

SEED CLEANING OF *Strychnos ramentifera* (Loganiaceae) BY ANTS IN MARACÁ ISLAND, BRAZILIAN AMAZONIA

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(With 1 figure)

INTRODUCTION

Thousands of plant species rely on ants to disperse their seeds, including many South American epiphytes and vines, which, apart from minimizing competition among seedlings, may also reduce competition among different plant species (Handel & Beattie, 1990). The lianas of the Genus *Strychnos* (Loganiaceae) are recognized as having fruits with highly poisonous seeds containing strychnine in the integuments, which are, nevertheless, dispersed endozoochorously by highly-specialized frugivores (i.e., spider monkeys, Genus *Ateles*) (Van Roosmalen, 1985, pers. comm.), mostly under an emergent tree where they spend the night (Mendes Pontes, unpubl. data; Van Roosmalen, pers. comm.).

Fungus-growing ants (Myrmicinae, Attini) are known to collect various types of vegetal matter, among which is fruit pulp, in order to cultivate fungal stock inside their nests (Holldobler & Wilson, 1990), (Lewinsohn, 1980; Pedroni, 1993; Oliveira *et al.*, 1995). Timely removal of fruit pulp from fallen seed has been shown to reduce seed mortality by decreasing fungal attack, which otherwise may be the major mortality factor in the pre-dispersal stage on the forest floor (Primack, 1995). Additionally, by removing the seed pulp of tropical fruit found on the forest floor, the attines facilitate seed germination of otherwise vertebrate-dispersed plants (Oliveira *et al.*, 1995; Leal & Oliveira, 1998).

Strychnos ramentifera Ducke (Loganiaceae) is an extremely rare Amazonian liana (Van Roosmalen, 1985), which has been recorded as endozoochorously dispersed only by *Ateles belzebuth belzebuth* (Cebidae) (Nunes, 1992; Mendes Pontes, unpubl. data), a

nonetheless endangered primate (IUCN 2002 – VU A1c), in only one locality in Brazilian Amazonia. I report on cleaning of non-dispersed *S. ramentifera* seeds by attine ants, which may enhance dispersion efficiency by preventing fungal infestation and increasing germination rates.

MATERIAL AND METHODS

The study was carried out in the eastern part of Maracá Ecological Station, a 1,013 km² fluvial island formed by seasonally-dry Amazonian forests (latitude 3°15' to 3°35'N and longitude 61°22' to 61°58'W) (Radambrasil, 1975; Mendes Pontes, 2000).

Mean annual temperature during the study period 1997-1998 was 31.6°C; rainfall was 1,577 mm. Vegetation types were identified according to Milliken & Ratter (1990) along a 10-km study transect, which crosses two main forest types, terra firme forest (TFF) (4,650 m), and mixed forest (MF) (5,350 m) (for more details, see Mendes Pontes, 1997, 1999).

Observations of *Atta sexdens* behaviour on the fallen *Strychnos ramentifera* fruit were made *ad libitum* (Altmann, 1974) during March and April 1997 in TFF, and April 1997 in MF, as well as during January 1998, in MF, along 2-km transects used for phenology and raked-ground fruit surveys (see Mendes Pontes, 2000).

RESULTS

Whole fruit collected (n = 3 in TFF, and n = 2 in MF) were sub-globose green to brown, very hard, berry-like. They contained a mean of 20.8 (± 9.9) greenish to pale beige seeds, measured a mean of 2

cm (± 0.4), weighed a mean of 4.6 g (± 1.1), and were enveloped in abundant soft white pulp. Mean fruit weight was 386 g (± 265), mean length was 92.6 mm (± 14.4), and mean width, 91.8 mm (± 14.9). Epicarp hardness was 9N and seed hardness was $> 50N$.

During three sessions of bi-weekly raked-ground fruit surveys, which were carried out during one year, three collections were made of parts of 12 fruit with numerous seeds, which totalled 1.940 g.

Six cleaning sessions were recorded, in which variously sized *Atta sexdens* workers cut and carried

away relatively large pieces of *S. ramentifera* fruit pulp. Without disturbing the seeds still adhering to the epicarp, the workers carried away both the pulp of fruit that had opened after falling, and also that which had separated from the fruit.

The attines spent a maximum of 2 hours per cleaning session, after which they left some seeds to which some pulp was still attached (Fig. 1). The seeds that remained along the trail till dusk, when observations were discontinued, were never found the following morning.

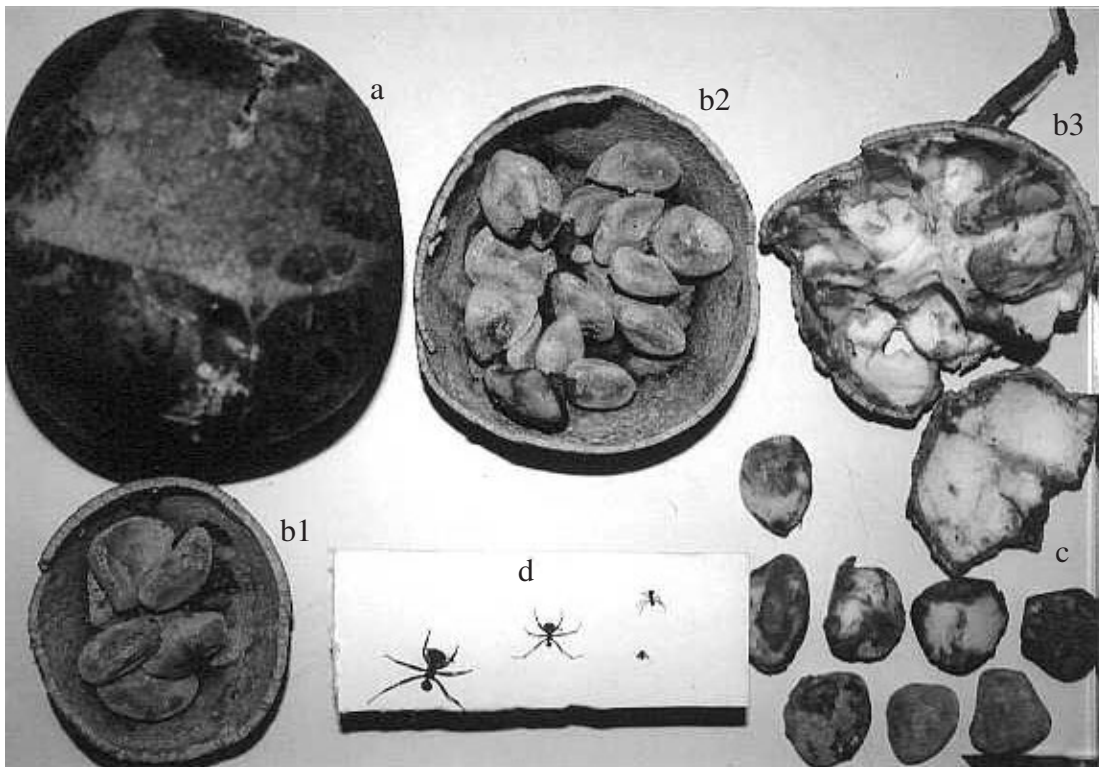


Fig. 1 — *Strychnos ramentifera* (Loganiaceae): (a) whole fallen fruit; (b1,2) completely cleaned seeds, still adhered to the exocarp; (b3) seeds still covered with pulp; (c) seeds discarded by *Atta sexdens* in different stages of cleaning; (d) the different sizes of *A. sexdens* workers involved in cleaning.

DISCUSSION

The only mechanism known to date by which the diaspores of *Strychnos ramentifera* are dispersed is through the highly-specialized frugivore, the spider monkey *Ateles belzebuth belzebuth* (Van Roosmalen, 1985, pers. comm.; Mendes Pontes, unpubl. data).

I hypothesize, nevertheless, that this is not the ideal for *S. ramentifera*, since spider monkeys drop their seeds mostly in a pile under their sleeping trees at dawn (normally a *Buchenavia capitata* Combretaceae) (Van Roosmalen, 1985, pers. comm.), which precludes more even diaspore dispersion. This study, therefore, suggests that *Strychnos* fitness probably benefits when seeds are cleaned on the forest floor by Attine ants after dispersion, because this process preventing fungal infestation, and increasing germination rates (Leal & Oliveira, 1998; Passos & Oliveira, 2002).

Further studies should be able to confirm our hypothesis by determining the final fate of the seeds, since they were invariably removed by unknown nocturnal forest dwellers. Since *Strychnos ramentifera* has highly-poisonous seeds (Van Roosmalen, 1985) that apart from their enveloping pulp are unsuitable for vertebrates, a possible nocturnal disperser of the partially cleaned seeds is probably other ants (Leal & Oliveira, 1998; Leal, pers. comm.), which may carry the seeds to their nests during the night in search of the remaining pulp.

This alternative dispersion process is of special importance because the spider monkey is the only known disperser of this rare liana, which is threatened due to habitat loss, degradation, and harvesting in Brazilian Amazonia (IUCN, 2002).

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