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Author: Larsen, Trond

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Chapter 6

Dung Beetles of Lely and Nassau plateaus, Eastern Suriname

Trond Larsen

INTRODUCTION

Dung beetles (Insecta: Coleoptera: Scarabaeidae: Scarabaeinae) are frequently used as a focal taxon in biodiversity studies for several reasons (Larsen and Forsyth 2005). Dung beetles are a diverse and abundant group of insects, especially in tropical forests, and their diversity patterns often mirror those of overall biodiversity. Most dung beetle species have small distributional ranges and high Beta-diversity, with relatively few species shared between habitat types (Spector 2002). Dung beetles are very sensitive to many kinds of disturbance. Since they depend primarily on mammal dung for food and reproduction, dung beetles may be a good indicator of mammal biomass and hunting intensity. By burying vertebrate dung, beetles perform several important ecosystem functions, including recycling nutrients for plants, dispersing seeds, and reducing infestation of mammals by parasites (Mittal 1993, Andresen 2002). Finally, dung beetles are a tractable group to study because they can be rapidly and cheaply sampled in a standardized and non-biased way using transects of baited pitfall traps (Larsen and Forsyth 2005). Within just a few days, this trapping method usually captures the majority of Alpha-diversity and also yields good abundance data.

METHODS

I sampled dung beetles at Lely and Nassau plateaus in eastern Suriname using pitfall trap transects. Ten traps baited with human dung were placed approximately 150 m apart at each site and collected every 24 hours for four days (see Larsen and Forsyth 2005 for methodology details). Each trap consisted of 16 oz plastic cups buried in the ground and filled with water and liquid detergent. Bait was suspended above the cups wrapped in nylon tulle and covered with large leaves. Human dung baits were replaced every two days. Since some dung beetle species feed on other resources, additional traps were baited with rotting fungus, rotting fruit, and dead insects. At Nassau, I placed two flight intercept traps consisting of mosquito netting with soapy water beneath. These types of traps often passively catch dung beetle species not attracted to baits.

At Lely, 11 traps were placed from October 27-31, 2005 in primary forest that varied in canopy height and in plant species composition depending on the soil, with small, short trees dominating in more rocky areas. In addition, three traps were placed from October 27-29; one trap was placed in the grassy airstrip, one in secondary forest at the edge of the airstrip, and one in a weed-filled clear-cut area surrounding a radio tower. One trap baited with dead insects and one trap baited with rotting fungus were also placed in primary forest. At Nassau, 10 traps were placed from November 2-6, 2005 in the same general forest type as at Lely, although in many places the forest was taller and showed a wetter forest floor with greater leaf litter decomposition. Two flight intercept traps, one trap baited with dead insects and one trap baited with rotting fruit were also placed in primary forest. Beetles were sorted and identified as they were collected, and vouchers were placed in alcohol for further identification and museum collections.

To determine the completeness of faunal sampling at each site, I compared the observed number of species to the expected number of species based on randomized species accumulation curves computed using EstimateS (Colwell 2003). I used the abundance-based coverage estimator (ACE) because it accounts for species abundance as well as incidence. Similarity indices were calculated using the same software.

RESULTS

I found a total of 42 species from both sites, represented by 1,110 individuals (Appendix 7). Lely had 37 species and 906 individuals, while at Nassau, I captured only 27 species and 204 individuals. Comparing only standardized dung pitfall transects from primary forest between the two sites, Lely had 33 species and 21.2 individuals/trap, while Nassau had 24 species and 4.3 individuals/trap. Species richness estimators (ACE) based on species accumulation curves from dung transects in primary forest predict true species richness of 39 species for Lely and 29 species for Nassau (sampling was about 85% complete for both sites). Both sites appeared to have hunting pressures that are likely to have negatively impacted dung beetle species richness and abundance, but Nassau appeared to have the strongest hunting pressure and the lowest beetle species richness and abundance. Dung beetle abundance at Nassau may also have been negatively affected by a large open cesspool near the basecamp. Even though Lely contained more dung beetle species, the dung beetle species composition of primary forest at the two sites was fairly similar. The sites shared 18 species and showed a high Morisita-Horn similarity index of 0.93.

At Lely, only three individuals of one species, a grassland specialist, occurred on the airstrip. I only found four individuals of one species on the secondary forest edge, and no dung beetles at all in the weedy clearing. Dead insects attracted two species, while no species were attracted to fungus. One species (*Anomiopus* spp.) was only hand-collected on a leaf. A second species of *Anomiopus* was collected in a flight intercept trap at Nassau, as well as six other species. At Nassau, dead insects attracted seven species and fruit attracted none. One species was only hand-collected at felid scat.

Both sites were characterized by hard, dry and rocky soils which may make it difficult for many dung beetle species to dig burrows for food and nesting, and may also increase larval mortality (Sowig 1995). This may be one reason why overall dung beetle abundance was much lower at both sites than for almost all other tropical forests where I have sampled dung beetles.

Interesting Species

While identification to the genus level is relatively simple, the taxonomic status and lack of identification keys for Neotropical dung beetles makes it difficult to place many species names, especially without comparing specimens against multiple museum collections. Nonetheless, I estimate that about 20-30% of the species collected are undescribed. The genera *Anomiopus*, *Ateuchus*, *Canthidium* and *Uroxys* are likely to contain the most undescribed species. A few species appear to have wide geographical ranges and are also found in the southern Amazon, although most species probably have relatively restricted ranges. A paucity of existing dung beetle data from nearby sites makes evaluation of range size difficult.

At Lely, dead insects attracted one individual of *Coprophanaeus lancifer*, the largest species of neotropical dung beetle. This metallic blue species is highly valued for its impressive size and beauty, and the long horns possessed by both sexes. Both species of *Anomiopus* are likely to be undescribed. Species in this genus have never been attracted to baited traps, and their natural history is completely unknown, although their compact morphology suggests an association with ant nests observed for other genera. In most sites I have sampled in the neotropics, I have observed species of *Canthidium* which appear to be Batesian mimics of species in the ball-rolling tribe Canthonini, although to my knowledge nothing has been published about this. Almost all canthonines secrete a foul smelling chemical when handled, while *Canthidium* species, which are tunnellers rather than ball-rollers, do not. At Lely, *Canthidium* sp. 1 possesses the identical yellow and brown coloration pattern, including an unusual pronotal stripe, shown by *Scybalocanthon cyanocephalus*.

THREATS AND RECOMMENDATIONS

The greatest threats to dung beetle communities are logging and hunting, and dung beetles are known to be especially sensitive to fragmentation. Even slight perturbations of the forest are known to strongly affect dung beetles (Davis et al. 2001). At Lely, clear-cut areas and early secondary vegetation contained only two dung beetle species at extremely low abundance. Dung beetle communities at both sites are probably suffering from hunting, although the strongest hunting pressures are likely occurring from gold-miners at Nassau where dung beetle abundance was the lowest I have ever observed. A large open cesspool at Nassau may also be killing many thousands of dung beetles that are continuously attracted and drowned. An underground sewage system would not only spare many dung beetles, but would also make the area more pleasant for people.

Although deforestation is still not widespread at either site, it is important to maintain large areas of intact primary forest in the future in order to maintain intact communities of mammals and dung beetles. I have found that some dung beetle species require more than 85 ha of continuous forest, and that many species will not cross even short distances of clear-cut forest such as to cross roads. I observed indications already at Nassau of a recently created dense network of roads that are fragmenting the forest so severely that the vegetation is being altered, and the dung beetles will also be strongly affected. I also observed no mammals in these strongly fragmented areas. Hunting is currently the greatest threat to dung beetles at both sites, but especially at Nassau. Stricter regulations and enforcement of hunting practices could make a big difference to dung beetles as well as mammals. Preventing what appears to be widespread hunting within the BHP concession at Nassau should be a first priority. Although fewer people live in the Lely area, hunting pressures are still strong, and incentives should be made for the workers to minimize hunting, especially of species which they are not killing for food. Maintaining healthy mammal and dung beetle communities will be especially important for maintaining primary and secondary seed dispersal which is essential for plant regeneration and forest dynamics (Larsen et al. 2005).

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Appendix 7

Species list and abundance of dung beetles from the Nassau and Lely plateaus.

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	Abundance at each site	
	Nassau	Lely
Anisocanthon cf. *sericinus* Harold	9	19
Anomiopus sp. 1	0	1
Anomiopus sp. 2	1	0
Ateuchus sp. 1	1	1
Ateuchus sp. 2	1	13
Canthidium cf. *bicolor* Boucomont	0	1
Canthidium sp. 1	0	6
Canthidium sp. 2	0	4
Canthidium sp. 3	0	3
Canthidium sp. 4	2	20
Canthon bicolor Laporte	2	46
Canthon mutabilis Lucas	0	3
Canthon quadriguttatus Olivier	1	7
Canthon triangularis Drury	13	14
Coprophanaeus cf. *dardanus* MacLeay	0	3
Coprophanaeus cf. *parvulus* Olsoufieff	0	1
Coprophanaeus lancifer Linne	0	1
Deltochilum carinatum Westwood	2	2
Deltochilum icarus Olivier	1	3
Deltochilum sp. 1	8	0
Deltochilum sp. 2	4	0
Deltochilum sp. 3	3	1
Dichotomius mamillatus Felsche	0	1
Dichotomius sp. 1	1	0
Dichotomius sp. aff. *podalirius* Felsche	4	7
Eurysternus caribaeus Herbst	5	16
Eurysternus cf. *hirtellus* Dalman	0	1
Eurysternus sp. 1	0	3
Eurysternus sp. 2	1	0

Eurysternus sp. aff. *caribaeus* Herbst	4	17
Eurysternus velutinus Bates	1	1
Hansreia affinis Fabricius	88	569
Onthophagus cf. *haematopus* Harold	1	11
Onthophagus sp. 1	34	52
Oxysternon aeneum Olsoufieff	0	2
Oxysternon cf. *durantoni* Arnaud	0	24
Phanaeus chalcomelas Perty	2	7
Scybalocanthon cyanocephalus Harold	1	10
Sylvicanthon sp. nov.	0	4
Uroxys sp. 1	4	2
Uroxys sp. 2	4	1
Uroxys sp. 3	6	29
Total abundance	**204**	**906**
Number of species	**27**	**37**