SEED DISPERSAL BY CHIMPANZEES: A Preliminary Note

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ABSTRACT Seeds out of feces of chimpanzees (*Pan troglodytes schweinfurthii*) inhabiting the Mahale Mts., western Tanzania, were tested for viability. Seeds of *Myrianthus holstii* (Moraceae), *Pycnanthus angolensis* (Myristicaceae), and *Pseudospondias microcarpa* (Anacardiaceae) from chimpanzee feces showed marked germinability in comparison with seeds collected from fallen fruits. With field observations, this result was discussed in relation to the vegetation of the area by focusing on the chimpanzee's role in seed dispersal.

INTRODUCTION

In chimpanzee feces, many seeds of ingested fruits are discharged without apparent signs of digestion. Dissemination of plants by animals, interrelated with mutualism, has been an important theme in ecology (e.g., Kern, 1921; Temple, 1977; Wheelwright & Orians, 1982). Recent studies in tropics have added many examples (e.g., birds: Howe, 1977; bats: Janzen et al., 1976; primates: Hladik & Hladik, 1967; Howe, 1980). This article presents another example from the chimpanzee (*Pan troglodytes schweinfurthii*) in western Tanzania, reporting the results of a germinability test of seeds collected from chimpanzee feces.

MATERIALS AND METHODS

In the Kasoje area of the Mahale Mountains (6°S, 30°E), western Tanzania, 5 or 6 chimpanzee unit groups (Nishida, 1977) are known to live. Seeds for the experiment were collected in the home range of the M-group (consisting of 80–90 individuals), especially around the Kansyana base camp (800 m above sea level). The vegetation of the area is a mosaic of transition from primary low-altitude forest or gallery forest mixed with secondary forest to *Acacia* savanna (Nishida, 1972, 1974, 1977). The area has a savanna climate, with a rainy season from October to May (Uehara, 1982).

During my study period (11 September–28 November 1981), the M-group chimpanzees fed on fruits of the following tree or woody vine species: *Ficus exasperata* Vahl, *Myrianthus holstii* Engl. (Moraceae), *Pycnanthus angolensis* (Welw.) Warb. (Myristicaceae), *Garcinia huillensis* Oliv. (Guttiferae), *Pseudospondias microcarpa* (R. Rich.) Engl. (Anacardiaceae), *Landolphia owariensis* P. Beauv., *Saba florida* (Benth.) Bullock (Apocynaceae); *Ficus vallis-choudae* Del. (Moraceae), *Zanha golungensis* Hiern (Sapindaceae), *Azanza garckeana* (F. Hoffm.) Exell et Hillcoat (Malvaceae), etc. [The scientific names follow the list in Nishida & Uehara (1981).] Seeds of the first 7 species were commonly found in chimpanzee feces. Tested were seeds of *Landolphia*/*Saba* (compound group for *Landolphia* and *Saba* because of the similarity of their seeds), *Myrianthus*, *Pycnanthus*, and *Pseudospondias*. "Fecal" seeds were collected from chimpanzee feces, while "control" seeds from presumably ripe fruits fallen to the ground. I opened an experimental garden at the camp. The *Landolphia*/*Saba* seeds were sown in late September (no precise date record). The seeds of *Myrianthus* and *Pycnanthus*

Table 1. Contingency table summarizing the results of the germinability test of fecal seeds in comparison with control seeds.

		Fecal	Control	Total
Myrianthus	Germinant	24	13	37
	Non-germinant	12	28	40
	Total	36	41	77
Pycnanthus	Germinamt	28	10	38
	Non-germinant	38	35	73
	Total	66	45	111
Pseudospondias	Germinant	29	32	61
	Non-germinant	29	48	77
	Total	58	80	138

were sown on 26 October, and those of *Pseudospondias* on 8 November 1981. The seeds were placed 5 cm apart from one another, and thinly covered with soil. After my departure from the Mahale Mts., H. Hayaki and Y. Takahata examined the germination of the seeds on 2 January 1982.

RESULTS

The *Landolphia*/*Saba* seeds were decayed and unrecognizable when examined, although T. Nishida (pers. commun.) confirmed the germination of *Saba florida* seeds washed out of chimpanzee feces.

Table 1 summarizes the results in the other three species. The germinability significantly differed between fecal and control seeds in *Myrianthus* ($\chi^2 = 9.39$, $P<0.01$) and *Pycnanthus* ($\chi^2 = 4.85$, $P<0.05$). Their fecal seeds had higher germinability than their control seeds. *Pseudospondias* also showed higher germinability in the fecal seeds, though non-significantly ($\chi^2 = 1.36$).

Interpretation of the results should be carefully made. Although the control seeds were chosen from presumably ripe fruits without apparent signs of insect infestation or other defects, they may not have been ripe yet. Or incidentally I may have collected seeds from unripe fruits discarded by the chimpanzees. Also the study period (2 months) may not have been sufficient for all viable seeds to germinate. These points should be elucidated by further study. Nevertheless, it can be at least concluded that chimpanzees pass viable seeds of these plant species, and that chimpanzees could be their efficient disseminators.

DISCUSSION

Chimpanzees rely much on fruits (Goodall, 1968; Hladik, 1977; Nishida, 1977; Wrangham, 1977). When they eat fruits, they discard the seeds at the spot, or swallow and discharge them in feces. The present test showed that seeds of *Myrianthus*, *Pycnanthus*, and *Pseudospondias* at least do not lose, and possibly increase germinability through ingestion by chimpanzees. Also T. Nishida (pers. commun.) observed the germination of seeds of *Cordia millenii* Bak. (Boraginaceae) and *Saba florida* obtained from chimpanzee feces. They are all important fruit species for chimpanzees (Nishida, 1974, 1977).

The chimpanzees in the Kasoje area use foods found in various types of forest-woodland vegetation (Nishida, 1974, 1977). *Pycnanthus* is a main component species of the secondary vegetation reforesting patches of abandoned fields after thrash-and-burn agriculture. *Myrianthus* and *Pseudospondias* grow in gallery forest, of which belts are separated from one another

by patches of woodland. Without effective means of dispersal, these plants cannot grow in suitable habitats. According to Nishida (pers. commun.), in Kasoje there is a peculiar stand of *Parinari curatellifolia* Benth. (Rosaceae), which usually grows on hill crests, near the shore of Lake Tanganyika. There is a large tree 15 m tall, presumably the parent tree of the stand, surrounded by small trees 3–4 m tall. Probably a chimpanzee discharged the first seed remote from the original habitat (Nishida, pers. commun.). The chimpanzee, which travels 1.6–4.5 km a day and uses various vegetation types (Nishida 1977), must be an important seed distributor for such fruit plants.

For the chimpanzee, which has a rich repertoire of plant foods, it is absurd to assume one-to-many coevolutionary mutualism. Rather the chimpanzee's seed dispersal should be related to the correlation between the chimpanzee and the plant community of its habitat.

The Kasoje forest on the western slope of the Mahale Mts. on the eastern shore of Lake Tanganyika shows a rare vegetation for the savanna climate in the region (Kielland, 1978). Probably because of the topography and location, and possibly because of the vegetation itself, the forest has more rainfall (ca. 2000 mm/year at Kansyana; Uehara, 1982) than the surrounding savanna woodland. Generally the vegetation is explained by the given climate, and the habitation of chimpanzees by the given vegetation. Note, however, that many of the fruit plants disseminated by chimpanzees constitute the forest vegetation, which the chimpanzees use. The forest vegetation is interdependent with the forest-dwelling animals. Other primates, especially *Cercopithecus* monkeys as suggested by Hladik & Hladik (1967), mammals (e.g., bushpig) and birds (e.g., green pigeon) must be also important seed dispersers. But above all, the chimpanzee, which has a diverse food habit and an extraordinarily large ranging area, seems to occupy the key position in influencing the regional vegetation.

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