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## **Dung pad size and colonisation patterns of dung beetles**

### **Abstract**

The relationship between dung pad size and both adult colonisation and larval development was investigated in an assemblage of north temperate dung beetles (*Geotrupes*, *Aphodius* and *Sphaeridium*) using both dung pads and baited pitfall traps. Dung pad samples revealed a positive relationship between pad size and dung beetle abundance. There was a strong trend for *Aphodius* species richness to increase, and maintain higher values for longer periods of time, in larger pads. Pat residence times of *A. rufus* in the laboratory were significantly positively correlated with dung pad size. In one field experiment, a correlation was found between dung pad size and numbers of larvae in pads of different sizes and larval densities (numbers per unit dung volume) were significantly and positively correlated with dung pad size.

### **Introduction**

Most experimental studies of dung beetle ecology to date have been performed on replicate standardised dung pads, leading Sowig and Wassmer (1994) to comment that, "A common method in experimental dung beetle ecology is to exclude the influence of patch size..." However, under natural conditions, pad quality, size and morphology can be observed to vary considerably. Dung pad size may differ due to the size of the defecating animal, the consistency of the faecal material and/or the conditions under which defecation occurs (e.g. whether an animal is walking during defecation). A dearth of knowledge on the effects of variability in dung pad size is evident, despite some known effects of dung size on reproductive performance (Landin 1961, Lumaret and Kirk (1987), Gittings, T., 1994) and the known influence of patch size on ecological sampling in general.

Little standardisation is evident in relation to methods of sampling among dung beetle ecologists, and this extends to the size of the dung pad employed. *Aphodius* species (ca 10 - 20 mg dry weight) are known as dwellers (the larvae of most species live and feed within the pad) and the adults typically feed on the liquid content of dung. Depending on the species, adults lay either single eggs or clutches of eggs in the pad or at the pad/soil interface. Upon hatching, the larvae undergo three larval stages and a pupal stage before an adult emerges (see Hanski 1991). *Geotrupes* beetles (ca 300 mg dry weight) are known as tunnellers (the larvae develop in brood masses of dung buried underneath the dung pad) and can bury substantial proportions of single pads.

They are usually of relatively low abundance. *Sphaeridium* species (ca 12 mg dry weight) can occur in considerable abundances in pads; the adults are coprophagous, whereas the larvae are carnivorous within the pad. Recent research has revealed that dung beetle colonisation activity is affected by a number of factors. These include dung quality (which may vary between species or due to different animal diets within a single species), weather (rainfall and temperature changes may have significant effects, even between consecutive days), geographical variation and sampling methodology (dung-baited pitfall traps vs. dung pat sampling).