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**Devinder Singh**

Department of Zoology and  
Environmental Sciences, Punjabi  
University, Patiala, Punjab  
147002, India

**Ravneet Kaur**

Department of Zoology and  
Environmental Sciences, Punjabi  
University, Patiala, Punjab  
147002, India

**Harbhajan Kaur**

Department of Zoology and  
Environmental Sciences, Punjabi  
University, Patiala, Punjab  
147002, India

**Correspondence:**

**Ravneet Kaur**

Department of Zoology and  
Environmental Sciences, Punjabi  
University, Patiala, Punjab  
147002, India

Email: 85kravneet@gmail.com

## Taxonomic studies on the Genus *Halyabbas* Distant and the Type-Species *Halyabbas unicolor* Distant (Heteroptera-Pentatomidae-Pentatominae-Amyntorini)

Devinder Singh, Ravneet Kaur, Harbhajan Kaur

### ABSTRACT

*Halyabbas unicolor* Distant, the only representative under genus *Halyabbas* Distant have no published records in the literature of Pentatomidae with respect to its taxonomic details. Taxonomic studies have been conducted on this genus, supported with various reliable taxonomical characters like morphometry, external morphological structures emphasizing on shape and structure of head, pronotum, metathoracic scent gland osteolar peritreme, ventroanterior and ventroposterior margin of abdominal sternite VII, dorsal and ventral colorations and external male genitalic structures (pygophore, paramere and aedeagus) and female genitalic structures (spermatheca and female genital plate). Besides, a new Indian locality of its distribution has also been added to its previous list for the first time.

**Keywords:** Halyabbas, Pentatomidae, genitalia, morphology.

### 1. Introduction

The true bugs or Heteroptera, is a highly diverse insect taxon with approximately 42,300 described species worldwide, represented by seven infraorders and 75–89 families<sup>[5, 12]</sup>. Within the suborder Heteroptera, family Pentatomidae is known to form the third largest family, surpassing Reduviidae and Miridae. Pentatomidae are one of the largest families of the order, spread over the tropical and temperate zones, most abundant in tropical regions. The Indian fauna is Indo-Malayan mostly, with a number of Palaearctic hill forms which extend into the north and with the larger number of species known only from hill or submontane forest localities<sup>[8]</sup>. Of the estimated 39,096 described species of Heteroptera from the world, 4772 species within 896 genera belong to this family<sup>[11]</sup>. Globally, these insects represent an important part of the fauna as far as their number is concerned. They are generally known with some common names to all the taxonomists, such as “Shield bugs” due to the shield-shaped body; “Stink bugs” because of the emission of a disagreeable pungent odor by means of a pair of scent glands which open in the region of the metacoxae<sup>[8]</sup> and “Pentatomidae” because of distinct five segments in an antennae or because their body appears to have five parts. Most of the taxa within the family exhibits sexual dimorphism, with respect to variation in size, coloration and form. They act as one of the major agricultural pests of economically important crops throughout the world, that includes legumes (Soybeans); cereals (rice, wheat), tree crops (coconut, palms, citrus, cocoa, coffee). Most of these are host specific and thus depending on the type of plant they attack, their economic importance varies greatly from species to species, and also within a species, it may range to multiple hosts. Few Pentatomidae members are also exclusively predaceous and are known to show Intraguild Predation (IGP)<sup>[7]</sup>. Throughout the Heteroptera, the imago is a very important and active stage of life, the previous development being practically only a growth in size, with the gradual development of wings. As far as Indian region is concerned, very few workers have directed their research towards heteroptera fauna after the publication of Distant’s Fauna of British India<sup>[3, 4]</sup>.

### 2. Material and methods

Collection-cum-survey tours were carried out in different localities of North India that includes

the states of Punjab, Haryana, Himachal Pradesh, Uttarakhand, Union Territory of Chandigarh, NCR region of Delhi and parts of Jammu and Kashmir during Nov, 2008- Oct, 2011. Single female and male specimens belonging to the species *Halyabbas unicolor* were collected from Nainital (Uttarakhand). Identification was done with the help of "Fauna of British India"<sup>[13]</sup> and Rider's catalogue<sup>[11]</sup>. For preparing the slides of external female genitalia, the abdomen was potashed in 10% KOH and boiled for 5-10 minutes on a gas burner so as to expose its genital plate and spermatheca. After proper dehydration, the plate was cleared in clove oil and preserved. The spermatheca was preserved in 70% alcohol. For external male genitalia, the entire abdomen was potashed in 10% KOH and kept in oven for 15-20 minutes. The pygophore was dehydrated in various grades of ethyl alcohol and preserved in clove oil for further studies. Later, the pygophore was dissected to separate out the internal parts viz., parameres and aedeagus that form the taxonomical tools in identification. The procedure and nomenclature of <sup>[13]</sup> for female genitalia and <sup>[9]</sup> for male genitalia was adopted. The photographic details were captured with the help of Image Processing Unit installed in the DRS [Departmental Research Scheme] laboratory of the Department of Zoology and Environmental Sciences, Punjabi University, Patiala [PUP].

This genus, *Halyabbas* represents Indian fauna. It is represented only by a single species, *H. unicolor* known so far from India (Kerala)<sup>[11]</sup>, Myanmar and China on bamboo tree as per<sup>[3]</sup> faunistic studies and the latest<sup>[11]</sup> catalogue on Pentatomidae. Some diagnostic characters of this genus and few characters of the species with respect to its specific colorations and markings were provided by<sup>[3]</sup>. The members are characterized by being ovate with large and triangular head placed in line with lateral margins of pronotum, its lateral lobes very broad at base, narrowing towards apex and meeting a little in front of central lobe; labium reaching base of abdomen; pronotum about twice as broad as long, lateral margins obliquely straight, slightly crenulate near eyes with lateral angles obtusely subprominent and 2<sup>nd</sup> abdominal segment centrally sulcated. During the present survey, only 2 specimens (female and male) were collected in the month of August, 2011 from Nainital. Every minor morphological detail with respect to its specific colorations and markings on dorsal and ventral surface, shape of head, pronotum, metathoracic scent gland osteolar peritreme, ventroanterior and ventroposterior margin of abdominal sternite VII of both the sexes has been studied. The external male and female genitalia have been studied for the first time with special reference to pygophore, paramere, aedeagus, genital plate and spermathecal parts.

### 3. Observations

Genus *HALYABBAS* Distant, 1900

*Halyabbas* Distant, 1900, *Trans. entomol. Soc., Lond.*, p. 164.

(Type-sp.: *Halyabbas unicolor* Distant, by monotypy)

*Halyabbas unicolor* Distant

*Halyabbas unicolor*: Distant 1900, *Trans. entomol. Soc., Lond.*, p. 164.

**Type-locality** – Burma; Siam; Lombok; Hong Kong

**Body length:** ♀ - 13.50 mm; ♂ - 13.10 mm (Fig. 1A)

#### 3.1 Female

**Measurements (mm):** Head length: 1.90; width across eyes: 2.80;

interocular space: 1.70; intercellular space: 0.90; preocular distance: 1.05; length of posterior head including eyes: 0.85; antennal segments lengths: I: 0.50, II: 1.0, III: 0.80, IV: 1.05, V: 1.30; pronotal length: 3.20; width across humeral angles: 7.25; scutellar length: 5.0; scutellar width: 4.50; length of abdomen: 6.10; maximum width of abdomen: 6.93; length of rostral segments: I: 0.90, II: 1.60, III: 1.10, IV: 0.75; Distance - base scutellum-apex clavus: 3.10; apex clavus-apex scutellum: 1.85; apex scutellum-apex abdomen including membrane: 4.75; total body length: 13.50.

**Dorsal Coloration:** Head pale greenish, coarsely and darkly punctured with black; eyes brownish black; ocelli brown; boundaries of eyes and their posterior margin pale yellowish green, area before eyes impunctate and green; 1<sup>st</sup> and 2<sup>nd</sup> antennal segments green, 3<sup>rd</sup> and 4<sup>th</sup> darker, 5<sup>th</sup> somewhat infuscated; pronotum greenish, darkly punctate, anterior margin dark green and impunctate; anterior pronotal area with two green irregular transverse callosities; humeral angles yellowish green, darkly punctured, more pronounced laterally; scutellum green, darkly punctured with black; calvus and corium yellowish green, sparingly punctured with costal margin densely punctate; anteriormost portion of costa pale, impunctate; connexiva yellowish green, suffused with black and brown, blackly punctured; hemelytral membrane brown.

**Ventral Coloration:** Labium yellowish green, apex black; legs yellowish green, apex of tibiae and tarsi darker with brown suffusions; head green, punctate; area between legs paler; lateral areas of sternum green, thickly punctured with series of irregularly scattered black punctures, with distinctly black margins; metathoracic scent gland opening yellowish green with brown punctures, evaporatorium impunctate; abdomen dark green with brown fascia, lateral area impunctate, green with a medial elongated brown spot on sternite VII; genital capsule admixture of brown and green, pilosed with golden brown.

**Head (Fig.1B):** Distinctly wide, strongly declivent downwards, rugulose; paraclypeal lobes slightly longer, meeting in front of clypeus, lateral margins sinuous above eyes, reflexed anterolaterally, narrowed and subrounded at apex; clypeus slightly raised medially; antennal segmental formula – I<III<II<IV<V; labium reaching metacoxae, labial lengths formula – IV<I<III<II.

**Thorax:** Pronotum (Fig.1C) with anterior margin concave, truncate behind eyes, produced as small subacute tubercles directed anterolaterad, anterolateral margins crenulate, posterolateral margin obliquely straight, lateral margins upwardly reflexed, humeral angles subrounded, obtuse and posterior margin straight; scutellum broad at base, beyond frena slightly sinuous, narrowed as subtriangular apical lobe; connexive well exposed at repose; metathoracic scent gland osteolar peritreme (Fig.1D) small, raised, slightly sinuous, narrowed at apex, reaching only one fourth way to metapleural margin; evaporatorium moderately large, distinctly broad, with well-defined anterior and posterior margins, slightly concave medially, covering about two third sternite; legs hairy.

**Abdomen:** Ampliate medially, flattened laterally; inner margins of spiracular boundaries spotted with black; hemelytral membrane passing beyond abdominal apex; ventroanterior margin of

abdominal sternite VII broadly concave, somewhat an inverted U-shaped with acute posterior angles (Fig.1E).

*Halyabbas unicolor* Distant

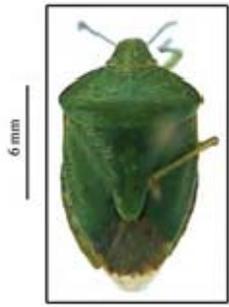


Fig. 1A ADULT



Fig. 1B HEAD



Fig. 1C PRONOTUM



Fig. 1D SCENT GLAND



Fig. 1E FEMALE ABDOMEN (V.V.)



Fig. 1F MALE ABDOMEN (V.V.)

**Genitalia:** 1<sup>st</sup> gonocoxae medially wide apart, quadrangular with posterior margins straight and inner margins parallel; 2<sup>nd</sup> gonocoxae fused medially, slightly concave; 8<sup>th</sup> paratergites broadly triangular, posterior margins with a tooth like angulation; 9<sup>th</sup> paratergites elongate, lobe-like, inner margin medially produced, passing beyond fused posterior margin of 8<sup>th</sup> paratergites (Fig. 2A); spermatheca (Fig. 2B) with distinct distal and proximal flanges; pump region distinctly short, smaller than distal spermathecal duct; bulb small, flattened with two finger like lobules; medial dilation balloon like; proximal spermathecal duct sclerotized, subequal to distal spermathecal duct.

**3.2 Male**

**Measurements (mm):** Head length: 2.0; width across eyes: 2.59; interocular space: 1.45; intercellular space: 0.80; preocular distance: 1.10; length of posterior head including eyes: 0.90; antennal segments lengths: I: 0.50, II: 0.95, III: 0.85, IV: 1.25, V: 1.60; pronotal length: 3.20; width across humeral angles: 6.93; scutellar length: 4.50; scutellar width: 4.20; length of abdomen: 5.94; maximum width of abdomen: 6.60; length of rostral segments: I: 0.80, II: 1.35, III: 1.0, IV: 0.90; Distance - base

scutellum-apex clavus: 3.0; apex clavus-apex scutellum: 1.50; apex scutellum-apex abdomen including membrane: 3.52; total body length: 13.10.

**Coloration and Structure:** Body form and coloration similar to female except, male being comparatively darker and with dense black punctures; ventroanterior margin of abdominal sternite VII concave, somewhat dome-shaped with subacute posterior angles and ventroposterior angles broadly concave, somewhat an inverted U-shaped (Fig.1F).

**Genitalia:** Pygophore (Fig. 2C) as long as broad, lateral margin straight with prominent narrowly rounded dorsolateral lobes; dorsal opening small; dorsomedial surface broadly concave; ventroposterior margin sinuate; paramere (Fig. 2D) somewhat sickle shaped, apex of blade oar like, outer margin convex with medial hump, inner margin with a small nodule near base; aedeagus (Fig. 2E) with theca broad at base, narrowed apically, a pair of elongate dorsolateral membranous conjunctival appendages, sclerotized at apices, directed laterad; a pair of ventral conjunctival appendages, fused basally; a pair of elongate spindle like sclerotized medial pineal lobes, not fused basally; vesica distinctly long, passing much beyond margins of medial pineal lobes; ejaculatory reservoir area broad.

*Halyabbas unicolor* Distant

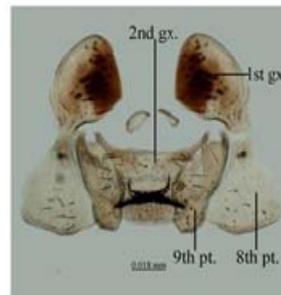


Fig. 2A GENITAL PLATE

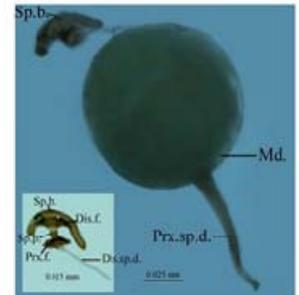


Fig. 2B SPERMATHECA

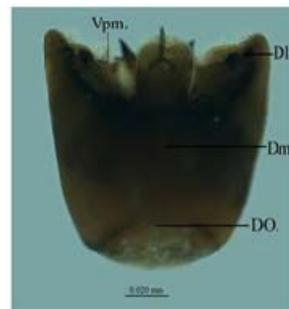


Fig. 2C PYGOPHORE

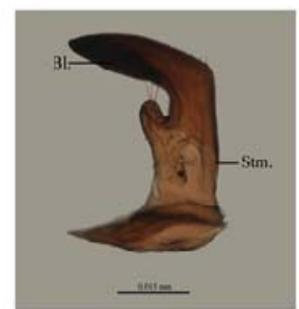


Fig. 2D PARAMERE

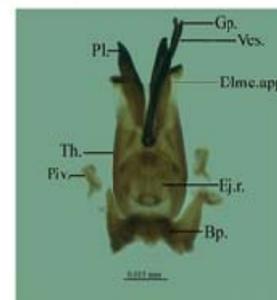


Fig. 2E AEDEAGUS (D.V.)

**3.3 Specimens Examined:** 1♀, 1♂. INDIA : Uttarakhand: Naini Tal, 20.viii.2011, Ravneet Kaur coll. [PUP, Patiala].

**Altitude at Naini Tal (in metres):** 2,084 metres (6,837 ft)

**3.4 Host:** *Bambusa* sp.<sup>[6, 16]</sup>; *Phyllostachys pubescens*<sup>[15]</sup>: both Poaceae.

**3.5 Distribution:** India (Uttarakhand, Kerala), Burma (=Myanmar); Hong Kong.

**3.6 Remarks:** This genus and species are recorded for the first time from North India and a new locality has been added to its previous list. Its detailed morphology and external genitalia has also been studied for the first time. It has been recorded as a pest on *Bambusa* sp., and *Phyllostachys pubescens* (Poaceae) from Asia (Burma, Yunnan and China)<sup>[6, 14]</sup>.

#### 4. Acknowledgements

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#### 5. Abbreviations used

8<sup>th</sup> pt. - Eight paratergites; 9<sup>th</sup> pt. - Ninth paratergites; Sp. b. - Spermathecal bulb; Dis. f. - Distal flange; Prx. f. - Proximal flange; Dis. sp. d. - Distal spermathecal duct; Prx. sp. d. - Proximal spermathecal duct; Md. - Median dilation; Sp. p. - Spermathecal pump; Vpm. - Ventroposterior margin; Dl. l. - Dorsolateral lobes; Dms. - Dorsomedial surface; DO. - Dorsal Opening; Bl. - Blade; Stm. - Stem; Bp. - Basal plate; Piv. - Pivot; Th. - Theca; Ves. - Vesica; Gp. - Gonopore; Pl. - Pineal lobe; DImc. app. - Dorsolateral membranous conjunctival appendages; Ej. r. - Ejaculatory reservoir.

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