

SPECIES

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Taxonomy of stored grain pest *Callosobruchus phaseoli* (Gyllenhal, 1833) (Coleoptera: Chrysomelidae: Bruchinae)

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ABSTRACT

The members of the genus *Callosobruchus*, in particular, feed on stored beans. The species *Callosobruchus phaseoli* is distributed in Brazil, the United States of America, Nigeria, Colombia, Mexico, the Philippines and India. In India, this species was previously recorded from Coimbatore (Tamil Nadu) and in present investigation from Kanthewadi, Kembali, Gargoti and Haladi from district Kolhapur, Maharashtra (present investigation) on seeds of Lima bean (*Phaseolus lunatus*). Key characters of *C. phaseoli* are: Reddish brown and pubescent body; the pronotum is yellow with dark brown stripes and a white basal lobe; the elytra are mostly yellow with elongate white patches in the coastal area and variable black stripes at the lateral and apical parts. Pygidium swollen at the apex and the meta-femur with a distinct tooth-like angulation at its posterior end. The present study describes the taxonomy of *C. phaseoli* along with genitalia for the first time with color photographs.

Keywords: Bruchinae, seed beetle, taxonomy, lima bean, distribution.

1. INTRODUCTION

Chrysomelidae (Latreille, 1802) is one of the largest families of Coleoptera, containing more than 37,000 to 40,000 described species (Jolivet and Verma, 2002). It includes the most destructive invasive species around the world, causing billions of dollars in annual losses to agricultural crops (Alexander et al., 2023). Notorious Chrysomelidae include the subfamily Bruchinae, which constitutes a homogeneous group of 1700 species (Farrell and Sequeira, 2004; Johnson et al., 2004). The subfamily Bruchinae (Latreille, 1802) consists of approximately 64 genera grouped into six tribes, namely Amblycerini, Bruchini, Eubaptini, Kytorhinini, Pachymerini and Rhaebini; hence formerly considered subfamilies (Kergoat, 2004).

The tribe Bruchini constitutes 80% of the species and the remaining species are assigned to the tribes Amblycerini (10%) and Pachymerini (9%) (Johnson, 1981). These beetles are generally monophagous or oligophagous and most bruchinae tribes are associated with specific plant families: Megacerini on Convolvulaceae, Bruchini on Fabaceae, Pachymerini on Arecaceae,

Spermophagini on Convolvulaceae and Malvaceae (Johnson, 1981; Borowiec, 1987). The genus *Callosobruchus* Pie includes approximately 20 species (Borowiec, 1987; Tuda et al., 2005) and unusually, most of these are stored bean pests.

A larva of *Callosobruchus* species is the most destructive stage and more than one larva can develop within a single grain. Which exerts seeds of legumes of the tribe Phaseoleae (Fabaceae), including many beans cultivated for human consumption (Southgate, 1978; Johnson, 1981). The species *Callosobruchus phaseoli* was first reported from Brazil (Gyllenhal, 1833), particularly feeds on green peas, chick peas, kidney beans, black beans, greengram, blackgram, horsegram, cowpea and lablab (Haripriya et al., 2022). The present study describes the detailed taxonomy of *C. phaseoli* for the first time with color photograph.

2. MATERIALS AND METHODS

Sampling of *Callosobruchus phaseoli* was done from a farmer's house in Kanthewadi, Kembali, Gargoti and Haladi district Kolhapur, along with Lima bean-stored seeds, from March 2022 to March 2023 by hand picking method. Some of the collected specimens were preserved in absolute ethanol. The culture was maintained on seeds of lima beans in a 1 kg plastic rearing jar. Photography was done under an Olympus CX31RTSF microscope attached to an HDMI digital camera in TCapture software. Images were stacked in Helicon Focus 7 software and edited in Photoshop CS3. Measurements were done with Image J software. Dissection was done under a stereo zoom microscope (LYNX LM-52-3621). The specimen was identified as *C. phaseoli* by using the original description (translated from Latin to English) of Gyllenhal, (1833) and illustrations of the type specimen and key in Kingsolver, (2004).

3. RESULTS AND DISCUSSION

Callosobruchus phaseoli (Gyllenhal, 1833)

Family- Chrysomelidae (Latreille, 1802)

Subfamily- Bruchinae (Latreille, 1802)

Tribe- Bruchini Latreille, 1802

Subtribe- Bruchidiina Bridwell, 1946

Genus- *Callosobruchus* Pie, 1902

Species- *phaseoli*

Type Locality

Brazil

Distribution

Africa, Colombia, Israel, Kenya, Mexico (Sonora), Nigeria, Philippines and USA (Romero-Napoles and Johnson, 2004).

Host seeds

Lima bean- *Phaseolus lunatus*, Common bean- *Phaseolus vulgaris*, Pigeon pea- *Cajanus cajan*, Chick Pea- *Cicer arietinum*, Lablab- *Lablab purpureus*, Pea- *Pisum sativum*, Cow pea- *Vigna angularis*, Green Gram- *Vigna radiata* (Kingsolver, 2004).

Material examined

17.iii.2022, Kanthewadi; 06.vii.2022, Kembali; 27.xi.2022, Gargoti and 04.iii.2023, Haladi; Coll. D. R. Salunkhe.

Diagnostics

Male: Length 2.36 ± 0.024 mm, Breadth 1.21 ± 0.034 ; Female: Length 3.37 ± 0.022 , Breadth 1.59 ± 0.067

The body is reddish brown and pubescent, with enlarged eyes in males, Antenna 11 segmented and dimorphic (Figure 1A, 1B), Vertex and frons are finely punctate, Frontal carina fine (Figure 1F), Pronotum: Subconical, yellow with dark brown stripes and a white basal lobe (Figure 1E), Scutellum: Narrow, Elytra: Mostly yellow with elongate white patches in the coastal area and variable black stripes at the lateral and apical parts (Figure 1A, 1B). Hind leg: Meta-femur: Distinct tooth-like angulation at its ventrolateral carina; ventromesal carina with a short, acute denticle about as long as the lateral angulation. Metatibia: Dilated toward the apex, dorsomesal and ventral carinae complete, lateral carina sinuate apically, Mucro short, slightly longer than lateral denticle (Figure 1D), Pygidium swollen at the apex, apically two dark brown spots present (Figure 1C).

Male genitalia

Median lobe is elongate, about 5 times as long as wide, ventral valve hastate, produces a slender apex and the base is constricted (Figure 1G); internal sac has a small bundle of spicules at apical orifice, two pairs of burr like sclerites in middle and a pair of spine clusters near apex; most of the sac is lined with fine spicules (Figure 1I); the lateral lobes are elongate, cleft to base and curved inward at tips (Figure 1H).

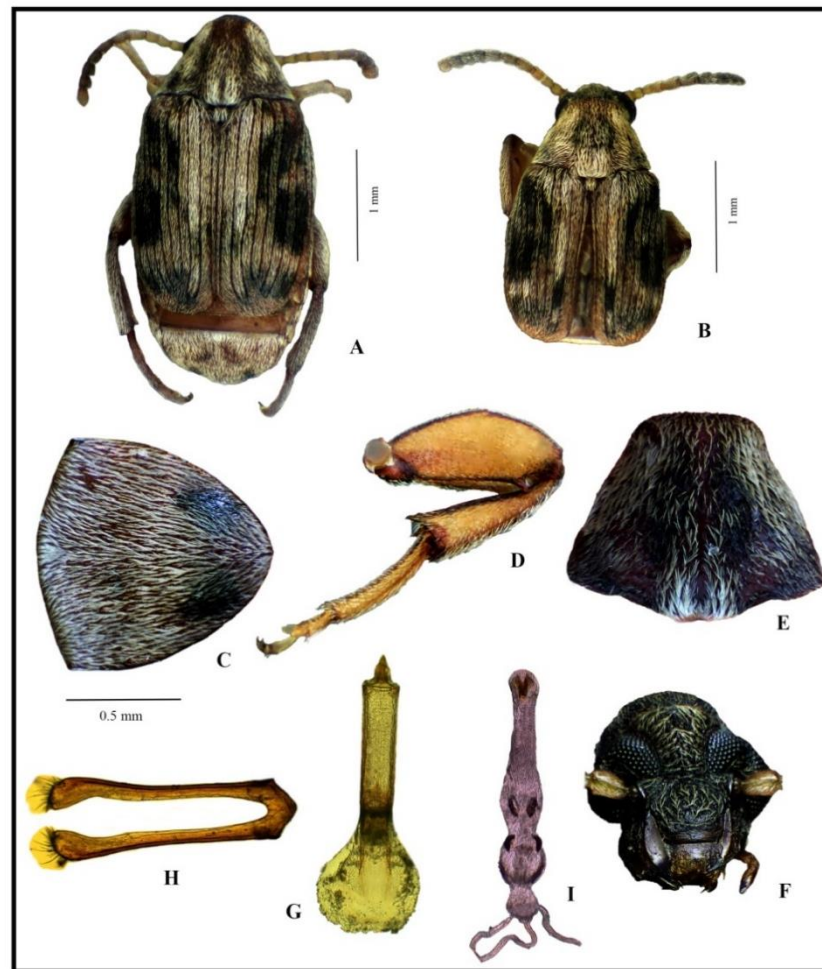


Figure 1. Habitus of *Callosobruchus phaseoli* : A- female, B- male, C- pygidium, D- hind leg, E- pronotum, F- head(front view), G- median lobe(intromittent organ), H- lateral lobe, I- Aedeagus

Figure 1 Habitus of *Callosobruchus phaseoli*; A- Female; B- Male; C- Pygidium; D- Hind leg; E- Pronotum; F- Head (front view); G- Median lobe (intromittent organ); H- Lateral lobe; I- Aedeagus

Remarks

According to Kingsolver, (2004) and Gyllenhal, (1833), the specimens were identified as *C. phaseoli*, confirmed by the yellowish pronotum with dark brown stripes, the yellow elytra with black and white strips and the eye with a narrow posterior fringe. Pronotum is red coloured; in both sexes, the pygidium is convex; male elytra have vague patches at the middle and apex and female elytra have more intense patches; male antennae are pectinate, whereas female antennae are serrate in *C. chinensis* (Linnaeus, 1758). Pronotum dark black, lacking longitudinal lines; elytral pattern variable; eye with posterior margin *C. maculatus* (Fabricius, 1775)

Tuda et al., (2005) studied ecological factors associated with pest status in *Callosobruchus*: High host specificity of non-pests to Cajaninae (Fabaceae). Yus-Ramos et al., (2014) studied *C. phaseoli*, which is only able to reproduce in storehouses as it requires temperatures ranging between 30 to 32.5°C and a humidity level of 70%, environmental conditions more typical of tropical and subtropical countries. Temreshev and Kazenas, (2020) describe an invasive seed beetle species *C. phaseoli*, that was found in south-eastern Kazakhstan (Almaty city) for the first time. Abrego-Lezcano et al., (2022) gave the first record of *Eupelmus pulchriceps* (Hymenoptera: Eupelmidae) parasitizing *C. phaseoli* (Coleoptera: Chrysomelidae) as a pest of *Cajanus cajan* in Panama.

Haripriya et al., (2022) worked on the host preference of stored pulses to Pulse bruchid, *C. phaseoli*. It did not support seeds like black gram, black beans and kidney beans for larval development, whereas it prefers to breed in lablab and cowpea. The description and illustrations of habitus and genitalia of *C. phaseoli* given by Kingsolver, (2004) are supporting the observations on the morphology and genitalia of the specimen under study, confirming *C. phaseoli* species. For the first time, taxonomy on *C. phaseoli* is provided here in detail, along with its first record from Kolhapur, Maharashtra, India.

4. CONCLUSION

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Authors' contributions

SMG involved in design of the research, identification of specimen and writing of the manuscript. DRS collected, identified, dissected specimen and digital photographed.

Ethical approval & declaration

In this article, as per the animal regulations in Department of Zoology, Shivaji University, India, the authors observed the grain pest *Callosobruchus phaseoli* (Gyllenhal, 1833) (Coleoptera: Chrysomelidae: Bruchinae) from India. The Animal ethical guidelines are followed in the study for species observation, identification & experimentation.

Conflicts of interests

The authors declare that there are no conflicts of interests.

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Data and materials availability

All data associated with this study are present in the paper.

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