

Pteropus poliocephalus Dispersing Seeds of the Queen Palm (*Syagrus romanzoffiana*) in Albury, NSW

DIRK H.R. SPENNEMANN

Institute for Land, Water and Society; Charles Sturt University; PO Box 789; Albury NSW 2640, Australia.
e-mail dspennemann@csu.edu.au

Published on 10 August 2020 at <https://openjournals.library.sydney.edu.au/index.php/LIN/index>

Spennemann, D.H.R. (2020). *Pteropus poliocephalus* dispersing seeds of the Queen Palm (*Syagrus romanzoffiana*) in Albury, NSW. *Proceedings of the Linnean Society of New South Wales* 142, 49-54.

Flying Foxes have adapted to feed on a range of introduced ornamental plants species. In the past, Flying Foxes have been implicated in seed dispersal from the source plant back to the roost. This paper documents a dispersal of Queen palm drupes to an intermediate feeding location. The state of knowledge on the consumption of Queen Palm drupes by Flying Foxes is reviewed in the context of the distribution, dispersal and establishment of the palms in the Australian environment.

Manuscript received 16 June 2020, accepted for publication 2 August 2020.

Keywords: activity patterns, feeding behaviour; frugivory, invasive species, palmae, *Pteropus poliocephalus*, seed dispersal.

INTRODUCTION

Queen Palms, also known as Cocos Palms (*Syagrus romanzoffiana*, synonym *Cocos plumosa*), native to the Atlantic and semideciduous forests of Brazil, Paraguay, Uruguay, and Argentina (Noblick 2017:180ff), are common ornamental plants in subtropical and warm temperate Australia. In Albury (NSW) they are commonly associated with residences and businesses erected in the late 1970s to 1990s (pers. obs.).

In Australia, the plant is regarded as naturalised in tropical and south-eastern Queensland (Batianoff and Butler 2002) as well as north-eastern NSW, where the dispersal into remnant bushland is reputedly facilitated by “flying foxes and other animals” (DPIE 2020). The Atlas of Living Australia suggests a naturalised distribution along the NSW coast as far south as the Narooma area, with a concentration of observations in Queensland and the Sydney Basin (ALA 2020b). In horticultural settings, Queen Palms are distributed across most of southeastern Australia except in the colder parts of the Southern Tablelands and the Alps, as well in the semi-arid zone (apart from well-watered residential gardens) (Spennemann 2020a).

While the dispersal of Queen Palms by Flying Foxes is widely asserted, there are no documented observations of dispersal events in the published literature. The aim of this short communication is to place on record, and into context, an incidence of mid-range dispersal of seeds of the Queen Palm (*Syagrus romanzoffiana*) by the Grey-headed Flying Fox (*Pteropus poliocephalus*).

The specimens

On the morning of 27th April 2020, the remains of two drupes of the Queen Palm (*Syagrus romanzoffiana*) were encountered on a paved driveway underneath a flowering bottlebrush (*Callistemon viminalis*, synonym *Melaleuca viminalis*) in a suburban neighbourhood in Albury, NSW.

The drupe remains, comprised of a seed with part of their pericarp adhering at the distal end, were fresh and had been deposited during the preceding night (Figure 1, Figure 2, Table 1). A large spit-out of pericarp and mesocarp, but without a seed, was found two days later (Figure 3). These Queen Palm spitouts differ in texture and moisture content markedly from spit-outs of less fibrous palm drupes, such as those of *Phoenix canariensis* or *Washingtonia*

PTEROPUS POLIOCEPHALUS DISPERSING SEEDS OF THE QUEEN PALM

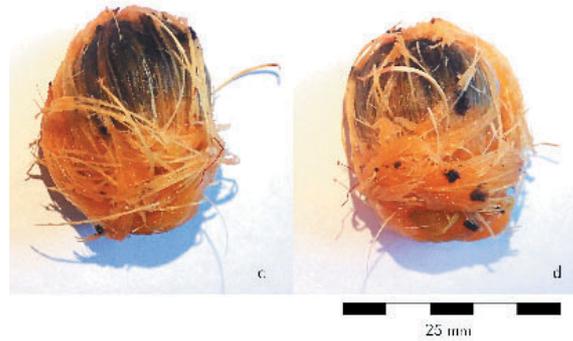
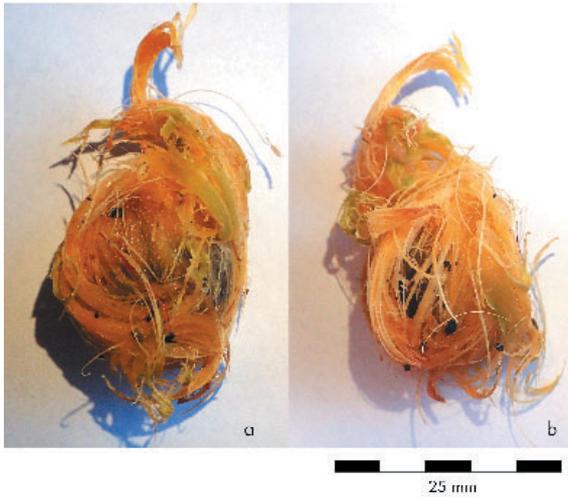


Figure 1. Remains of the two drupes (27 April 2020) a–b drupe 1; c–d drupe 2.

robusta, which tend to resemble pieces of Weet-Bix® cereal (Spennemann 2018a; Spennemann 2018b; Spennemann 2018c).

In addition, orange-coloured liquid digestive droppings with the consistency of a thick, somewhat dehydrated puree, were also located at several locations under the canopy (Figure 4). While earlier occurrences would have been overlooked or ignored, such droppings were further noted on subsequent days (28–29 April, 1–10 May) until the *Callistemon* ceased to flower. This indicates that the bat(s) had developed a feeding pattern that involved the visitation of a *Syagrus* palm before coming to the *Callistemon* for nectar. It was noted that the colour of the droppings changed from a bright orange yellow to a duller and darker greenish yellow (from 4 May onwards), suggesting that the diet changed slightly in this time.

While there are numerous Queen Palms in suburban gardens in the vicinity of the find location (within a 1,500m radius), a systematic search found

only two palms, both 1.17 km to the southwest, which were both fruiting and showed evidence of spit-outs. One of the two adjacent palms (2.5 m apart) had a few ripe fruits left, while the other had a full bunch of half-ripe fruit with a green exocarp (for photos see Spennemann 2020b).

Table 1. Metric data of the two drupe remains

	Drupe 1	Drupe 2
Drupe weight (wet)	4.1 g	4.8 g
Seed diameter	15 mm	16 mm
Seed length	19 mm	19 mm
Seed weight (dry)	2.6 g	3.0 g
Illustration	Figure 1a–b	Figure 1c–d

The colony of Grey-headed Flying Foxes closest to the study site of the drupe remains is located on the northern bank of the Murray River, approximately 1.5 km to the south-southwest (-36.085, 146.8975) and 0.5 km south of the (presumed) source palms. That camp comprises between 800 and 2,500 individuals (DEWLP Hume 2017; Roots 2018).

DISCUSSION

Setting aside the Flying Foxes (see below), the size of the drupe of Queen Palms and that of the associated seed limits the nature of effective dispersal vectors to large fruit pigeons (based on New Zealand analogues, Cameron, Sullivan and Whaley 2002) and Red Foxes (*Vulpes vulpes*) (based on South American analogues, Varela and Bucher 2006).

In the coastal areas of Queensland, Queen Palms planted in suburban gardens have become an alternate food source for Grey-headed Flying Foxes and Black



Figure 2. Seeds extracted from the two drupes shown in Figure 1. a drupe 1; b drupe 2.

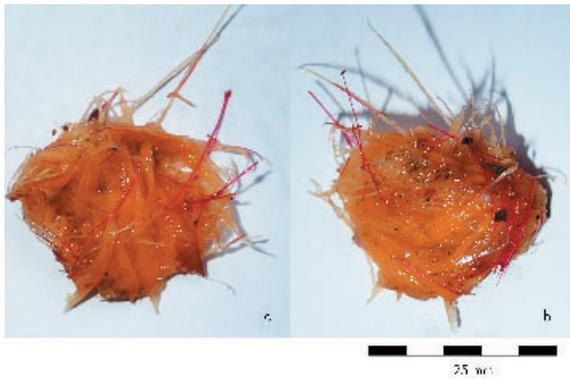


Figure 3. A spit-out comprised of pericarp and mesocarp fragments (29 April 2020).

Flying Foxes (*Pteropus alecto*) (Markus and Hall 2004), reputedly making up to 30 % of the seasonal diet. In the urban areas of Brisbane, Queen Palms may serve as a staple diet during the winter months (Paxton 2017:82). Queen palms are also accepted as a diet by Grey-headed Flying Foxes in south-eastern Australia (Spennemann 2020b).

Nutritionally, *Syagrus romanzoffiana* drupes contain 65.9% carbohydrates, 8% lipids and 1.5% proteins (Batista, Reis and Rezende 2017). Other studies report up to 5.4% protein (Coimbra and Jorge 2011). In addition, the pulp provides a range of macro nutrients such as Calcium, Magnesium and Potassium (Lescano, de Oliveira, de Lima, da Silva Baldivia, Justi, Cardoso, Júnior and Sanjinez-Argandoña 2018). According to Richards and Hall (2012) the fruit of Queen Palms are toxic to *Pteropus* sp., but the authors do not provide any supportive evidence (see similar assertions in Australian Wildlife Society 2010; BCRQ s.d.). A reputed high level of acidity has been publicised in the public arena (e.g. ALA 2020a; EOL 2020), but this has not been substantiated in the academic literature and does not seem to be borne out by nutritional analyses of fruit pulp (Coimbra and Jorge 2011; Coimbra and Jorge 2012; Lescano et al. 2018). Silva, Siqueira, Damiani, Boas and de Barros (2016) report 0.29% titratable acidity with a pH of 4.96, which is well within the range of other foods consumed by *P. poliocephalus*. Throughout its endemic area in South America, *Syagrus romanzoffiana* drupes are widely

eaten by several vertebrate species, including the fruit bat *Artibeus lituratus* (Batista et al. 2017).

The feeding behaviour and associated seed dispersal capability of Flying Foxes depends on the size of the mouth cavity of the species. While small fruit (relative to mouth size) are taken whole and chewed, separating the seeds from the pericarp in the mouth (although some very small seeds can be swallowed and subsequently defecated), larger fruit are held against the chest and chunks of epicarp and pericarp are bitten or stripped off larger seeds before mastication. These partially or completely stripped seeds are then dropped and accumulate as seed rain under the host plant (Dumont and O'Neal 2004; Nakamoto, Sakugawa, Kinjo and Izawa 2007). Numerous *Pteropus* species are on record for carrying of single fruit from the host tree for processing elsewhere, especially when their feeding is disrupted (e.g. *Pteropus rufus*, Bollen and Van Elsacker 2002; *P. voeltzkowi*, Entwistle and Corp



Figure 4. Consistency of a liquid digestive dropping. Left dropping as deposited, right after pressure applied with index finger (1 May 2020).

1997; *P. tonganus*, McConkey and Drake 2006; *P. conspicillatus*, Richards 1990). This is also asserted for *P. poliocephalus* (Gosper and VivianSmith 2010).

In the majority of instances, Flying Fox-mediated dispersal of palm drupes/seeds will occur between the source palm and the Flying Fox camp/roost, or between the source palm and an intermediate food source (as described here). For establishment underneath the intermediate food source or roost tree to be successful, a number of conditions must be fulfilled, ranging from the ground providing an environment suitable for germination, the lack of allelopathic reactions to inhibit successful seedling establishment, and ongoing provision of moisture

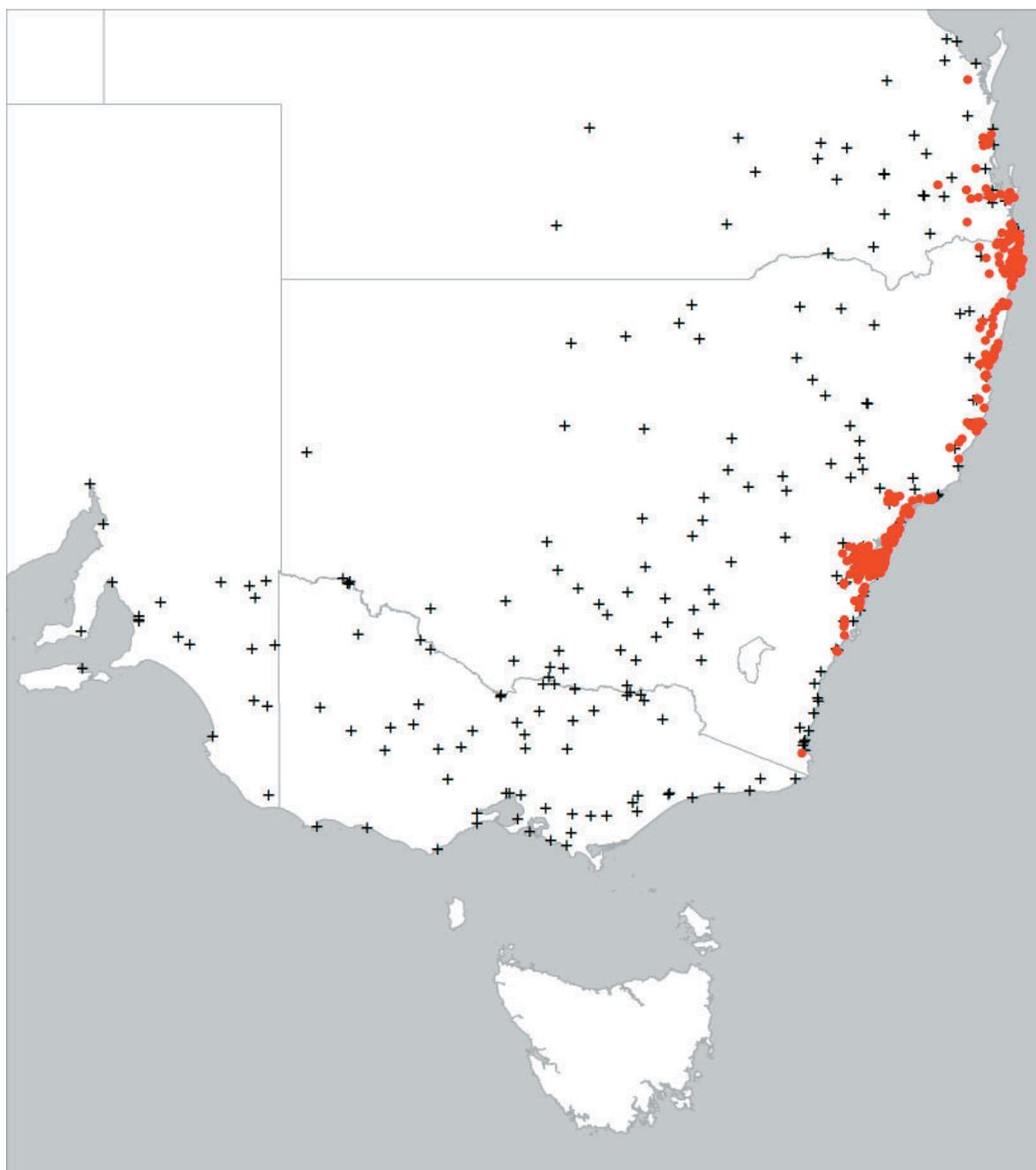


Figure 5. Distribution of cultivated (+) and naturalised (•) *Syagrus romanzoffiana* in south-eastern Australia (based on Spennemann 2020a).

until the juvenile plant is fully established. These conditions seem to be fulfilled in the Sydney Basin as well as in south-eastern Queensland where the seeds are reputedly readily germinating in riparian areas and even in dry eucalypt forests (DAF 2020) leading to intensification of the plant's footprint (Spennemann 2020c).

Since horticulturally planted *S. romanzoffiana* thrive as far south as Melbourne, and as far west

as Broken Hill (Figure 5), but do not establish as self-seeded in these locations, it is likely that range expansion and colonisation are governed by a combination of moisture and temperature regimes. More work is required to understand the seed dispersal effectiveness of vectors and the biological determinants that govern seed germination and seedling establishment of *S. romanzoffiana* in Australia.

REFERENCES

- ALA. (2020a). *Pteropus alecto* Temminck, 1837 *Atlas of Living Australia*.
- ALA. (2020b). *Syagrus romanzoffiana* (Cham.) Glassman *Atlas of Living Australia*.
- Australian Wildlife Society. (2010). Flying-foxes: Australian Wildlife Society.
- Batianoff, G.N., Butler, D.W. (2002). Assessment of invasive naturalized plants in south-east Queensland. *Plant Protection Quarterly* **17**, 27-34.
- Batista, C., Reis, N., Rezende, M. (2017). Nutritional content of bat-consumed fruits in a forest fragment in Southern Brazil. *Brazilian Journal of Biology* **77**, 244-250.
- BCRQ. (s.d.). Cocos Palm Queen Palm – Killer of Flying-foxes. : Bat Conservation and Rescue Queensland.
- Bollen, A., Van Elsacker, L. (2002). Feeding ecology of *Pteropus rufus* (Pteropodidae) in the littoral forest of Sainte Luce, SE Madagascar. *Acta Chiropterologica* **4**, 33-47.
- Cameron, E.K., Sullivan, J.J., Whaley, K. (2002). A new palm naturalises in Auckland. *Auckland Botanical Society Journal* **57**, 123-124.
- Coimbra, M.C., Jorge, N. (2011). Proximate composition of guariroba (*Syagrus oleracea*), jervivá (*Syagrus romanzoffiana*) and macaúba (*Acrocomia aculeata*) palm fruits. *Food Research International* **44**, 2139-2142.
- Coimbra, M.C., Jorge, N. (2012). Fatty acids and bioactive compounds of the pulps and kernels of Brazilian palm species, guariroba (*Syagrus oleraces*), jervivá (*Syagrus romanzoffiana*) and macaúba (*Acrocomia aculeata*). *Journal of the Science of Food and Agriculture* **92**, 679-684.
- DAF. (2020). Cocos or Queen palm *Syagrus romanzoffiana* [fact sheet]. Brisbane: Department of Agriculture and Fisheries, State of Queensland, .
- DEWLP Hume. (2017). Flying Foxes in the Hume Region [Facebook Post].
- DPIE. (2020). Cocos palm (*Syagrus romanzoffiana*) NSW *WeedWise*. Sydney: NSW Department of Planning, Industry and Environment.
- Dumont, E.R., O'Neal, R. (2004). Food hardness and feeding behavior in Old World fruit bats (Pteropodidae). *Journal of Mammalogy* **85**, 8-14.
- Entwistle, A., Corp, N. (1997). The diet of *Pteropus voeltzkowi*, an endangered fruit bat endemic to Pemba Island, Tanzania. *African Journal of Ecology* **35**, 351-360.
- EOL. (2020). Black Flying Fox *Pteropus alecto* Temminck 1837 *Encyclopedia of Life*. Washington DC: Smithsonian.
- Gosper, C.R., Vivian-Smith, G. (2010). Fruit traits of vertebrate-dispersed alien plants: smaller seeds and more pulp sugar than indigenous species. *Biological Invasions* **12**, 2153-2163.
- Lescano, C.H., de Oliveira, I.P., de Lima, F.F., da Silva Baldivia, D., Justi, P.N., Cardoso, C.A.L., Júnior, J.L.R., Sanjinez-Argandoña, E.J. (2018). Nutritional and chemical characterizations of fruits obtained from *Syagrus romanzoffiana*, *Attalea dubia*, *Attalea phalerata* and *Mauritia flexuosa*. *Journal of Food Measurement and Characterization* **12**, 1284-1294.
- Markus, N., Hall, L. (2004). Foraging behaviour of the black flying-fox (*Pteropus alecto*) in the urban landscape of Brisbane, Queensland. *Wildlife Research* **31**, 345-355.
- McConkey, K.R., Drake, D.R. (2006). Flying foxes cease to function as seed dispersers long before they become rare. *Ecology* **87**, 271-276.
- Nakamoto, A., Sakugawa, K., Kinjo, K., Izawa, M. (2007). Feeding effects of Orii's flying-fox (*Pteropus dasymallus inopinatus*) on seed germination of subtropical trees on Okinawa-jima Island. *Tropics* **17**, 43-50.
- Noblick, L.R. (2017). A revision of the genus *Syagrus* (Arecaceae). *Phytotaxa* **294**, 1-262.
- Paxton, G.L. (2017). Wild urban companions: living with everyday native animals in Brisbane. Unpublished Doctor of Philosophy, University of Queensland.
- Richards, G. (1990). The spectacled flying-fox, *Pteropus conspicillatus* (Chiroptera: Pteropodidae), in north Queensland. 2. Diet, seed dispersal and feeding ecology. *Australian Mammalogy* **13**, 25-31.
- Richards, G.C., Hall, L.S. (2012). *A natural history of Australian bats: working the night shift*. CSIRO Publishing.
- Roots, P. (2018). Flying Fox colony near Albury. In: email to Dirk HR Spennemann, ed. Wodonga: Department of Environment, Land, Water and Planning
- Silva, E.P.D., Siqueira, H.H., Damiani, C., Boas, V., de Barros, E.V. (2016). Physicochemical and sensory characteristics of snack bars added of jervivá flour (*Syagrus romanzoffiana*). *Food Science and Technology* **36**, 421425.
- Spennemann, D.H.R. (2018a). Observations on the consumption and dispersal of *Phoenix canariensis* drupes by the Grey-headed flying fox (*Pteropus poliocephalus*). *European Journal of Ecology* **4**, 41-49.
- Spennemann, D.H.R. (2018b). *Phoenix canariensis* drupes consumed by the Grey-headed flying-fox (*Pteropus poliocephalus*). A photographic documentation. Albury, NSW: Institute for Land, Water and Society, Charles Sturt University. DOI: 10.13140/RG.2.2.36238.18249
- Spennemann, D.H.R. (2018c). *Washingtonia robusta* drupes consumed by the Grey-headed flying-fox (*Pteropus poliocephalus*). A photographic documentation. Albury, NSW: Institute for Land, Water and Society, Charles Sturt University. DOI: 10.13140/RG.2.2.22816.40968
- Spennemann, D.H.R. (2020a). Distribution of cultivated Queen Palms (*Syagrus romanzoffiana*) in south-eastern Australia. Results of a rapid internet survey. Albury, NSW: Institute for Land, Water and Society, Charles Sturt University. DOI: 10.13140/RG.2.2.34560.46080

PTEROPUS POLIOCEPHALUS DISPERSING SEEDS OF THE QUEEN PALM

- Spennemann, D.H.R. (2020b). Drupes of *Syagrus romanzoffiana* consumed by *Pteropus poliocephalus*. A photographic data sheet Albury, NSW: Institute for Land, Water and Society, Charles Sturt University. DOI 10.13140/RG.2.2.29527.29604
- Spennemann, D.H.R. (2020c). Frugivory and seed dispersal revisited: codifying the plant-centred net benefit of animal-mediated interactions. *Flora* **263**.
- Varela, O., Bucher, E.H. (2006). Passage time, viability, and germination of seeds ingested by foxes. *Journal of Arid Environments* **67**, 566-578.