

SHORT COMMUNICATION

First record of the largest copro-necrophagous beetle in South America (*Coprophanaeus lancifer*) feeding on fruits

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*Corresponding author: elena.chaboteaux@hotmail.com; ¹<https://orcid.org/0000-0001-5288-5910>**ABSTRACT**

Coprophanaeus lancifer is a copro-necrophagous beetle endemic to the Amazon region. Although beetles belonging to the subfamily Scarabaeinae primarily feed on dung, some have a greater diet plasticity that includes carrion, fungi, rotten fruits and invertebrates. The diet of the scavenger beetle *C. lancifer* mainly consists of vertebrate carcasses, although it is also attracted to mammal faeces. Here, we describe the first record of this species feeding on fruits of the genus *Nectandra*.

KEYWORDS: Peru; dung beetle; frugivory; diet plasticity; Scarabaeinae; Amazon

Primer registro del escarabajo coprófago más grande de América del Sur (*Coprophanaeus lancifer*) alimentándose de frutos

RESUMEN

Coprophanaeus lancifer es un escarabajo copro-necrófago endémico de la región amazónica. Aunque los escarabajos pertenecientes a la subfamilia Scarabaeinae se alimentan principalmente de excrementos, algunos tienen una mayor plasticidad dietética que incluye carroña, hongos, frutas podridas y invertebrados. La dieta del escarabajo carroñero *C. lancifer* consiste principalmente en cadáveres de vertebrados, aunque, también se siente atraído por heces de mamíferos. Aquí, describimos el primer registro de esta especie alimentándose de frutos del género *Nectandra*.

PALABRAS CLAVE: Perú; escarabajo coprófago; frugívoro; plasticidad dietética; Scarabaeinae; Amazonía

The dung beetle *Coprophanaeus lancifer* Linnaeus, 1767 is a member of the Scarabaeidae family (subfamily Scarabaeinae) and, together with *C. ensifer* (Germar), *C. bonariensis* (Gory) and *C. bellicosus* (Olivier), is a valid member of the *Megaphanaeus* subgenus (Maldaner *et al.* 2017; Maldaner *et al.* 2018). It reaches a length of up to 55 mm (Edmonds 1972) and weighs up to 10 g (pers. comm. Sandra María Bejár Hermoza), more than most hummingbirds (pers. comm. G. Chacon, who weighed individuals of 10 different species of hummingbirds in the Kosñipata valley (Peru), with just one individual exceeding 10 g). It is the largest copro-necrophagous beetle in South America and its range extends throughout Venezuela, French Guiana, Guyana, Suriname, Brazil, Bolivia and Peru, in the Amazonian subregion (Edmonds and Zidek 2010; Maldaner *et al.* 2018).

Coprophanaeus lancifer is mostly found in terra firme habitats, of both pristine and second growth forests, and less commonly in floodplain forests (Hamel-Leigue *et al.* 2009;

Larsen 2015). As all other copro-necrophagous beetles, it carries out an important part of the nutrient-cycling process in tropical rainforests (Halffter and Favila 1993). This species flies up to 5 km per day, generally at dusk (Feer and Pincebourde 2005) to find and bury animal faeces and small carcasses, especially in the wet season, according to our hitherto unpublished investigations. Its feeding habits also make it useful in forensic entomology, mostly due to its ability to cause tissue injury and by moving the cadaver from its original position (Ururahy-Rodrigues *et al.* 2008).

Although dung beetle species are mostly coprophagous, there are many species that feed on carrion, rotten fruits or fungi (Larsen *et al.* 2006; Halffter and Halffter 2009; Amézquita and Favila 2011; Salomão *et al.* 2017, 2021; Langton-Myers 2022; Santiago *et al.* 2022), and there are even some that predate upon millipedes (Larsen *et al.* 2009) and leaf-cutter ant queens (Aquino *et al.* 2018). As they use faeces and carrion as feeding sites for adults, they also build brood

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balls with these decomposing substrates to lay their eggs and feed their larvae (Gittings *et al.* 1998; Byk and Piętko 2018; Santiago *et al.* 2022).

The diet of *C. lancifer* mainly consists of vertebrate carcasses, which it quickly buries in the soil, often after intense competitive battles within and between the sexes, both of which are armed with large horns (Otronen 1988). These beetles are also attracted to mammal faeces. Edmonds and Zideck (2010), in their taxonomic review of *Coprophanaeus*, comment that beetles of this genus were observed feeding on decomposing millipedes. There are no reports of this species consuming foods other than carrion and dung. Here we report the first observations of *C. lancifer* feeding on fruits.

On March 24th 2022, at approximately 9:45 am, an individual of *C. lancifer* was found feeding on drupes of the genus *Nectandra* (Lauraceae). The drupe was completely ripe, with no evident smell, and was about half the size of the beetle (Figure 1). The feeding event was registered in a terra firme forest, on a trail (12°33'48.1392"S, 70°5'51.5508"W) at Los Amigos Biological Station (LABS), an Amazonian lowland research station located in the Madre de Dios watershed of southern Peru.

The beetle was collected along with a sample of the fruit, in the absence of a camera to document the event, and stored in a plastic zip-lock bag for later identification. During that same day, four more individuals of *C. lancifer* were collected using non-lethal carrion-baited pitfall traps in order to replicate the observation with more than one individual. On March 25th 2022, the five individuals were transported in a tupperware to the same site where the first individual was observed eating the drupe and released at 10:00 am close to where the *Nectandra* sp. fruits were located.

Within a few minutes, three out of the five individuals had moved away from the trail and hidden under the litter, while the remaining two had encountered a drupe and had started consuming it (Figure 2). During this observation, one of the individuals had also started digging a small hole in the soil to bury the drupe and the seed, even though the action of burying

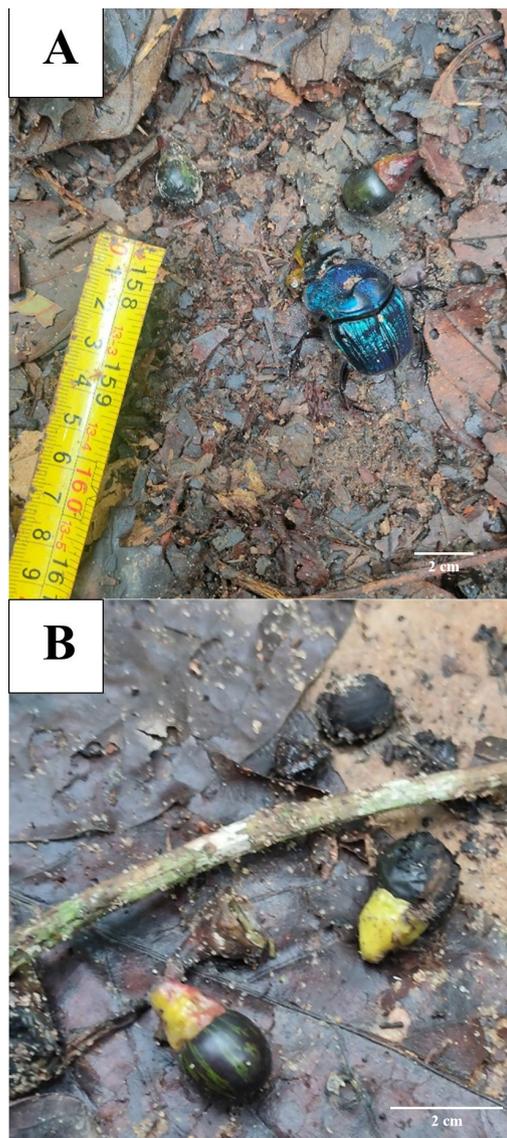


Figure 1. A – Individual of *Coprophanaeus lancifer* feeding on a *Nectandra* sp. drupe, at Los Amigos Biological Station, Peru; B – Close-up of *Nectandra* sp. drupes, the decomposing one on the right subsequently selected by one individual of *C. lancifer*. This figure is in color in the electronic version.



Figure 2. A,B – Two individuals of *Coprophanaeus lancifer* consuming ripe *Nectandra* sp. fruits at Los Amigos Biological Station, Peru. This figure is in color in the electronic version.

was not completed, as the beetle interrupted it and went away a few minutes later. The activity of two individuals eating and moving the fruits lasted 30 minutes and was registered on video (https://drive.google.com/drive/folders/1N5R9P_c1d2mSSZLH9UM9tQZwKRDE_Ztc?usp=sharing) until both spontaneously left the site. We noticed that both beetles seemed to prefer the decomposing fruits, already mashed or opened, over fresh and intact fruits on the forest floor. A total of three individuals were observed feeding on *Nectandra* fruits over two days.

Many species of Neotropical Scarabaeinae are considered generalists (Raine *et al.* 2019) with some feeding on fallen fruits (Davis and Sutton 1997; Sarges *et al.* 2012). However, the vast majority of papers on dung beetle diet preferences are derived from collection of beetles with baited pitfall traps rather than observations of feeding behavior under natural conditions. Most carrion feeders of the genus *Coprophanaeus* are facultative dung consumers, as is the case of *C. lancifer* which is only known to consume rotten meat and faeces. The ability to feed on alternative seasonal resources may be a consequence of the difficulty to find patchily distributed food sources such as dung and carrion. In this context, fruit such as the *Nectandra* drupes may help to provide the necessary energy to keep on foraging, but probably would not be used for nesting, a hypothesis that remains to be tested. Our observation raises questions regarding the importance of alternative food sources such as fruits for the interaction between this species with plants and the provision of ecosystem services.

Dung beetles play an important role in secondary seed dispersal all over the world (Vulinec 2002; Koike *et al.* 2012; Midgley *et al.* 2015; Midgley *et al.* 2021; Pedersen 2022). Our observations suggest that *C. lancifer* may not only contribute to seed dispersal indirectly through dung removal but may be involved in the process of directly dispersing seeds that are not eaten and dispersed by other animals and, consequently, are not found in their scats.

Coprophanaeus lancifer presents an even greater feeding plasticity than what was already known. This argues for more effort at observations of live beetles under field conditions rather than complete reliance on baited pitfall traps.

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