

Seed dispersal by the invasive Kalij Pheasant: implications for Hawaiian forests



Katherine A. Postelli¹⁻³, Donald R. Drake¹, Thane K. Pratt² & Darcy Hu³

¹Botany Department, University of Hawai'i – Mānoa; ²U.S. Geological Survey, Pacific Island Ecosystems Research Center; ³National Park Service, Hawai'i Volcanoes National Park



Introduction

- Due to widespread extinction, Hawai'i has only two native forest birds that regularly consume fruit and seeds.
- Native seeds may now be dispersed primarily by non-native frugivores.
- The Kalij pheasant (*Lophura leucomelanos*) is an introduced, forest-dwelling galliform very abundant in forests on the Island of Hawai'i (Fig. 1).
- We investigated the hypothesis that the invasive Kalij pheasant serves as a proxy for extinct native frugivores by dispersing the seeds of native plants, and increasing their germination percentages.

Methods

- We tested the effects of Kalij ingestion on the viability of seeds of 60 species of native and alien fruits using a pair of captive birds.
- Every 5 weeks for one year, we identified fragments and whole seeds in 30-50 Kalij droppings collected from each of two forest sites in Hawai'i Volcanoes National Park.
- Using the same sampling periods, we also recorded the fruiting phenology of 5 abundant native species (*Coprosma rhynchocarpa*, *Myrsine lessertiana*, *Nestegis sandwicensis*, *Pipturus albidus* and *Psychotria hawaiiensis*) regularly consumed by Kalij to see whether the proportion of droppings containing seeds of the target species suggested preferences for these species.
- Using Petri dishes and timed lights, we compared the germination percentage of ingested seeds against that of conspecific control seeds from which fruit pulp had been manually removed.

Results

- Feeding trials revealed that the majority of seeds fed to the captive Kalij were destroyed (Fig. 2). Seed diameter did not consistently predict survival percentage (Fig. 3).
- Intact seeds were defecated up to one month after consumption.
- Kalij droppings collected from each field site contained thousands of intact seeds (Table 1).
- Plant species dispersed by Kalij included herbs, shrubs and trees with a range of putative dispersal modes (adhesive, ballistic, vertebrate, unassisted, and wind).
- Comparison of fruiting phenology and presence of seeds of the target species in Kalij droppings revealed consistent patterns (Fig. 4).
- Kalij ingestion significantly hindered germination of most species, both native and alien (Fig. 5a-b).



Fig. 1. Adult male Kalij Pheasant

Fig. 2. Percentage of seeds surviving Kalij ingestion

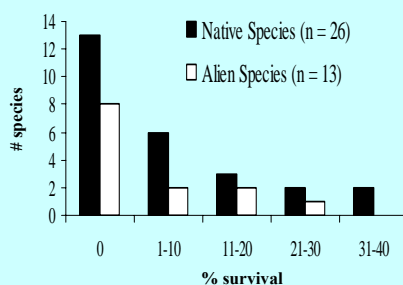


Fig. 3. Seed size and survival

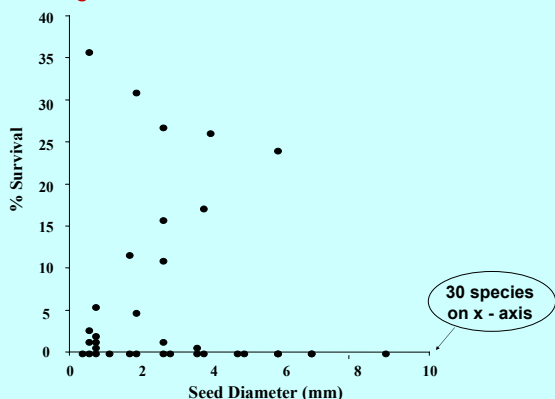


Table 1. Intact seeds extracted from droppings

Mesic forest site	Wet forest site
67% of 26,000 seeds were native	75% of 4000 seeds were native
≤1350 seeds/dropping	≤800 seeds/dropping
10 native species (17,000 seeds)	9 native species (2,000 seeds)
mean = 33 native seeds/dropping	mean = 13 native seeds/dropping
14 alien species (8,700 seeds)	5 alien species (750 seeds)
mean = 17 alien seeds/dropping	mean = 5 alien seeds/dropping

Fig. 4. Fruit consumption by Kalij vs. fruit availability

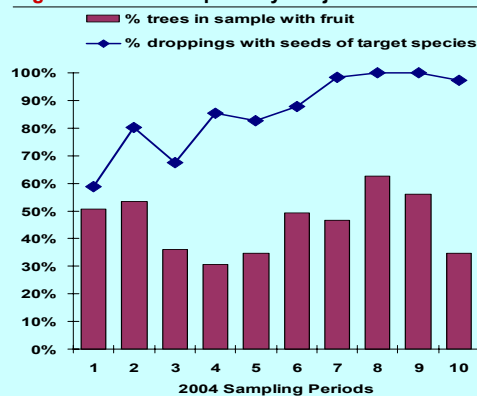
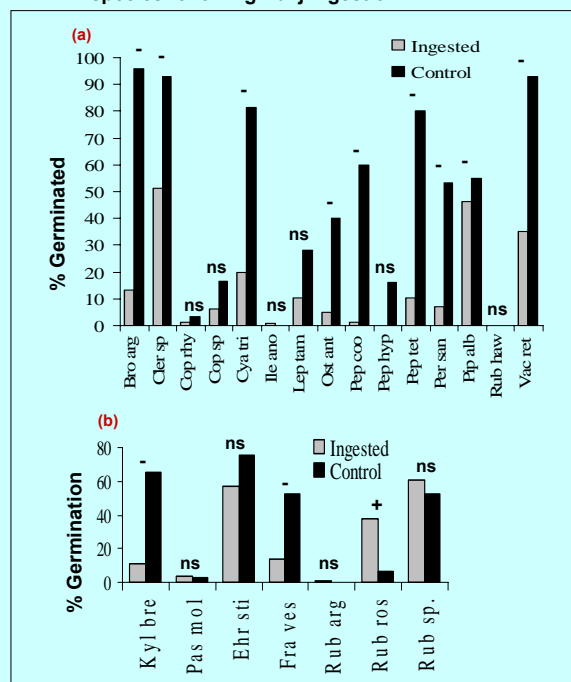


Fig. 5. Percent germination of native (a) and alien (b) species following Kalij ingestion.



All sample sizes were ≥ 20 . G% was compared with the test for the difference in binomial proportions. Non-significant (ns) tests had P -values > 0.02 . The sign of the effect indicates if Kalij suppress (-) or enhance (+) germination.

Conclusions

- Captive feeding trials showed that Kalij are significant seed predators; even very small seeds were destroyed by ingestion.
- Nevertheless, Kalij are serving as significant dispersers of both native and alien species; almost 30,000 seeds were found in Kalij droppings collected from two forest sites in one year.
- Due to slow gut passage rates, Kalij dispersing away from natal territories may move seeds long distances.
- We found no evidence for feeding preferences for the native species we monitored.
- Kalij ingestion did not increase germination percentage for any native species tested and germination was enhanced for only one introduced species.