *et al.*, 2012; Kandhro *et al.*, 2016; Shabana *et al.*, 2018, 2019, 2021, 2022; Mehneh *et al.*, 2010; Lis 2013, Golestan *et al.*, 2011). Subfamily Asopinae added 350 species and 60 genera worldwide (Thomas *et al.*, 1994; Gapud, 1981).

Genus *Zicrona* (Amyot et Serville 1843) is a member of the subfamily Asopinae, they are scattered in all regions and countries: Oriental, Nearctic, as well as Palaearctic region, Africa, Burma, Syria, Equatorial Guinea, Pakistan, Australia, North America, Central America, India, Iran, China, Japan, Turkey, Greece Malawi and Madagascar (Altaf *et al.*, 2017; De Clercq, 2008; De Bortoli and Volpe, 2011; Pericart, 2010; Chopra and Sucheta, 1984; Vacari Debortoli, 2007).

They are identified on the lengthened rostrum and they are useful as biocontrol agents, paraclypeus lengthier than clypeus, pronotum broader, scutellum broader at the base, antennae five-segmented, labium four-segmented, male genitalia (aedeagus) pygophore broader than longer concave, paramere sinuate, stem short, blade lengthened, 1st gonocoxae sinuate, 8th paratergites triangular, spermathecal bulb large. *Z. caerulea* and *Z. murreenis,* these are two species are recorded from different localities of Pakistan such as Karachi, Murree, Abbottabad, Balakot, Ghari, Habibullah, Kagan, Narran, Kalam, Muzaffarabad, Chunari, Sylhet in East Bengal, Rawalpindi and changmanga (Niyazi and Feyzi, 1983; Schuh and Slater, 1995; Ahmed, 1974).

They are predatory stink bugs of various insect orders. They play an important role in the inhabitant balance of phytophagous insects and have reduced pesticide use on crops, vegetables, forests, and agricultural systems. Therefore, conserve the ecosphere and biological control agents (Junior *et al.*, 2022; Claver and Jaiswal, 2013).

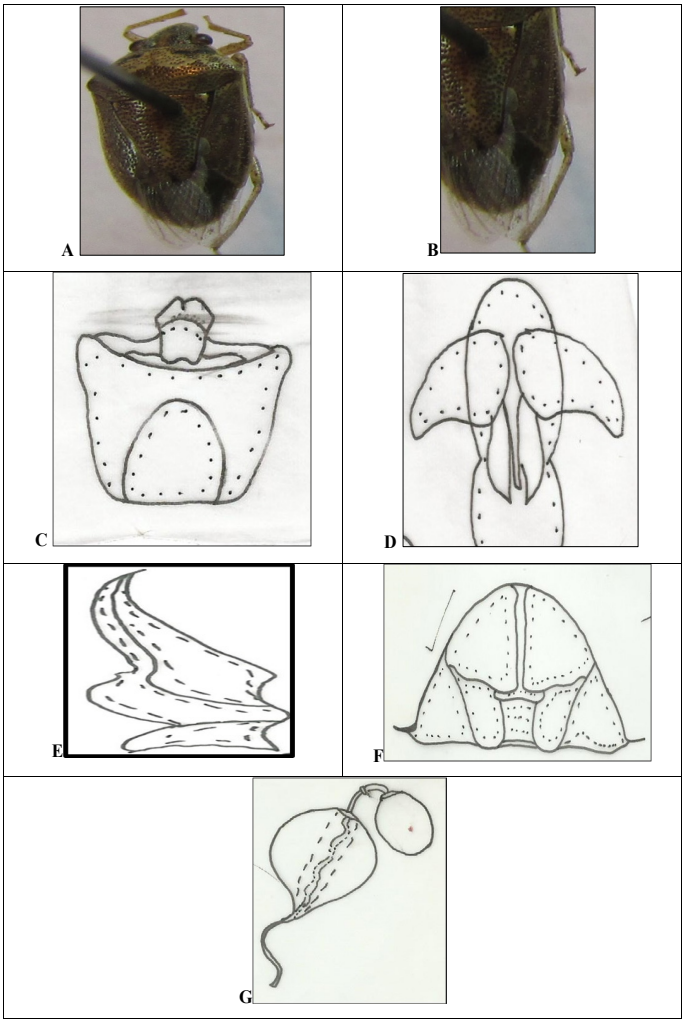


**Figure 1:** *Digital Photography of stink bug (Zicrona caerulea) and its genitalia. (A) Adult dorsal views; (B) Left hind leg; (C) Pygophore; (D) Aedeagus; (E) Paramere; (F) Terminalia; (G) Spermatheca (*Shabana *et al.*, 2022*).*

This paper will be helpful for entomologists as well as farmers because this species *Z. caerulea* is first time documented from the district Khairpur Sindh Pakistan. This species is predatory on different larvae which are pests on different crops and vegetables, so it is a very beneficial insect and has economic importance. This paper also helps to spread scientific knowledge among the masses in reference to biological pest control and due to this the farmers may achieve a good yield of crops and vegetables.

## Materials and Methods

*Study site and sampling*

The present research is conducted from March to December (2014-2016). The samples were collected from the various crops fields and vegetables such as potatoes, corn, wheat, tomato, cotton, stored corn, weeds, herbs, shrubs, soybeans, and also wetland areas. The sampling area was divided into rocky areas, sand grains, and agricultural land. The samples were collected using light traps and hand-picking traditional methods. The specimens were kept in bottles. Specimens were collected from the various sites of district Khairpur and kept in the Entomology laboratory at the Department of Zoology, Shah Abdul Latif University, Khairpur (Shaikh *et al.*, 2011).

*Methods of killing and preservation*

The collected specimens were kept in chloroform jars for 5-10 minutes for paralyzing. They were taken out carefully with the help of a fine hair brush and permanently preserved into wooden insect boxes as per standard method with Naphthalene balls placed inside corners of wooden boxes for defense purposes from predators. The identification process was undertaken based on external morphology by consulting previous and latest publications, key of (McPherson, 1982; Gapon, 2006).

*Dissection of male genitalia*

Male genitalia (aedeagus) was dissected and placed into (10 % KOH) and boiled for almost 10-15 minutes depending upon the hardness of the aedeagus until the inner structures became visible. Aedeagus was washed and examined through dissecting microscope model Kyowa Tokyo No. 884443. Consequently, observed aedeagus were placed into micro vials with glycerin and then re-attached with the specimens (Shaikh *et al.*, 2011).

*Measurements and photography of male genitalia*

The measurements of various morphological body parts such as total body length and width of the specimen, head, pronotum, and elytra were measured by micro millimeters under the binocular dissecting microscope. Photography was done with a manual bar scale as well as with CCD Stereozoom Microscope with Meiji analysis image infinity software (Schaefer, 1968).

## Results and Discussion

*Systematic list*

- Class: Insecta
- Order: Hemiptera
- Suborder: Heteroptera
- Superfamily: Pentatomoidea
- Family: Pentatomidae
- Subfamily: Asopinae
- Genus: *Zicrona* Amy. and Serv., 1834
- Species: *Zicrona caerulea* Linneus, 1758

**Diagnostic characters genus *Zicrona* Amy and Serv., 1834:** Lateral margins of the head are longer than the central margins, the second segment of antennae longer than the second segment of rostrum but smaller two apical joints; pronotum with the lateral sides are obsoletely eroded; abdomen without at base anterior tibiae not dilated.

*Description*

*Zicrona caerulea* (Linnaeus 1758)

*Cimex caerulea* Linnaeus, Syst. nat. ed. 10: 445. 1985.
*Zicrona caerulea* (Linnaeus), Dalla, Ghosh and Dhar

*Material examined*

Khairpur, Sindh Province, Pakistan, Longitude, 68.6916501, Latitude, 27.5133613. viii. 2020, 4 ♂♂, 5 ♀♀ (Abdul Manan Shaikh and Shabana Mangi).

*Comparative note*

The present species closely resembles *Z. murreeensis* in usual appearance, it is easily separated on the basis of 2nd segment of antennae which is longer than other segments, and the rostrum whose 3rd segment is almost equal to 4th segment, breadth of pronotum longer than the length, *Z.americana* species closely resembles *Z.caerulea* clypeus slightly less than paraclypeus, antennae 2nd segment longer than the other segment, rostrum 1st segment attached to the head, 2nd segment moderately large; in the genitalia of *Z. hisarensis,* dorsolateral lobe of pygophore slightly wider, aedeagus inflated like two balloon-like lobes, paramere, blade rounded, stem short.

*Body size and coloration of paratype male and female*

Medium in size, wider than longer, having a deep slightly brownish to bluish shiny copper in color, covered with finely coarse punctures, elytra golden brown, eyes black, scutellum light brown, antennae orchaeous to deep brown, golden brown hairs on

lateral margins of the abdomen, legs light brown, elytra lightish, clypeus and paraclypeus slightly brownish. The black color of clypeus, paraclypeus, meta thorax, and pro abdomen, brown color of the middle part of the pronotal angles, the apex black, in the antennae, 1st three articles brown, and posterior 4 articles black, the middle part of abdomen black and lateral sides deeply brown, tarsals brown and metatarsals black in color.

*Head*

Head hard downward apically, paraclypeus lengthened, sinuous originate on the eyes with similar inner margins, anterolateral lobe upwards. Antennae segments are slightly wider, labium long goes up to the 2nd abdominal segment. Anterior margin, wider than longer, minutely concave, paraclypeus and clypeus rounded. Head (length 1.3mm width 7mm). Antennae 1st segment is longer than 2ndsegment (0.3mm), 2nd segment (1.2mm), 3rd segment (0.9mm), 4th segment (8mm), 5th segment (1.1mm) and antennal formula (< 3< 2=4 < 5), rostrum also has 4 segments, 3rd and 4th segments are equal in measurements, 1st segment (0.5mm), 2nd segment (0.9mm), 3rd segment (0.4mm), 4th segment (0.4mm), rostrum formula (3 < 1< 2= 4), measurements of anterior anteaocular (0.4mm) and posterior anteaocular (0.5mm) and interocular (0.9mm). Head broader than long, the space between anteocular smaller than the back sides of head and eyes, clypeus shorter than paraclypeus, rostrum thickly goes up to meso coxae, head slightly descending, margins of paraclypeus circular, pronotal angles encircling.

*Thorax*

Pronotum bent, concave at the frontal anteriorly, sub quadrate in angle having small tubercules, pronotal angles are circular, (length 1.8mm), (width 2.5mm), lateral margins medially sinuate, upward reflexed, distinct, apices circular, posterior angles marginally convex. The osteolar metathoracic scent gland was open, rectangular, consistently thickened, rounded at the apex, reaching the metapleural edge, and had a broad evaporatorium with clearly defined posterior and anterior boundaries and pilosed legs that showed no signs of alteration. Scutellum rugulose, apical lobe of scutellum subtriangular, broader than long, anterior portion longer than posterior, tapered and conical in shape length 2.1mm, width 1.1mm).

*Abdomen*

Medially, convexa distinctly punctured, connexiva exposed ventrally and dorsally, pilosed genital capsule, membrane covered the abdomen apical portion and the abdominal sternites curved shaped, dark bluish in color. The U-shaped posterior angle of connexiva, arc-shaped ventro posterior margin. Ventrolateral side's dense, elytra longer than the prontal; lateral margins having small dents on the abdomen with distinct punctures, abdomen covered with long brown hairs and the full specimen length is 1 mm.

*Female genitalia*

Posterior margins of 1st gonocoxae are circular, conical, posterior margins of 8th paratergites warped, and lengthened, 9th paratergites thin narrow, tip pointed, cylindrical, barred 2nd gonocoxae spermathecal bulb big rounded, small pump section, duct intermediate. 2nd gonocoxae thin, near to posterior margins at the middle, Spermathecal bulb large circular, short pump section, duct elongated.

*Male genitalia*

Male genitalia pygophore lengthened as compared to width, tip circular, Pygophore with visibly dorsolateral lobe, dorsoposterior sides broader, aedeagus with two lobes elongated, dorsolateral conjunctival convex, sac, tapered, central dorsal conjunctival convex, circular at the tip, a two of penial trunk v-shaped, coiled, thecal sides, dorsolateral lobes anterior portion are the anterior portions are the circular, posterior portions narrow tapered, dorsoposterior margins wider, concave, convex at the center of ventroposterior, parameres have a short stem, one side concave and other is convex, tip pointed, wider at proximal half, two lobes of aedeagus trunk like dorsolateral conjunctival convex, sac like in structures, tapered apically, central dorsal conjunctival convex, half circular at an angle, a two of penial ladle like v shaped, bent thecal margins.

Genus *Zicrona* was mentioned by (Amyot et Serville 1843), this genus synonymized from species *Cimex caerulea* (Linnaeus 1758), *Pentatoma corcrulea* (Curtia 1823), *Pentatoma coeruleum (*Hahn, 1843), *Pentatoma concinna* and *Pentatoma violacea* (Westwood 1837). *Z.caerulea* (Linnaeus 1758) was synonymized from the *Z. illustris* (Amyot et Serville 1843). This species is identified on the taxonomical and genital characteristics such as i.e., clypeus, paraclypeus slightly less in length, aedeagus trunk-like in structure, pygophore wider smaller in length, 2nd gonocoxae with posterior margins are slightly curved.

The present species *Z. caerulea* resembles *Z. murreeensis* in body coloration as well shape of the head, it is easily separated on the antennae 2nd segment is longer than other segments and the 3rd segment of rostrum is almost equal to 4th segment (Nazeer *et al*., 1985; Hoffmanan, 1995).

*Z. murreeensis*, dark blue in coloration, pygophore dorsolateral lobe circular, posterior lobe concave, paramere twisted stem, blade lengthened, inflated aedeagus, 1st gonocoxae triangular, 9th paratergites longer but differed on the small in size and light bluish to dark brownish, antennae 2nd segment equal to rostrum 1st and 3rd segment, 3rd smaller than 4th segments, the spermathecal bulb is circular, pump section smaller, antennae 2nd segment is longer than other *Z. americana* (Thomas, 1992).

Present species have clypeus slightly smaller than paraclypeus, antennae 2nd segment longer than others, rostrum 1st segment attached to the head, 2nd segment larger and separated from the *Z. caerulea* and *Z. hisarensis* genitalia dorsolateral lobe of pygophore slightly wider, aedeagus inflated two balloon-like lobes, parameres, blade rounded, stem short (Thomas, 1992).

## Conclusions and Recommendations

The individuals of the family Pentatomidae are well known as stink bugs, together from various sites of Khairpur district i.e., Sobhodero, Gambat, Kotdigi, Herbarium Botanical garden of Shah Abdul Latif University Khairpur mirs Sindh Pakistan during the year (2015-2016). The specimens were identified into subfamilies, and genera up to species level. We identified the five species of predatory stink bugs *Andrallus spinidens, Arma custos*, *Canthecona furcellata*, *Picromerus orientialis*, *Zicrona caerule* from Khairpur District Sindh (Pakistan). All five species of subfamily Asopinae are the new record from the Khairpur District of Sindh, Pakistan and are deposited at the Department of Zoology Shah Abdul Latif University Khairpur Sindh Pakistan.

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## Novelty Statement

This paper also helps to spread scientific knowledge among the masses in reference to biological pest control. This species attacks the pests of cereal crops and due to this the farmers may achieve a good yield of crops and vegetables.

## Author's Contribution

**Shabana Mangi:** Conceptualization.
**Waheed Ali Pahnwar and Javeed Ali Ujjan:** Formal analysis.
**Fakhra Somroo:** Investigation.
**Shabana Mangi:** Methodology.
**Abdul Manan Shaikh:** Supervision.
**Abdul Manan Shaikh:** Visualization.
**Shazia Solangi, Sumbul Mureed and Ranjeet Kumar:** Writing, review and editing.

*Consent for publication*
Not applicable

*Availability of data and materials*
All data and materials are mentioned in the manuscript.

*Conflicts of interest*
The authors have declared no conflict of interest.

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