

FOREST RESTORATION RESEARCH IN NORTHERN THAILAND III: OBSERVATIONS OF BIRDS FEEDING IN A MATURE *HOVENIA DULCIS* THUNB. (RHAMNACEAE) TREE

Derek Hitchcock¹ and Stephen Elliott²

One of the most important criteria for selecting tree species for planting to restore natural forest ecosystems on degraded sites is their attractiveness to wildlife. The “framework species” method of forest restoration, which has been successfully used to re-establish tropical forest in Queensland, Australia (LAMB *ET AL.*, 1997; TUCKER & MURPHY, 1997), uses tree species which produce fruits, nectar or other wildlife resources at a young age. Birds and bats, attracted from nearby forest to feed in the planted trees, disperse the seeds of many other forest tree species into planted sites, thus accelerating the recovery of biodiversity.

In a previous paper, KOPACHON *ET AL.* (1996) recommended the tree *Hovenia dulcis* Thunb. (Rhamnaceae) for tree planting programs to restore evergreen forest sites in northern Thailand, due to its high growth rate and rarity (and therefore its need for conservation). *H. dulcis* fruits were assumed to be attractive to wildlife, but the authors made no direct observations of animals feeding on them. In the study presented below, two questions were addressed: 1) Could planted *H. dulcis* trees attract seed-dispersing birds into deforested areas? and 2) What are the main avian seed-dispersers of *H. dulcis*?

Observations of birds feeding on a mature fruiting *H. dulcis* tree were made on 5 days from 30 January to 17 February 1998, as part of an ongoing project to assess the role of birds in forest restoration. The study tree (height about 35 m, girth at breast height 200 cm) was located in Doi Suthep-Pui National Park, northern Thailand (18°50' N, 98°50' E) at 1,050 m elevation, in a transitional zone between mixed evergreen deciduous forest and evergreen forest (*sensu* MAXWELL, 1988). Observations were made from the ground beneath the canopy using 7 x 35 binoculars for four morning periods and one evening period, totaling 12 hours 45 minutes.

Fourteen bird species visited the tree (Table 1). The pigeon, bulbul and barbet species are all known to be important dispersers of small-to-medium-sized seeds (LEKAGUL & ROUND, 1991; WHITTAKER & JONES, 1994). These birds accounted for 93% of the total visit-minutes in the tree. Wedge-tailed Pigeons (*Treron sphenura*) and Brown-cheeked Fulvettas (*Alcippe poioicephala*) were observed defecating in the tree. It seems likely that other species also defecate or regurgitate seeds of other tree species while in or near *H. dulcis*. When in fruit, this tree species is clearly attractive to a wide variety of seed-dispersing birds (Table 1), indicating its potential usefulness in programs to restore forest ecosystems. Both pigeons (genus *Treron*) and bulbuls (genus *Pycnonotus*) can disperse seeds over several kilometers. Pigeons can retain seeds in their digestive tracts for up to several hours and bulbuls for up to 40 minutes (LAMBERT 1989). Pigeons have been

¹ 12223 Echo Dr., Nevada City, CA 95959, U.S.A.

² Forest Restoration Research Unit, Biology Department, Chiang Mai University, Chiang Mai, Thailand 50200
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Table 1. Bird species observed in *Hovenia dulcis*, including number of individual nodules on upper axes of infructescences (see Fig. 1) consumed and individual visit minutes (IVM)

Bird Species	Consumer Type	Consumption	IVM
Wedge-tailed Pigeon (<i>Treron sphenura</i>)	FV	2704	903
Black-crested Bulbul (<i>Pycnonotus melanicterus</i>)	FV	267 (2%F)	885
Brown-cheeked Fulvetta (<i>Alcippe poioicephala</i>)	FV	38 (42%F)	56
Blue-throated Barbet (<i>Megalaima asiatica</i>)	FV	25	12
Ashy Bulbul (<i>Hypsipetes flavala</i>)	FV	18	35
Mountain Bulbul (<i>Hypsipetes mcclllandii</i>)	FV	5 (40%F)	6
Pin-tailed Pigeon (<i>Treron apicauda</i>)	FV	4	2
Red-whiskered Bulbul (<i>Pycnonotus jocosus</i>)	FV	4	2
Puff-throated Bulbul (<i>Crimiger pallidus</i>)	FV	2 (100%F)	1
Black Drongo (<i>Dicrurus macrocercus</i>)	FV	-	15
Eyebrowed Thrush (<i>Turdus obscurus</i>)	FV	-	10
Ashy Drongo (<i>Dicrurus leucophaeus</i>)	IV	-	2
Streaked Spiderhunter (<i>Arachnothera magna</i>)	NV	-	1
Asian Emerald Cuckoo (<i>Chrysococcyx maculatus</i>)	IV	-	1

FV = Frugivore (either opportunistic or obligate)

IV = Insectivore

NV = Nectarivore

F = consumption of fallen fruit components suspended in smaller nearby trees. These totals are lower than actual because initially it was not detected that they were in fact feeding on *H. dulcis* fruits.

observed to fly across large deforested areas on Doi Suthep and the Red-whiskered Bulbul (*Pycnonotus jocosus*) is frequently observed feeding in such areas (ELLIOTT, pers. obs.). These birds are, therefore, probably important dispersers of seeds between forest and deforested areas.

One of the most notable observations of the study occurred on 30 January at 0740 h when a flock of 45 Wedge-tailed Pigeons (*Treron sphenura*) entered the tree, scaring off all previous visitors. They fed voraciously for 20 minutes. Rather than ingesting the fruits and seeds, the pigeons fed primarily on the swollen nodules which comprised the upper axes of infructescences (Fig. 1). They consumed an estimated 3 such nodules per minute. Therefore, the entire flock consumed approximately 2,700 nodules during the feeding bout. Their heavy-bodied movements, caused many small branches with fruits and seeds to fall to the ground. Such small branches were typically 10–20 cm long and contained significant amounts of edible material on their upper axes. Many of them became caught in the crowns of nearby smaller trees. These fallen branch ends, suspended 10–25 m below their original position in the crown of the *H. dulcis* tree and in a much more shady and protected environment, were consumed by different bird species to those in the *H. dulcis*

crown (e.g. Brown-cheeked Fulvetta (*Alcippe poioicephala*), Puff-throated Bulbul (*Criniger pallidus*) and Mountain Bulbul (*Hypsipetes mccllellandii*) or by canopy feeders during the heat of the day, when they descended from the exposed, hot upper reaches of the forest canopy. Black-crested Bulbuls (*Pycnonotus melanicterus*) were observed in this downward movement, usually between 1100 h and 1130 h.

The fragility of the infructescence branches might therefore have evolutionary significance for the dispersal of *H. dulcis* seeds. Abscission always occurred at the junction between the branch of the infructescence and the main branch to which it was connected (Fig. 1). This trait is coupled with the unusual architecture of the reproductive components of *H. dulcis*, whereby the attractive fleshy components (the swollen nodules) are separate from the seed itself. These characteristics attract a more diverse community of dispersers, ranging from upper forest canopy and mid-level forest, to terrestrial ones. The swollen nodules seemed to be the primary attraction to birds, although some species probably consumed *H. dulcis* fruit as well, but to a lesser degree. Examination of fallen branches revealed that about 20% of fruits were consumed. The most likely avian dispersers of *H. dulcis* seeds are pigeons, bulbuls, and barbets, based on the feeding behaviour and gape size of these bird species. The main contribution of avian frugivores may be simply to dislodge or remove seeds from the crown of the tree, after which seeds are probably dispersed by ground-dwelling animals. This was corroborated by observations of bulbuls on several occasions. Although birds plucked at individual swollen nodules, entire

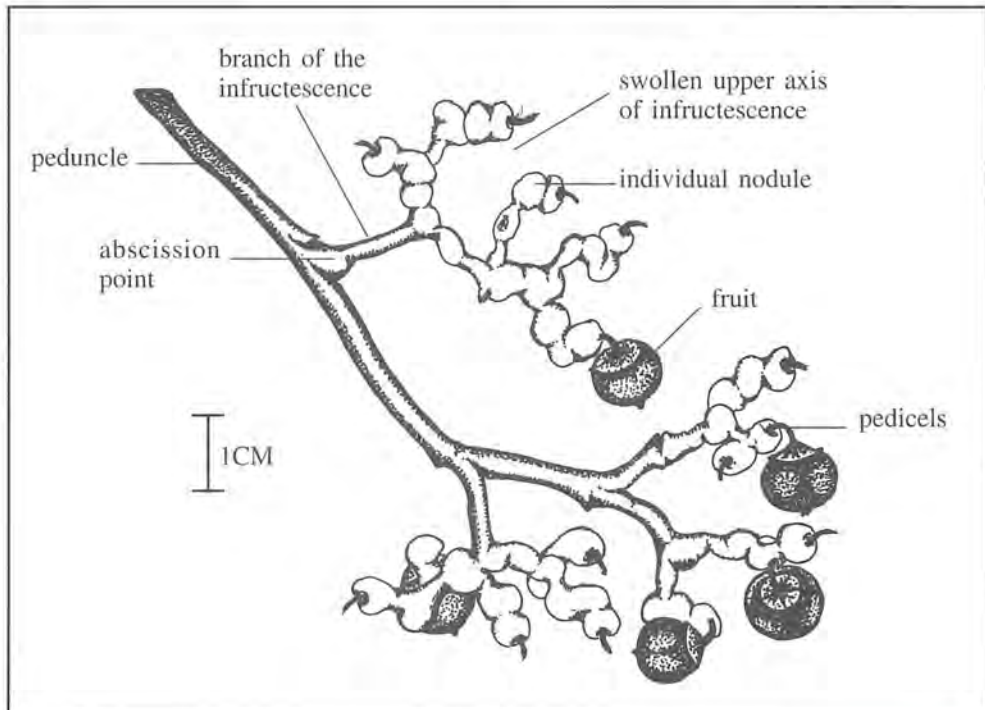


Figure 1. Infructescence of *Hovenia dulcis* (from Fig. 3A in KOPACHON ET AL. 1996 with additional labels).

infructescence branches were broken off. The birds then shook their heads vigorously, trying to ingest only the fleshy swollen nodules. The rest of the branch and the fruits and seeds fell to the ground.

Possible ground-dwelling dispersers include Silver Pheasant (*Lophura nycthemera*), partridges (*Arborophila* spp.), Common Barking Deer (*Muntiacus muntjak*), Common Palm Civet (*Paradoxurus hermaphroditus*) and Tree Shrew (*Tupaia glis*). Rats, including *Rattus rattus*, *R. surifer*, and *R. bukit* are common in the area (ELLIOTT ET AL., 1989) but they are more likely to be predators than dispersers of *H. dulcis* seeds.

Our observations show that *H. dulcis* is indeed very attractive to bird species capable of dispersing seeds from forests into deforested areas. When *H. dulcis* trees, planted in deforested sites, bear fruit, they would most likely attract such seed-dispersing birds. This would increase the seed rain in planted sites and accelerate the recovery of biodiversity. However, no data are currently available on the age at which flowering and fruiting of *H. dulcis* commences. The most important avian dispersers of *H. dulcis* seeds are probably Wedge-tailed Pigeon, Black-crested Bulbul, Blue-throated Barbet and Ashy Bulbul. However, the tree architecture seems to indicate that birds may not be the most important dispersers of *H. dulcis* seeds.

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