



Dung beetles (Coleoptera; Scarabaeoidea) diversity: indicator of animal diversity?

Dung Beetles

- Dung beetles (*Coleoptera*) feed on manure of animals, mostly large mammals
- The manure is also used as nest for breeding and growth of juveniles
- The nest can be made inside the manure (*Dweller*); ball of manure 'rolled' to the nest (*Roller*); or build nest under ground beneath the manure (*Tuneller*).
- Dung beetles in different habitats have different structures (Davis & Sutton, 1998). Some dung beetles are generalists and are able to use manure of a range of mammals. Others are more specialised and use manure of very specific animals. Hanski and Cambefort (1991) report that mammal diversity, hence, influences diversity of dung beetles. Therefore, dung beetles can be used to assess animal biodiversity in agro-ecosystems.

Ecological roles of dung beetles

- Degradation of organic matter (manure)
- Removing parasitic worms and germs of livestock
- Reduced nitrogen loss from manure into atmosphere
- Secondary seed dispersal and pollination (e.g. *Paragymnopleurus* and *Onthophagus taurus* beetles pollinate *Orchidantha inouei*)



Figure 1. A pair of male and female dung beetles rolling animal manure to their nest.

Taxonomy

Most of dung beetles member are from the family *Scarabaeidae* especially sub-family *Scarabaeinae* and *Coprinae*. Others come from the family *Aphodiidae*, *Trogidae* and *Geotrupidae*.



Coprinae (*Tuneller*)



Coprinae (*Tuneller*)



Geotrupidae (J. Dabry, 2003)



Scarabaeinae (*Roller*)



Aphodiidae (*Dweller*) (J. Dabry, 2003)

Morphological characters

- Hexapod and have three distinct body parts - head, thorax and abdomen
- Generally black colored, some with metallic and bold chromatic form
- Head of Scarabaeidae beetles is spade-like with one or a pair horns
- Elongated protibia make sharp outer teeth
- Antenna with 3-4 elongated segments at end (Flabellate)



Coprinae (*Tuneller*)

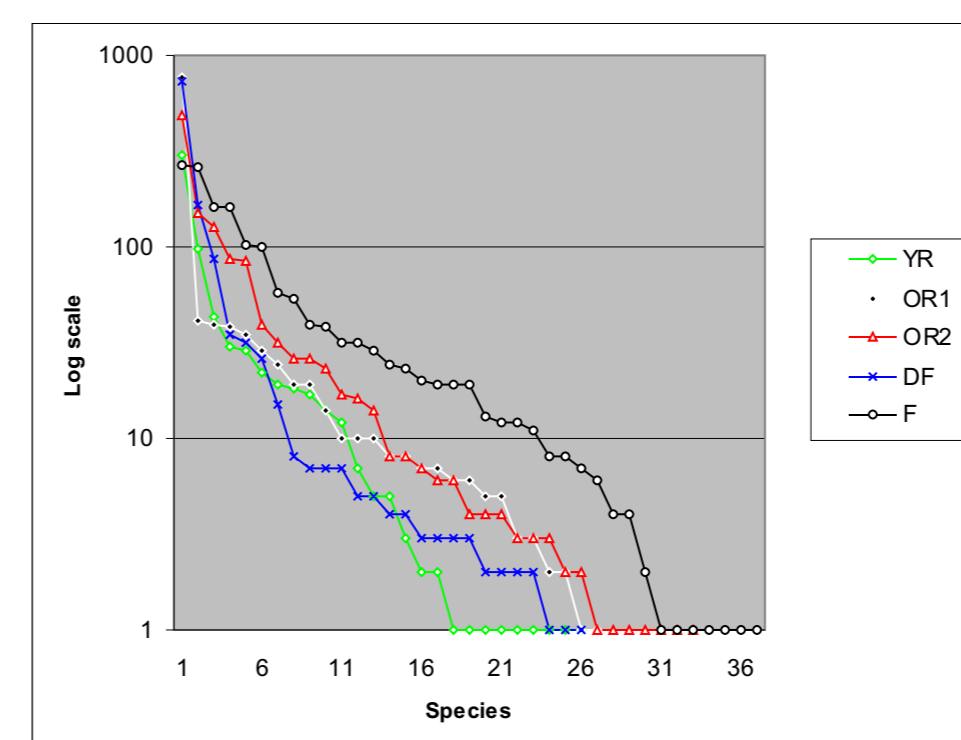


Trogidae (*Tuneller*)

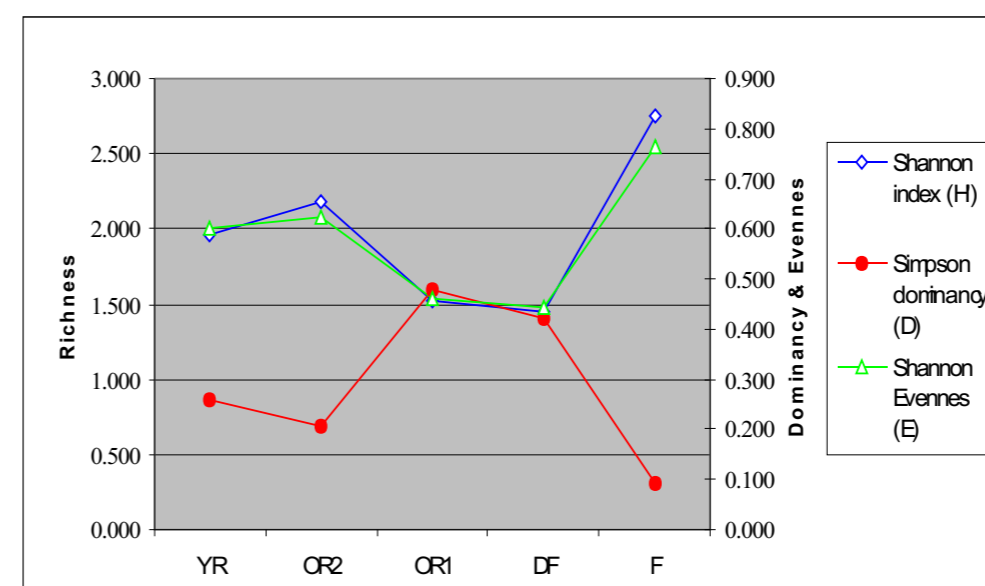
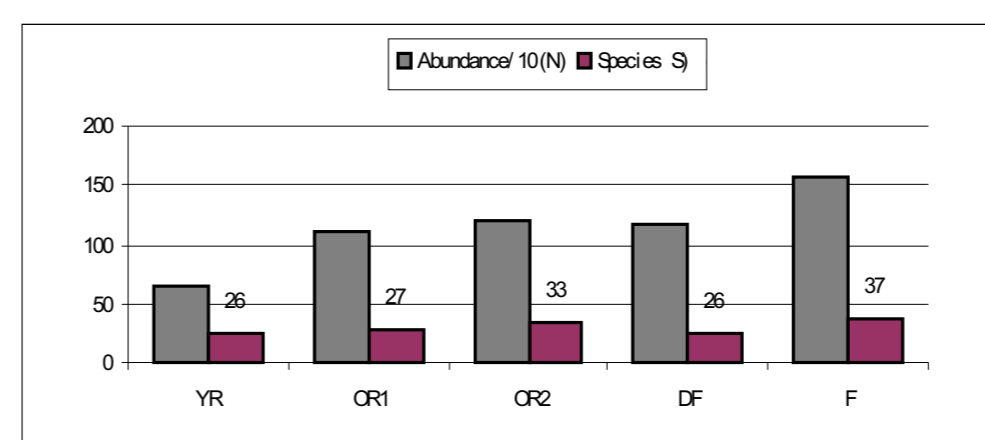
Methodology

The dung beetle surveys were carried out in the dry season of 2005 (May - July) and again in the rainy season of 2007 (December) in Bungo District of Jambi, Indonesia. The major land use systems covered in the surveys include rubber agroforests (young rubber, old mixed rubber, logged-over forests and forest). Dung beetles were trapped using human dung as bait every 100 m along 1 to 2 km transects. A total of 100 traps in 2005 and 50 more traps in 2007 were set up. Trapped beetles were collected 24 hours after baiting, and killed using saline and light detergents. The beetles were later identified in the laboratory.

Result



Young RAF (YR), Rantau Pandan Old RAF (OR1), Lubuk Beringin Old RAF (OR2), Disturbed forest (DF) and Forest.



Notes:

- Shannon index; used as richness index shown species number versus abundance in environmental logarithmic value
- Simpson dominancy; used to show whether habitat had some species that were very abundant compared to other species
- Shannon evenness; used to relate evenness to abundance
- Diversity: has two components, richness & evenness, so the diversity is high if richness & evenness high and dominancy low

- Increased land use intensity decreased dung beetle abundance (total population); impact on species diversity is less.
- In undisturbed forests, species dominance (Simpson dominancy) was lowest but dung beetle species richness was highest
- Beetle abundance was relatively high in old rubber agroforests indicating presence of higher diversity of animal species.



Figure 2
A. Old rubber agroforest (mixed garden),
B. Old rubber garden in Rantau Pandan near an abandoned coal mine;
C. Old rubber garden in Lubuk Beringin, accessible only on foot or by motorcycle

- Number of beetle species in young rubber plantations is close to that in disturbed forests, but has lower abundance.
- High dominance of dung beetles in disturbed forest and agroforests (e.g. Rantau Pandan) indicates low biodiversity (possibly due to presence of only few animal species).



Figure 3. Young RAF, similar to monoculture plantations

Figure 4. Disturbed forests (A-D), B, C logged area in the vicinity



Figure 5. Forests (A-D)