

# Possible New Species of *Araecerus* (Coleoptera: Anthribidae) associated with *Mastixiodendronpachyclados* (Rubiaceae) of Papua New Guinea

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**Abstract**— *Araecerus* is genus of beetles of the Anthribidae family which are important economic pests of various crops including coffee (Rubiaceae), with *A.fasciculatus* (Degeer) being the common pest (weevil) of coffee beans. This paper presents a study in which five undescribed species of genus *Araecerus* were reared predominantly from the seeds of *M.pachyclados* (Rubiaceae), a native tree of Papua New Guinea (PNG). Fruits of *M. pachyclados* were regularly sampled and insects attacking them were reared, preserved and identified. Fruits were hand collected, photographed, weighed and reared. Insects emerging from the fruits were captured and preserved in 99% ethanol. All the specimens were identified into morphospecies at the laboratory. The five new species discovered were designated as *A. sp.1*, *A. sp.2*, *A. sp.3*, *A. sp.4* and *A.sp.5*. This was accorded based on differences in body length; scutellum color, size, hair-scales and visibility; length of first and second segments of fore tarsus; apical and subapical teeth-size (mandible and maxillary palpi); declivity of dorsal abdomen; basal-anterior eye markings; lateral eye markings; absence of eye markings; and shape of pygidium. We discovered *A. sp.1* has yellowish gold marking inside the base of the eye, *A. sp.2* with pygidium almost vertically-flat at abdominal apex, *A. sp.3* has eyes without yellowish gold marking and generally dark in color, *A. sp.4* with distinct yellowish gold interior-lateral marking in its eye, and *A. sp.5* with pygidium pointed at abdominal apex.

**Keywords**— *Araecerus*, *coleoptera*, *anthribidae*, *Mastixiodendronpachyclados*, PNG.

## I. INTRODUCTION

*Araecerus* is a genus of beetles belonging to the family Anthribidae. They are important storage pests of cash crops such as coffee (Rubiaceae) and cocoa (Malvaceae). The species *A. fasciculatus* (DeGeer) is a common storage pest of coffee beans (coffee bean weevil) (Barrera 2008). *A. fasciculatus* is also a common pest infesting cocoa beans in storage (Eduku2014). Duke (1993) mentioned that *A. fasciculatus* was one of the pest of Nutmeg. *A. fasciculatus* was reported by Abo and Ja (2014) as major pests of yam and cassava flour. *Araeceruslevipennis* Jordan is a pest of leguminous plant *Leucaenaglauca* (L.) that has high protein content that is mainly used as a valuable foraging crop in ranches (Sherman and Tamashiro1955).

Early entomologists like Pascoe (1860) and Jordan (1894) extensively described about one hundred genera and one thousand species under Anthribidae family in which A.Schönherr, (Valentine 2005) was categorized under Subfamily Choraginae and Tribe *Araecerini*. Choraginae subfamily consisted of 3 species in South America in comparison with 14 species in Central America (Blackwelder1947). Jordan (1907) described ten species while Valentine (1999; 2002) contributed to the revision of the species. At least 98 species of Choraginae existed in the Old World (Mermudes and Lesche, 2014). The first species of the tribe *Araecerini* is *A.fasciculatus* (DeGeer1775), a pluralistic species of the genus A.Schoenherr, 1823 that comprises of about 70 described species in Indo Pacific (Mermudes2015).

Ctvrtecka *et. al.* (2014) obtained 1200 specimens of Anthribidae as a part of Curculionoidea in the same location where our research was carried out, but they could not be reliably identified to species. Seven species were found but had to be excluded also because most of the specimens remain unsorted (Ctvrtecka *et. al.*2014). Morimoto (1972) described *A.Schoenherr* as having tarsal segment 3 bilobed, nearly as broad as segment 2; tarsi slender, segments 1 and 2 much longer than wide; front tibiae simple at least in female; front tarsi normal; lateral prothoracic carinae reaching the middle; front tarsal segment 1 longer than the remaining segments added together; and eyes oval, less prominent.

This study was carried out to discover host-specific new species of *Araecerus* associated with *M.pachyclados* (Rubiaceae) using its “fallen fruits”.

## II. MATERIALS AND METHODS

### 2.1 Field Sampling

The study was conducted in relatively a primary forest at Wanang Conservation Area (5°13 'S, 145°04 'E), Madang, PNG between 15<sup>th</sup> January to 31<sup>st</sup> May, 2015. The vegetation of the study area is of mix evergreen rainforest on latosol with a humid climate (Laidlaw *et al.*2007; Paijmans 1976; Whitfeld *et. al.*2012). The annual rainfall is 3600 mm, and experiences a mild dry season from July to September, with annual temperature of 26°C (McAlpine *et. al.* 1983; Ctvrtecka *et al.*2014).

*Mastixiodendron pachyclados* is a locally abundant fruit bearing tree species, therefore was selected for this study. Fruits were collected (sampled) systematically following rows from within an existing 50 ha forest dynamics plant plot and few were sampled outside the plot. Sampling was carried out in different areas of the forest, including areas of both low and high abundance of *M. pachyclados*. The densities of fruits on the ground were measured and the sampling covered areas of both high and low density of fruits. Fruits of each tree species were separately placed into plastic bags and given an unique tree number code for identification. A fruit from each tree was sliced in half, and photographed together with unsliced fruits.

The fruits were then separated into plastic rearing containers (plastic boxes) and weighed on an electronic balance. Three fruits from each tree were sliced and measured (length, width, height, seed length, seed width and seed height). The rearing containers were closely monitored on a daily basis for hatched insects. The insects which hatched were collected by opening the side of the plastic lid, put in a pre-labeled test tube and preserved in 99% ethanol.

### 2.2 Identification

All the wet specimens were taken to New Guinea Binatang Research Center (NGBRC) in Madang, PNG to be identified. Identification was carried out with the aid of reference text books, online insect databases (www.buglife.com), and insect database and reference collections of NGBRC. The specimens were initially sorted into morpho-species and given codes based on distinct morphological features. Identification was done to genus level and species were divided into *A. sp.1*, *A. sp.2*, *A. sp.3*, *A. sp.4* and *A.sp.5*, according to their differences in morphology.

The morphological features used for identification of the ‘possible new species’ were: body length, tarsal segment, eye markings, apical teeth, scutellum and pygidium. Descriptions of these distinctive morphological features were analyzed using Dichotomous Key System.

## III. RESULTS

The identification keys of each species and pictures of their specific body parts are presented below.

- Length of body equal to or more than 4mm (Figure 1a) and length of body equal to or less than 4mm (Figure 1b)

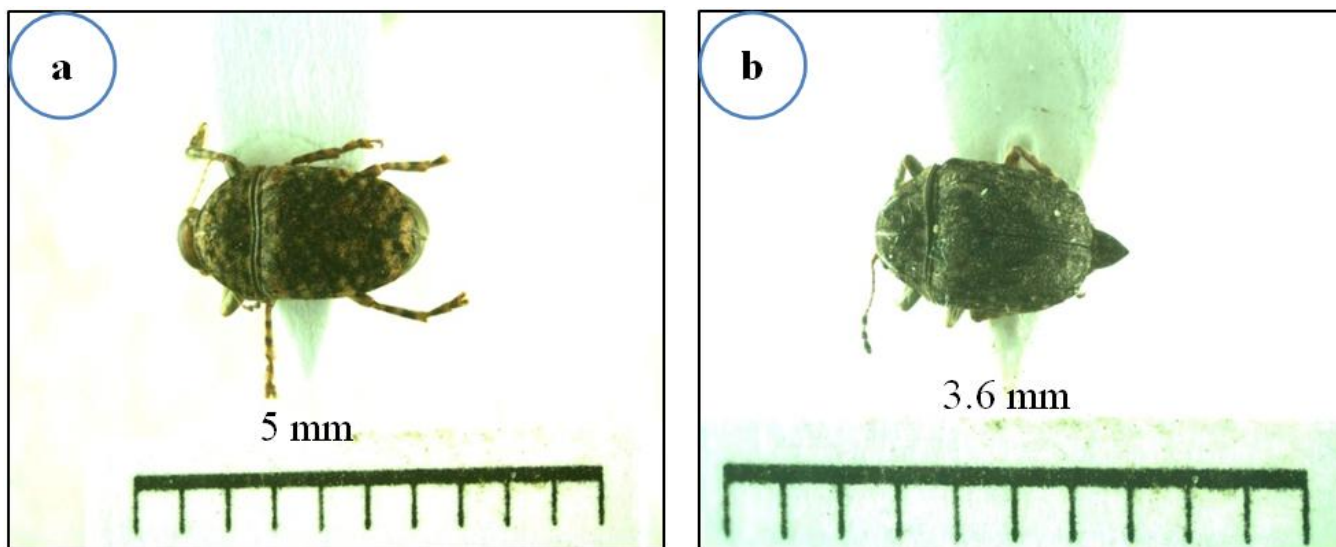
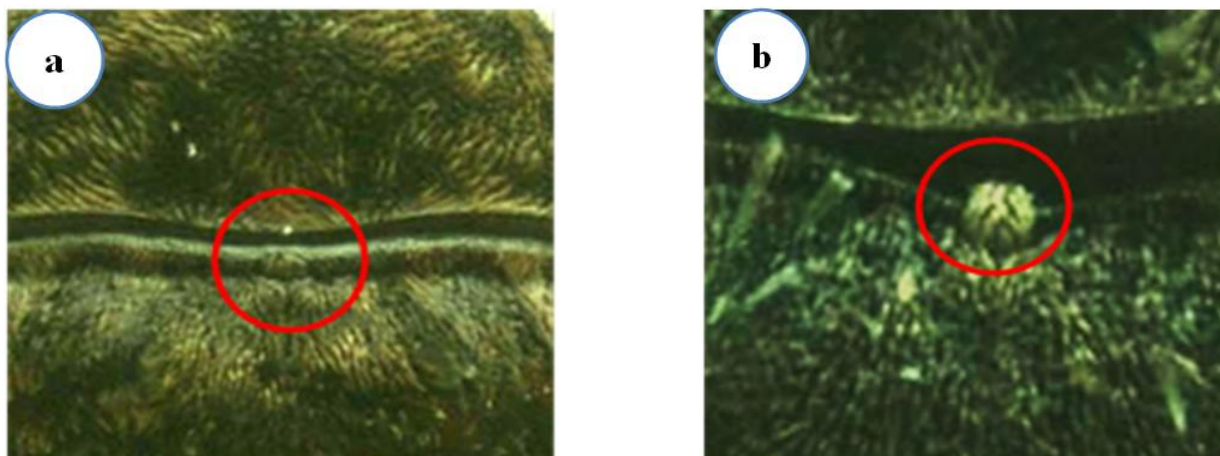


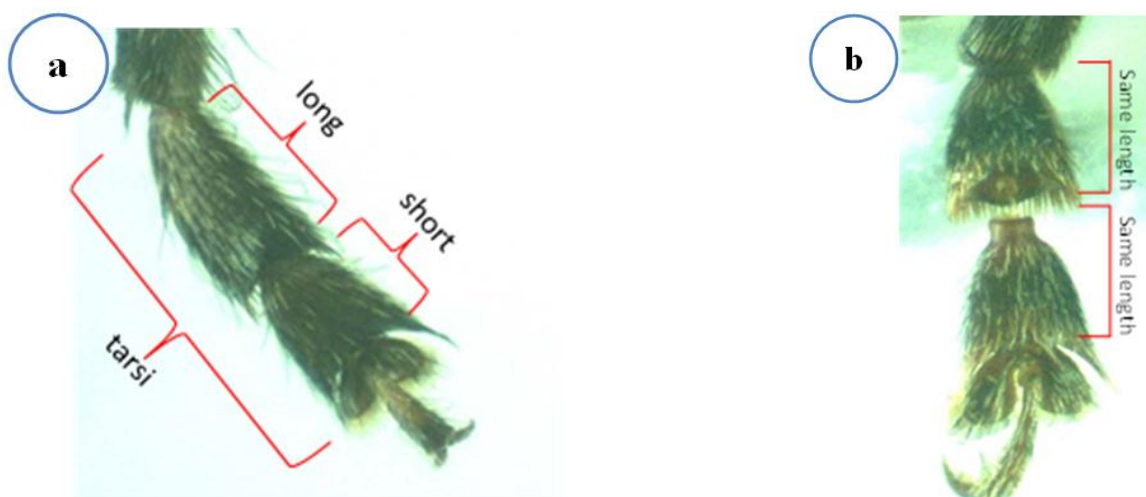
FIG. 1.BODY LENGTH OF THE SPECIES

- Scutellum very small, poorly visible or dark in color (Figure 2a) and scutellum small and densely covered with yellowish brown hair-like scales (Figure 2b).



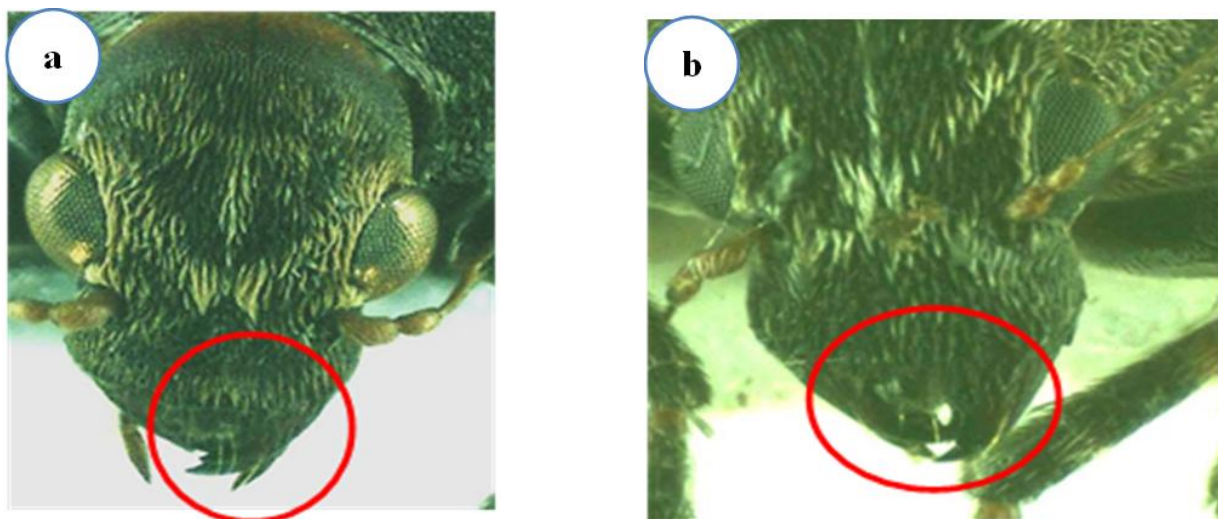
**FIG.2.SCUTELLUM SIZE AND COLOR OF THE SPECIES**

- First segment of fore tarsus longer than second segment (Figure 3a) and first segment of fore tarsus equal to or shorter than second segment (Figure 3b).



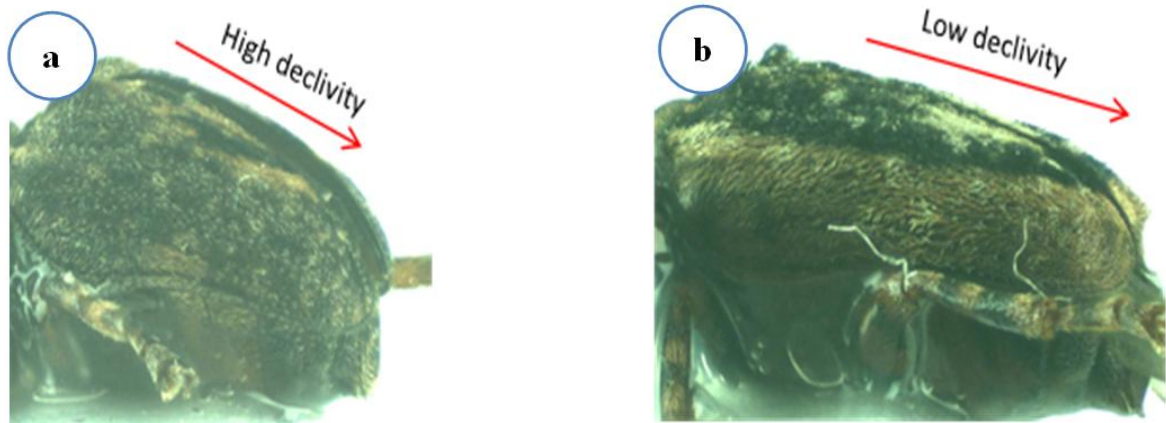
**FIG.3.FORE AND SECOND SEGMENT OF TARSUS**

- Unequal-sized apical and subapical teeth (mandible and maxillary palpi) (Figure 4a) and almost equal-sized apical subapical teeth (mandible and maxillary palpi) (Figure 4b).



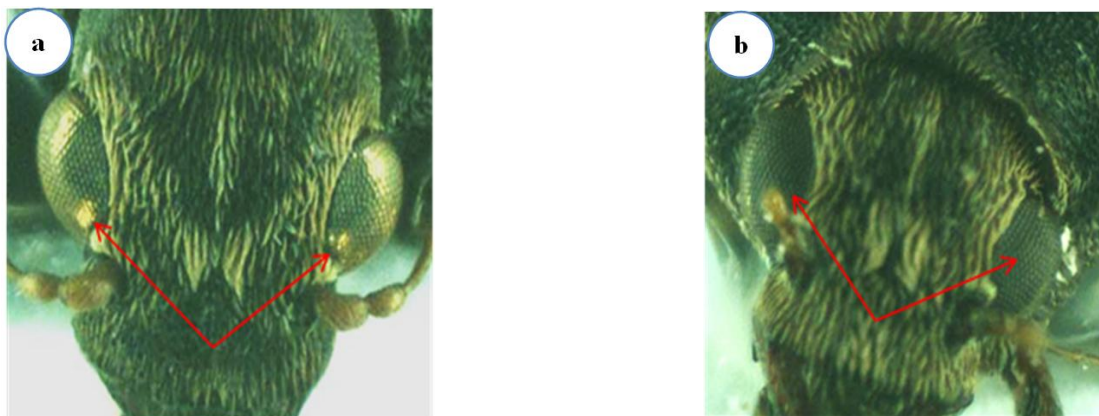
**FIG.4.MANDIBLE AND MAXILLARY PALPI OF THE SPECIES**

- High declivity towards the abdominal apex (Figure 5a) and low declivity towards the abdominal apex (Figure 5b).



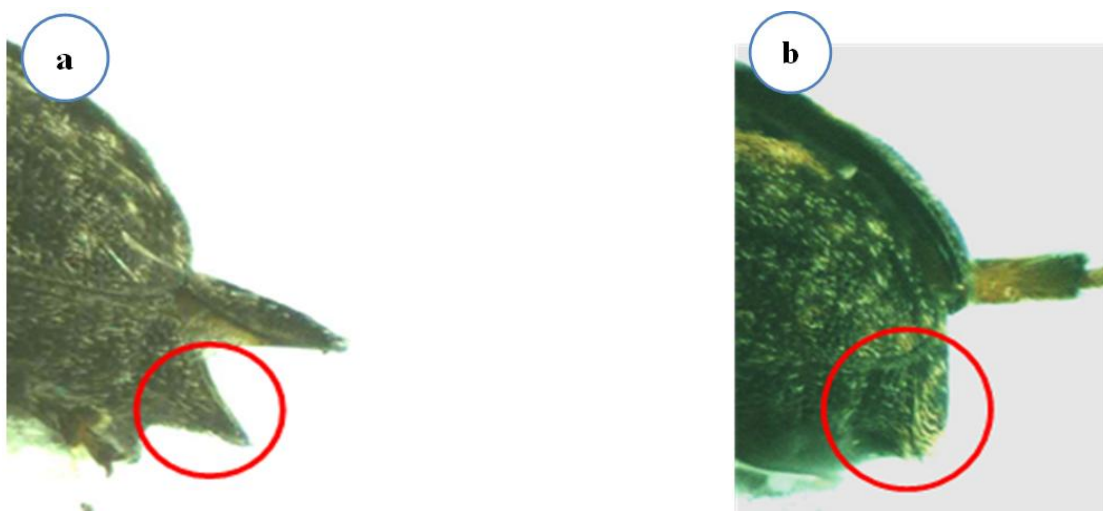
**FIG.5. DECLIVITY OF THE SPECIES**

- Yellowish gold marking inside the base of eye on A. sp. 1 (Figure 6a) and eyes without yellowish gold marking inside the base of eye (Figure 6b).



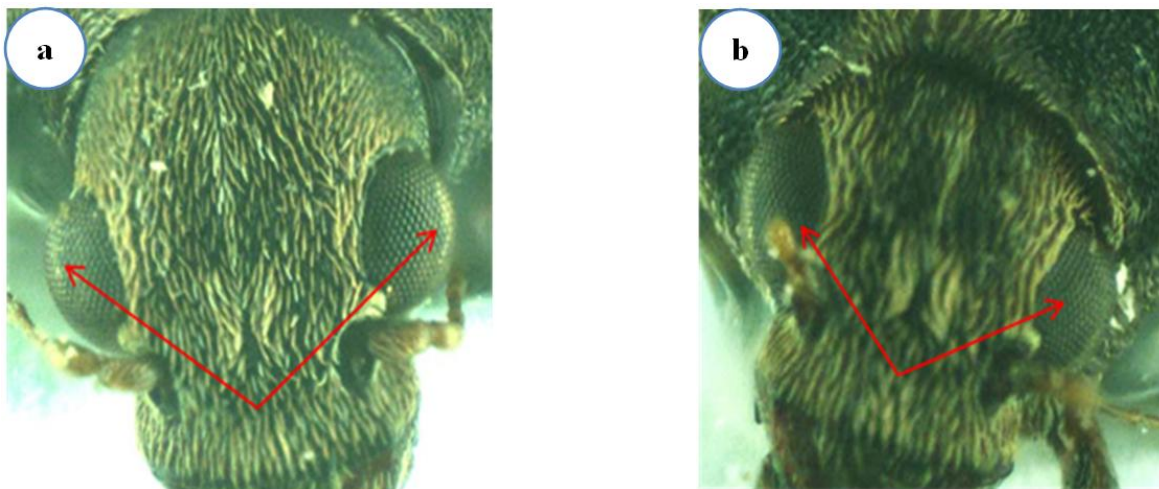
**FIG. 6. COLORATION INSIDE THE BASES (6A) SPECIES 1 AND (6B) SPECIES**

- Pygidium pointed at abdominal apex in A. sp. 5 (Figure 7a) and pygidium almost vertically-flat at abdominal apex in A. sp. 2 (Figure 7b).



**FIG.7.PYGIDIUM ORIENTATION (7A) SPECIES 5 AND (7B) SPECIES 2**

- Eye with yellowish gold interior-lateral marking in A.sp. 4 (Figure 8a) and eye without marking and generally dark in color of A.sp. 3 (Figure 8b).



**FIG.8.INTERIOR LATERAL MARKING (8A) SPECIES 4 AND (8B) SPECIES 3**

#### IV. DISCUSSION

*Araecerus* belonging to the Anthribidae family has the prominent club shaped antenna; adults are elongated and slightly oval; have a short beak and straight antennae; elytra with distinct rows of striae absent; and pronotum with a transverse ridge towards the base. As per Holloway (1982), the genus *Araecerus* has (i) second segment of tarsi forming lobes around the third segment; (ii) elytra with areas of differently colored scale-like hairs; (iii) antenna attached on the top of the head; (iv) base of antennal segment and groove is visible from above; (v) first segment of the tarsi is three times longer than wide; (vi) pronotum without a transverse ridge but with the base itself slightly raised; and (vii) base of pronotum gently curved with mid part converging towards scutellum.

The five species identified differ from their close relative *A. fasciculatus* by certain morphological features. *A. fasciculatus* possess antennal club, and the entire eye and the elytra without distinct striation (Bright 1993). Body length of an adult beetle is about 3–5 mm (El-sayed 1935; Bright 1993; Robinson 2005). All the five species identified fall in the same body length range; A.sp.1 (5mm), A. sp.2 (3.8 mm), A. sp.3 (4mm), A. sp.4 (4.5mm) and A.sp.5 (3.6mm). In comparison to the five species, *A. fasciculatus* has paler elytra with hairs denser and irregular so that there are darker and lighter areas and the first segment of the front tarsi is as long as the rest of the segments combined (including the claws). The five species have dense hairs, regular markings on the elytra and first segment of the front tarsi shorter than the rest of the segments combined (including the claws).

Interestingly, all species identified are host-specific to *M.pachyclados* and predominantly reared from seeds rather than the mesocarp. Since coffee (*Coffea arabica* & *C. robusta*) belongs to the same family as *M. pachyclados*, this unique feeding guild thus categorizes the five “new possible species” as seed feeders. Species under *Araecerus*, e.g. *A. fasciculatus*, mostly are reported as seed feeds of important crops such as coffee (Barrera 2008), cocoa (Eduku 2014), nutmeg (Duke 1993), leguminous plant *Leucaenaglauca* L.) (Sherman and Tamashiro 1955) and on pesticide plant, *Melia azedarach* L. (Ardakani and Nasserzadeh 2014). These indicate that the outcome of this study has implications for management of the species identified.

The fact that the insects were reared from *M.pachyclados* in a tropical rainforest habitat demonstrates wide host range of *Araecerus* beetles, and a range of forest trees as alternate host for breeding, oviposition, migration and food resources. We propose additional studies on molecular characterization and analysis for confirmation of these species.

#### V. CONCLUSION

The genus *Araecerus* is a major pest of important cash crops (e.g. coffee and cocoa) and identification of new pests and quantification of their abundance are prerequisites to crop protection. It is known now that *A. fasciculatus* was found feeding on pesticide plant *Melia azedarach* L., which may support their ability to tolerate application of botanical pesticides. In such

case, more suitable and effective control measures should be used to overcome such problems. Since these five species have not been described, it is presumed that they are possibly new species. Their morphological descriptions can therefore be used for nomenclatural system, and thus contributes to overall insect taxonomy.

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