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First report of *Rinamba opacicollis* Cameron (Hymenoptera: Braconidae, Doryctinae) in India as parasitoid of coffee stem borer, *Xylotrechus quadripes* (Chevrolat) (Coleoptera: Cerambycidae)

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ABSTRACT: *Rinamba opacicollis* Cameron (Hymenoptera: Braconidae) was collected from Chikkamagaluru, Karnataka, India for the first time from the larvae of white stem borer, *Xylotrechus quadripes* Chevrolat infesting arabica coffee. Its role in the biological or integrated control of *X. quadripes* remains to be evaluated. White stem borer could be the first host record of this parasitoid all over the world. © 2019 Association for Advancement of Entomology

KEY WORDS: Ectolarval parasitoid, *Rinamba opacicollis, Xylotrechus quadripes*

The coffee white stem borer (CWSB), *Xylotrechus quadripes* (Coleoptera: Cerambycidae) is a major and economically important pest of arabica coffee in India. This pest was first noticed in India during 1838 (Stokes 1838) and its distribution is confined to only Asian countries ((i.e. Burma, China, India, Java, Nepal, Sri Lanka, Thailand and Vietnam) and has not been reported in other coffee growing countries (Le Pelly, 1968). The adult beetles are active in bright sunshine hours and female lays eggs in the cracks and crevices under the loose scaly bark of the main stem and thick primaries. The infestation starts with the feeding of early instar larvae on the outer surface and then gradually entering inside the main stem. Extensive feeding leads to the formation of tunnels inside the stem interrupting the nutrient supply and thereby leading to substantial reduction in the yield (Seetharama *et al*.. 2005). The annual loss due to the CWSB in India is about $17.5-26 million (Venkatesha *et al*., 2012). Severe infestation leads to yellowing of leaves, defoliation and subsequent death of the plant. The Coffee White Stem Borer has two peak flight periods, summer flight during April - May and winter flight during October to December. The winter flight is very crucial, as all the adult beetles tend to emerge during this period (Seetharama *et al*., 2005). The concealed feeding habit of this pest necessitates timely implementation of IPM practices to manage the pest under the economic threshold level. Cultural practices like maintenance of optimum shade, tracing and uprooting of the infested plants before

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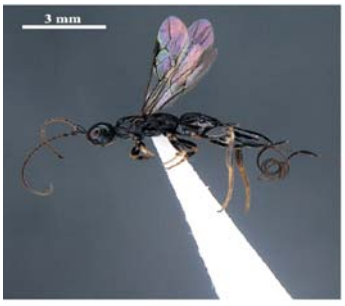
the flight period (March and September) and the judicial use of chemical pesticide, Chlorpyrifos @ 3ml/l (First fortnight of April and October) are the recommended IPM practices for the CWSB.

Nevertheless, use of bio-control strategies for management of CWSB has not been very successful. Though, some parasitoids were earlier identified on CWSB, they could not be included in the IPM because of their low potential against CWSB and failure in the establishment in field (Prakasan *et al*., 1986; Shylesha *et al*., 1992; Veeresh, 1993; Venkatesha *et al*., 1997; Seetharama *et al.,* 2008). Hence, efforts have been continued, to identify potential natural enemies against CWSB. In order to achieve potential biological control programs, severely CWSB infested coffee plants were collected before the emergence period (March 2017) from Central Coffee Research Institute (CCRI) farm, Chikkamagaluru Dist, Karnataka, India and stored in isolated closed room and regularly monitored for the emergence of natural enemies, if any. During the routine observations on the stored stems, we found the emergence of parasitoids in large numbers. These insects were collected using aspirator and observed under laboratory for confirmation. Further, the infested plants were split opened and found that some of the CWSB larvae were found parasitized. The parasitized larvae were taken to laboratory and reared till emergence of adults. Both the insects which emerged from cut stems in the storeroom and the parasitized CWSB larvae were found to be similar. The adults of these parasitoids were sent to Insect Ecology and Ethology laboratory, University of Calicut, for taxonomic identification and identified as *Rinamba opacicollis* Cameron (Hymenoptera: Braconidae, Doryctinae) by Ranjith. The same specimens were submitted to the Insect depository of National Bureau of Agriculturally Important Insects (NBAIR), Bengaluru, India to maintain as type specimen (NBAIR/HYM-BRAC/23819). Based on the literature, this is the first report of this parasitoid in India and even from Oriental region. More interestingly, this could be the first host record for the genus. Braconidae is one of the largest families within the Hymenoptera, which act as parasitoids on some immature stages of holo and hemimetabolous insects. Braconids include some important parasitoids that develop endoparasitically in the host body though majority of the species in Braconidae are ectoparasitoids on late instars of host larvae. *Rinamba*- one small genus with less than ten species described. The synonyms for *Rinamba* are *Pseudorhoptrocentrus* Granger, 1949 (synonymized by Belokobylskij in 2004) and *Rhoptrocentroides* Marsh 1993 (synonymized by Belokobylskij in 1995 with *Pseudorhoptrocentrus*). This is distributed in Afrotropical, Neotropical and Oceanic regions. The genus *Rinamba* belongs to the tribe Doryctini including approximately 35 Palaearctic genera (Belokobylskij *et al.,* 2004). This is a moderately large subfamily of the family Braconidae with more than 1000 described species worldwide. Most of the known doryctine species are idiobiont gregarious ectoparasitoids of the larvae of xylophagous or bark-boring Coleoptera, while some species live on Lepidoptera or Hymenoptera-Symphyta (sawfly) larvae (Loni *et al*., 2005).

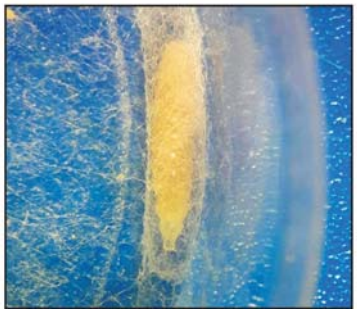
The adult parasitoids collected from the CWSB infested stored stems were maintained on 10% honey solution in the laboratory. Various methods were tried to standardize the mass rearing techniques for this parasitoid using the CWSB larvae. The adult parasitoids along with the CWSB infested stems were placed inside cages for two days. Adults were found active and hovering around the feeding WSB larvae inside the cut stems exhibiting good searching ability by means of cues. *Rinamba opacicollis* found to be a greagarious ectoparasitoid as female individual deposit eggs on CWSB larvae through its long ovipositor. The spot of oviposition was marked, and the egg laying was confirmed by splitting of the stem. In another method which was originally used for rearing the Braconid, *Parallorhogas pallidiceps* by Balakrishnan and Anishkumar (2008), a microscopic slide was glued on cardboard (5 mm thickness) and the other side of the cardboard was covered with muslin cloth. Arabica stem powder was sparsely sprinkled over the muslin cloth to elicit adults towards the slide-cardboard. A small slit (2.5 cm × 0.5 cm) was made on the cardboard and a late instar larva of CWSB was placed inside the



Adult female

Eggs laid on WSB larva

Parasitoid - Larvae



Parasitoid - Pupa

Parasitized larva of WSB

slit and covered with cotton plug. Oviposition was observed in the larva present inside the muslin cloth. Long and slender eggs were laid in groups and hatched larvae were found to feed externally on the WSB larva. The female parasitoid was larger in size (1 to 1.3 cm) compared to male (0.3 to 0.4cm). The life cycle of the parasitoid was studied on WSB larvae using the slide technique. The development period of egg, larvae and pupa were recorded as 6.14 ± 0.89 (5-7), 11.14 ± 1.86 (9-14) and 27.14 ± 3.6 (24-31) days, respectively. The study revealed that the time taken for completion of the life cycle ranged from 38 to 44 days.

Description of *Rinamba opacicollis* Cameron

Body length 6.84 mm, fore wing 4.96 mm, ovipositor 8.84 mm. Antenna short with 32 segments. Face convex in lateral view, rugose-reticulate, setose. Eyes glabrous with crenulated margin. Torular region raised. Clypeus strongly sculptured with distinct ventral carina. Tentorial pit deep. Lateral temple transversely striate. Frons longitudinally striate with a deep pit medio-basally. Ocellar area sculptured. Vertex smooth, sparsely setose. Occipital carina crenulate. Maxillary palp with five segments. Labial palp with three segments. Propleuron transversely striated. Mesosoma moderately dorso-ventrally flattened. Median lobe of mesoscutum with strong medial longitudinal grioove. Mesoscutum smooth, sparsely setose with lateral carina. Notauli crenulate anteriorly, meeting posteriorly. Scutellar sulcus divided by six carinae. Scutellum smooth, sparsely setose. Median area of metanotum with pits anteriorly, smooth medio-posteriorly. Propodeum rugose-reticulate with median longitudinal and lateral carinae anterior half, posteriorly with two anteriorly diverging carinae and with a pair of deep smooth pits sub medially. Mesopleuron smooth medially and anteriorly rest transversely striate. Sternaulus deeply impressed, crenulate, running along almost entire length of mesopleuron. Metapleuron smooth mid anteriorly, sparsely setose, rest transversely rugose striate. Fore wing 3.9× longer than maximum width. Pterostigma 3.9× longer than maximum width. Fore wing vein r arising before mid level of pterostigma. Second submarginal cell narrowing apically. Vein cu-a postfurcal. Fore femur robust. Mid and hind

femora transversely striate dorsally. Metasoma 1.0× longer than mesosoma and head combined. First metasomal tergite rugose reticulate, smooth medio-basally with moderately angulate corners basally and with apically converging pair of strong longitudinal carinae and small smooth medio-posterior area. Ovipositor with dorsal nodus and ventral serrations.

Considering the spontaneous occurrence of *R. opacicollis* in coffee white stem borer infested areas and its efficiency in parasitizing the CWSB larvae inside the stem, systematic studies to assess and exploit the potential of this parasitoid against *X. quadripes* are being pursued.

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