

## Short Communication:

# Endemics species of dung beetles (Coleoptera: Scarabaeidae) on the southern slope of Mount Slamet, Central Java, Indonesia

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**Abstract.** Widhiono I, Darsono, Fasihah N. 2017. Short Communication: Endemics species of dung beetles (Coleoptera: Scarabaeidae) on the southern slope of Mount Slamet, Central Java, Indonesia. *Biodiversitas* 18: 283-287. A survey was conducted to gauge the diversity of dung beetles (Coleoptera: Scarabaeidae) on the forested southern slope of Mount Slamet, Central Java, Indonesia, from April to June 2011. A total of 255 dung beetles of 14 species were collected. Of the 255 specimens collected, 125 (49.42%) were found in secondary forest and 130 (50.58%) were found in Agathis forest. The most abundant species was *Phacosoma punctatum* with 107 individuals (41.9%), followed by *Onthophagus echinus* with 53 individuals (20.7%) and *Onthophagus palatus* with 36 individuals (14.1%). One species (*Onthophagus trituber*) was discovered to be a cosmopolitan species, while ten species (*Onthophagus armatus*, *Onthophagus discedens*, *Onthophagus echinus*, *Onthophagus egenus*, *Onthophagus holzi*, *Onthophagus luridipennis*, *Onthophagus palatus*, *Onthophagus* sp., *Dactylosternum* sp. and *Apogonia cribrata*) were endemic to Mount Slamet.

**Keywords:** dung beetles, Mount Slamet, endemic species, cosmopolitan species

## INTRODUCTION

Dung beetles (Coleoptera: Scarabaeidae) serve an important function as detritivores in tropical forest ecosystems. Some species of dung beetles have highly specific habitat preferences (Halffter and Favila 1993) and many of them are unable to occupy areas of open vegetation (Boonrotpong et al. 2004). This specificity makes dung beetles useful as precise bioindicators of the health of forest ecosystems (Audino et al. 2014). Dung beetle community composition is strongly influenced by habitat loss and fragmentation, which may restrict species distribution or even cause local extinctions (Davis and Philips 2005; Hernández and Vaz-de-Mello 2009). Studies on dung beetles have been conducted in some forested areas of Indonesia, including North Sulawesi (Hanski and Krikken 1991; Hanski and Niemela 1990), Sumatra (Gillison et al. 1996), Lembah Harau National Park, West Sumatra (Putri et al. 2015; Sari et al. 2015), West Java (Noerdjito 2003) Gede Pangrango National Park, West Java (Shahabuddin et al. 2005; Kahono and Setiadi 2007) and Central Sulawesi (Shahabuddin et al. 2007; Shahabuddin 2010).

However, to this point no research has been conducted on dung beetles in the forested area of Mount Slamet, Central Java. Mount Slamet, a transitional bioregion between the wet forest of western Java and the monsoon forest of eastern Java, is the largest mountain on the island of Java. The forest ecosystem of Mount Slamet, especially on the southern slope, remains in good condition due to

regional hydrological protection that prohibits logging. This study was thus carried out there with the objective of investigating endemics species composition and abundance of dung beetles in two types of forest ecosystem.

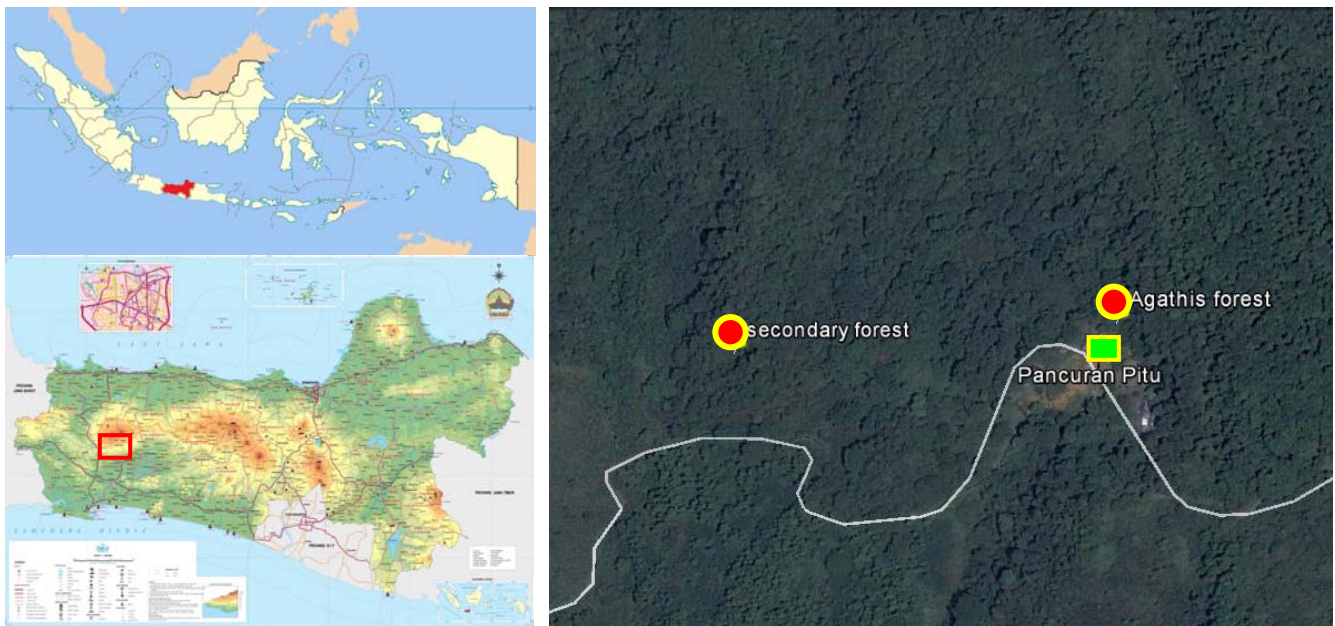
## MATERIALS AND METHODS

### Study site

This research was conducted on the southern slope of Mount Slamet between 645 m and 856 m above sea level (7° 18' 49.32" S and 109° 12' 45.86" E - 7° 18' 32.31" S and 109° 13' 16.70" E). Surveys were carried out from April to June 2011 in secondary and Agathis forest ecosystems, both of which are very stable in this location due to the lack of logging activity (Figure 1.)

### Dung beetle collection

Surveys were conducted by random sampling at three sites in each of the two habitat types. Beetles were collected along 40 m transect lines within 1,600 m<sup>2</sup> sampling plots. Ten traps were placed along each transect, at a distance of approximately ten meters from the transect line (Kahono and Setiadi 2007). Traps were created by embedding plastic cups in the ground with their rims flush to the ground surface. These cups were filled with an insect-killing solution (3 tablespoons of salt and 3 tablespoons of liquid detergent dissolved in 1 L of water). Fresh cow dung wrapped in gauze was hung in the centres



**Figure 1.** Study site secondary and agathis forest in southern slope of Mount Slamet, Banyumas, Central Java, Indonesia

of the mouths of the traps as bait. Traps were covered with plastic fibre to protect them from rainwater and dirt. Traps were checked after two days and beetles collected from them were preserved in Scheerpelz solution as recommended by Krell (2007). For beetles identification, all specimen were identified by beetle taxonomist from Research Center for Biology, Indonesian Research Institute (LIPI) Bogor, West Java, Indonesia.

#### Environmental factors

Environmental parameters were measured for each habitat included air temperature, humidity and canopy cover.

#### Data analysis

To compare the dung beetle community structure from two habitats, we calculated, and alpha diversity (Shannon  $H'$ , Simpson  $D$ , and Evenness  $[E]$ ). For analysis habitat preference and endemism we grouping all specimen into secondary and agathis forest and comparing with any references therein. To know impact of environmental on dung beetle species composition we applied correlation analysis with the help of SPSS 21.

## RESULTS AND DISCUSSION

A total of 255 dung beetles (Coleoptera: Scarabaeidae: Scarabaeinae), comprising 14 species in four genera (*Phacosoma*, *Onthophagus*, *Apogonia* and *Dactylosternum*), were collected from the southern slope of Mount Slamet. Eleven species were collected from secondary forest and ten species were collected from Agathis forest. Of the 255 specimens collected, 125

(49.42%) were found in secondary forest and 130 (50.58%) were found in Agathis forest. Three species were predominant; the most abundant was *Phacosoma punctatum* with 107 individuals (41.9%), followed by *Onthophagus echinus* with 53 individuals (20.7%) and *Onthophagus palatus* with 36 individuals (14.1%). *Onthophagus* sp. and *Onthophagus armatus* were moderately abundant, with 14 (5.54%) and 10 (3.9%) individuals collected, respectively. The remaining species, which were categorized as rare (with fewer than ten individuals found), were *Apogonia cribrata*, *Dactylosternum* sp., *Onthophagus batillifer*, *Onthophagus egenus*, *Onthophagus holzi*, *Onthophagus luridipennis*, *Onthophagus pacificus*, and *Onthophagus trituber*.

Four species (*O. batillifer*, *O. egenus*, *O. luridipennis*, and *O. trituber*) were found only in secondary forest. Three species (*A. cribrata*, *Dactylosternum* sp. and *O. discedens*) were found only in Agathis forest. The remaining seven species (*O. armatus*, *O. echinus*, *O. holzi*, *O. pacificus*, *O. palatus*, *Onthophagus* sp. and *P. punctatum*) were found in both habitats. *P. punctatum* was more abundant in secondary forest, while *O. echinus* and *O. palatus* were more abundant in Agathis forest. According to the Shannon-Weiner diversity index, secondary forest had a greater diversity of beetles ( $H' = 1.805$ ,  $E = 0.5528$ ,  $D = 0.7421$ ) than Agathis forest ( $H' = 1.596$ ,  $E = 0.4933$ ,  $D = 0.7343$ ).

We found 14 species of dung beetle on the southern slope of Mount Slamet (Figure 2). This is fewer species than the 28 found by a similar study in Kerinci Seblat National Park, Sumatra (Hariyanto 2007) Kayan Mentarang National Park, North Kalimantan and Gunung Gede Pangrango National Park, West Java (Shahabuddin et al. 2005) but significantly more than were identified in Lembah Harau National Park, West Sumatra (Putri et al.

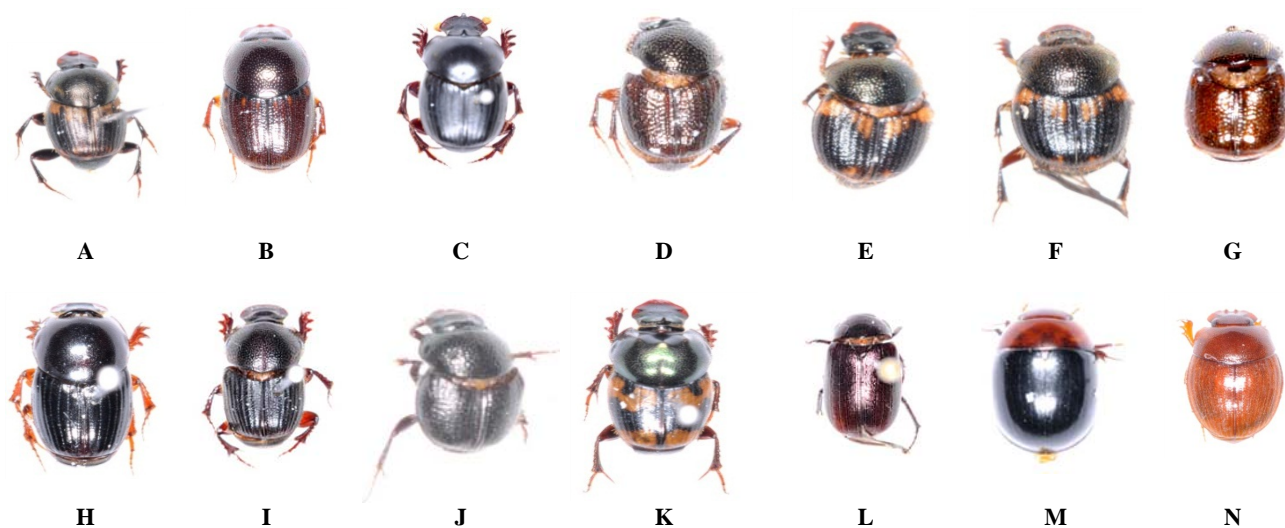
2015; Sari et al. 2015). There are many factors that explain these differences in species diversity, including differences in location, timing of the studies, type of ecosystem, vegetative cover, fragmentation, physical structure, and environmental elevation (Escobar et al. 2005). Of the 14 species collected from the southern slope of Mount Slamet, two (*O. pacificus* and *P. punctatum*) have also been collected from Gunung Gede Pangrango National Park in West Java (Shahabuddin et al. 2005) and three (*O. batillifer*, *O. pacificus* and *O. trituber*) were also found in the North Kalimantan forest (Davis et al. 2001). *O. trituber* has also been identified in Lore Lindu National Park in Central Sulawesi (Shahabuddin. 2010). This species is

widely distributed, having been found on the three islands of Java, Kalimantan and Sulawesi.

The species of dung beetle collected in this study can be classed into three groups according to habitat preference. The secondary forest group comprises *O. batillifer*, *O. egenus*, *O. luridipennis* and *O. trituber*. The plantation forest group includes *A. cribrata*, *Dactylosternum* sp. and *O. discedens*. The third group, cosmopolitan species that were found in both habitats, contains *P. punctatum*, *O. armatus*, *O. echinus*, *O. holzi*, *O. pacificus*, *O. palatus*, and *Onthophagus* sp.. This result correlated with environmental conditions of the study site, especially with canopy covers ( $r^2 = 0,73$ ) (Table 2).

**Table 1.** Species and abundance of dung beetles found in two habitat types on the southern slope of Mount Slamet, Central Java, Indonesia

Species	Secondary Forest	Agathis Forest	Total collected	Average from each site	Relative abundance (%)
<i>Phacosoma punctatum</i>	58	49	107	53.5	41.9
<i>Onthophagus echinus</i>	13	40	53	26.5	20.7
<i>Onthophagus palatus</i>	16	20	36	18	14.1
<i>Onthophagus</i> sp.	11	3	14	7	5.4
<i>Onthophagus armatus</i>	3	7	10	5	3.9
<i>Onthophagus trituber</i>	6	0	6	3	2.3
<i>Onthophagus batillifer</i>	6	0	6	3	2.3
<i>Onthophagus pacificus</i>	3	2	5	2.5	1.9
<i>Onthophagus holzi</i>	4	1	5	2.5	1.9
<i>Onthophagus discedens</i>	0	4	4	2	1.5
<i>Onthophagus luridipennis</i>	3	0	3	1.5	1.1
<i>Apogonia cribrata</i>	0	3	3	1.5	1.1
<i>Onthophagus egenus</i>	2	0	2	1	0.7
<i>Dactylosternum</i> sp.	0	1	1	0.5	0.3
Total (individuals)	125	130	255		
Total (species)	11	10	14		



**Figure 1.** Species composition of dung beetle in study area on the southern slope of Mount Slamet, Central Java, Indonesia. A. *Onthophagus armatus*, B. *Onthophagus batillifer*, C. *Onthophagus discedens*, D. *Onthophagus echinus*, E. *Onthophagus egenus*, F. *Onthophagus holzi*, G. *Onthophagus luridipennis*, H. *Onthophagus pacificus*, I. *Onthophagus palatus*, J. *Onthophagus* sp., K. *Onthophagus trituber*, L. *Apogonia cribrata*, M. *Dactylosternum* sp., N. *Phacosoma punctatum*

**Table 2.** Environmental factors in two habitat, secondary and agathis forest during sampling periods (means  $\pm$  SD)

Environmental parameters	Secondary forest	Agathis forest
Air temperature (°C)	25.56 $\pm$ 0.58	28.33 $\pm$ 0.43
Humidity (%)	87.56 $\pm$ 1.81	78.56 $\pm$ 1.24
Canopy cover (%)	82.67 $\pm$ 2.18	72.33 $\pm$ 2.18

According to Escobar et al (2015), dung beetle distribution is strongly influenced by the vegetative cover, fragmentation, physical structure, and elevation of the local environment. These characteristics are important factors that determine the composition, abundance, and richness of species assemblages (Almeida and Louzada 2009). Dung beetle community composition is strongly influenced by habitat loss and fragmentation, which may restrict their distribution or even cause local extinctions (Audino et al. 2014). Habitat suitability also affects the abundance of species such as *P. punctatum*, *O. echinus* and *O. Palatus*, the latter two species being more abundant in plantation forest while the former is more abundant in primary forest. The greater abundance of *P. punctatum* in primary forest is most likely due to this species' preference habitat with denser canopy cover and lower temperatures, making it a so-called "shaded species", while *O. echinus* and *O. palatus*, by contrast, prefer habitats with less canopy cover and higher temperatures (Shahabuddin. 2010), however in this study significant environmental factors affecting the distribution of the these beetles only canopy cover ( $r^2 = 0,73$ )

Furthermore, in comparing our data with that of studies conducted in Gede Pangrango National Park in West Java, Lore Lindu National Park in Central Sulawesi, and the mountain forest in North Kalimantan, Indonesia we identified several species (*O. armatus*, *O. discedens*, *O. echinus*, *O. egenus*, *O. holzi*, *O. luridipennis*, *O. palatus*, *Onthophagus* sp., *Dactylosternum* sp. and *A. cribrata*) that were only collected on Mount Slamet, and can thus be considered endemic to the area.

Based on the Shannon-Wiener diversity index, secondary forest on Mount Slamet has a greater diversity of dung beetles ( $H' = 1.805$ ,  $E = 0.5528$ ,  $D = 0.7421$ ) than Agathis forest ( $H' = 1.596$ ,  $E = 0.4933$ ,  $D = 0.7343$ ). The greater diversity of tree species and denser canopy cover found in primary forest can create microclimates, especially with regard to temperature and humidity, which strongly influence the species composition of dung beetle communities (Barbero et al. 1999). Habitats containing more complex vegetation structure and denser canopy cover can support a greater diversity of dung beetles, as complex vegetation provides larger areas in which dung beetles can search for food, as well as offering shelter from potential predators (Arellano et al. 2005). Based on the result can be concluded that the forest on the southern slope of Mount Slamet contains ten endemic species of dung beetles and the species abundance of endemic beetles correlated with forest condition especially canopy covers.

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