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**Seeds of the river red gum *Eucalyptus camaldulensis* as regular food of Laughing Dove *Streptopelia senegalensis* and Helmeted Guineafowl *Numida meleagris* under drought conditions**

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The river red gum *Eucalyptus camaldulensis* is a native tree of Western Australia. Since is fast growing, a prolific seed producer and highly resistant to drought, it has been introduced to over 100 countries throughout the world. It currently occurs commonly in southern Europe, the Middle East, SE Asia, USA, and Central and South America (Sani et al. 2014, Hirsch 2020). It is apparently the most widely planted tree in arid regions of the world and is considered an invasive species in many countries (Hirsch et al. 2020). It was introduced in southern Africa around 1870 and is common and widespread in urban and rural areas throughout the region (Hirsh et al. 2020).

Fruits of the river red gum are woody capsules 2-5 mm long and 4-10 mm wide (Hirsch et al. 2020). Seeds are pyramidal and 1.0-1.5 mm long. They contain large quantities of toxic tannins (0.11 g/100 g), glycosides, steroids and anthraquinone (Sani et al. 2014). Fruits are produced at a tree age of 7-10 years. In northern Namibia flowering is from July to January, while free seeds fall mainly in the dry season (G. Kopij per obs). Seeds are dispersed by wind, water and ants. A single tree can shed more than 52 000 seeds per m<sup>2</sup> per month (Hirsch et al. 2020).

Birds use the river red gum for shelter, roosting (e.g. Amur Falcon *Falco amurensis* and Lesser Kestrel *Falco naumanni*), nesting (mainly raptors such as Black *Accipiter melanoleucos*, Rufous-breasted *A. rufiventris* and Little *Accipiter minullus* sparrowhawks, Bat Hawk *Macheiramphus alcinus* and Crowned Eagle *Stephanoaetus coronatus*). This tree is also a source of nectar for birds such as white-eyes, bulbuls, and sunbirds. However, neither the fruits nor the seeds are reported as food items of animals (Hirsch et al. 2020).

The Ogongo campus where the observations made here occurred is located in the Cuvelai Drainage System, Omustati Region, northern Namibia (-17.6773 S, 15.2934 E). It is well-timbered with river red gums (planted along unpaved roads as avenues, and in some other places in the form of hedgerows) and many other indigenous (e.g. *Acacia* spp., *Colophospermum mopane*, *Comiphora* spp.) and alien trees.

Laughing Doves and Helmeted Guineafowls are among the

most numerous breeding resident bird species on this campus. The Laughing Dove is also common outside the campus, but the Helmeted Guineafowl, due to a high human pressure, occurs only on the campus (Kopij 2013a, b, 2014, 2015). The diet of the Laughing Dove normally comprises about 70-80% grass and herb seeds and this dove is known to feed mainly in the early mornings (Rowan 1983).

During a drought in June-November 2019 in northern Namibia (Fig. 1) grasses and herbs were virtually absent on the campus and its surrounds, growing only in some localized moist places only, such as near water points, on dam dikes, around pits, etc. Helmeted Guineafowls *Numida meleagris* (c. 80 individuals) and Laughing Doves *Streptopelia senegalensis* (c. 60 individuals) were observed every morning from July to October 2019 on Ogongo campus (Fig. 2) foraging on river red gum seeds (not crushed), released from the capsules and scattered on the unpaved road and roadsides. A similar situation occurred in the 2018/19 rainy season.

While feeding on the *Eucalyptus* seeds, the Helmeted Guineafowls foraged on the ground scratching with their feet in the leaf litter, while the doves gathered the seeds while walking quickly, turning often to the sides and pecking the ground. This could be a commensal relationship, as the doves apparently benefited from the guineafowls, which exposed the seeds by scratching the litter. Doves were however also observed foraging alone without guineafowls. The foraging took place mainly in the mornings, just after sunrise.

In normal years, in the dry season (July-August) most Laughing Doves in the Cuvelai drainage System, and beyond, form pairs, occupy territories and breed. During this drought, only a few of them attempted to breed (probably with very low success), while the majority tried to survive in non-breeding flocks spending most of their time looking for food.

Although Rowan (1983) and del Hoyo et al. (1994) do not report *Eucalyptus* seeds as part of the diet of doves, Laughing Doves and Ring-necked Doves *Streptopelia capicola*, as well as Helmeted Guineafowl, are known to feed on river red gum seeds released from capsules and crushed

by traffic (Dean 2005a, b; Ratcliffe 2005). These seeds, however, have never been reported as the main food items of doves. Under drought conditions, in urbanized areas and

in farmlands *Eucalyptus* seeds may become the staple food of some *Streptopelia* doves and other larger avian granivores.

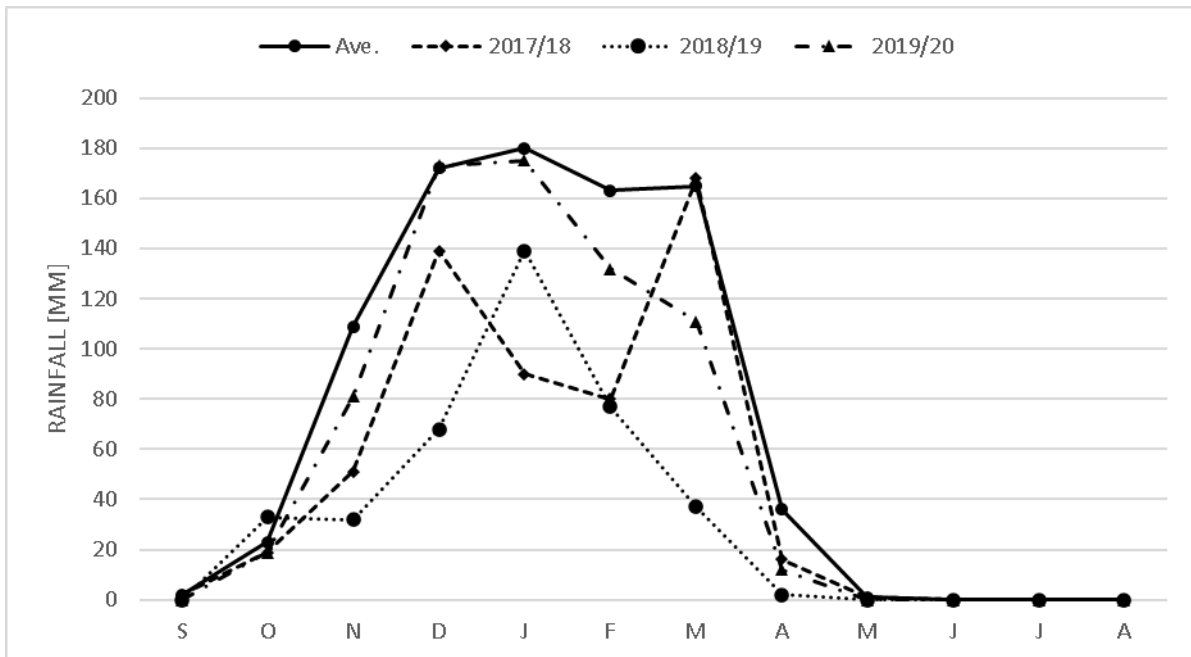


Figure 1. Monthly rainfall in Ongwediva during the years 2017-2020, with a long-term average (2009-20; <https://www.worldweatheronline.com/ongwediva-weather-averages/oshana/na.aspx>).



Fig. 2. River red gums on the Ogono campus (above), foraging Laughing Doves (bottom, left) and a Ring-necked Dove (bottom, right).

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