

Short Communication

A conservation assessment of *Douepea arabica* (Brassicaceae): a Critically Endangered plant species from Saudi Arabia

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Abstract *Douepea arabica* (Hedge & Kit Tan) O. Appel & Al-Shehbaz is a rare and threatened endemic plant species of Saudi Arabia. We present the first field studies of *D. arabica* in over 2 decades and update the sparse historical data on this important plant species. Surveys of the type locality Wadi Qaraqir and surrounding areas indicate that numbers of *D. arabica* are low. Although regeneration is occurring in the type locality and a newly recorded locality in the neighbouring Wadi Ghamrah, the extent of occurrence and area of occupancy of *D. arabica* are restricted. This species appears to be strongly associated with available water sources and the dominant *Nerium* shrubland in the wadi channels. These are both threatened by increasing agricultural activities and road building in the area. We propose that *D. arabica* should be categorized as Critically Endangered on the IUCN Red List. We recommend conservation measures for this species, as well as the further research required to implement a conservation action plan.

Keywords Critically Endangered, *Douepea arabica*, endemic, Jibal Qaraqir, Saudi Arabia

Plant endemism on the Arabian Peninsula is typically associated with tropical succulent genera (e.g. *Aloe*, *Caralluma* s.l. and *Euphorbia*) of dry habitats; a smaller number of endemics are restricted to mesophytic refugia. *Douepea arabica* (Hedge & Kit Tan) O. Appel & Al-Shehbaz (syn. *Dolichorhynchus arabicus* Hedge & Kit Tan), of the family Brassicaceae, is one of these rarer Arabian endemic species. Despite its rarity, the ecological and conservation status of *D. arabica* has not been previously studied. In Arabia basic distribution and abundance data are lacking for many endemic plant species, a situation that hinders conservation assessment and planning, ecological model-

ling and resource management (Hall & Miller, in press). Our goal is to begin to redress this situation by providing field data on one of the region's rarest endemic species.

D. arabica was first collected by Sheila Collette in 1979 from Jibal Qaraqir in north-west Saudi Arabia (Fig. 1, Plate 1) and is known from no other locality. When described by Hedge & Tan (1987) *Dolichorhynchus* was regarded as an endemic genus, the only plant genus endemic to Saudi Arabia. Since then Appel & Shehbaz (2001) have placed this species in the genus *Douepea*, with one other species, *Douepea tortuosa*, which is principally restricted to the Punjab in Pakistan (Ali & Qaiser, 1986). The genus *Douepea* thus has a unique floristic disjunction between Jibal Qaraqir in north-west Saudi Arabia and the Punjab region of Pakistan.

During a visit to the Jibal Qaraqir area for Saudi Arabia's Important Plant Area Programme, in April–May 2008 (Al Abbasi et al., 2010; Llewellyn et al., 2010), an informal survey of Wadi Qaraqir and the neighbouring Wadi Ghamrah was conducted to: determine the distribution of *D. arabica*, count mature individuals and seedlings, provide more accurate descriptions of the habitat and ecology of the species, and assess its conservation status and recommend measures for conservation action (Margules & Pressey, 2000). Notes on the original collections (Collette, 1961,

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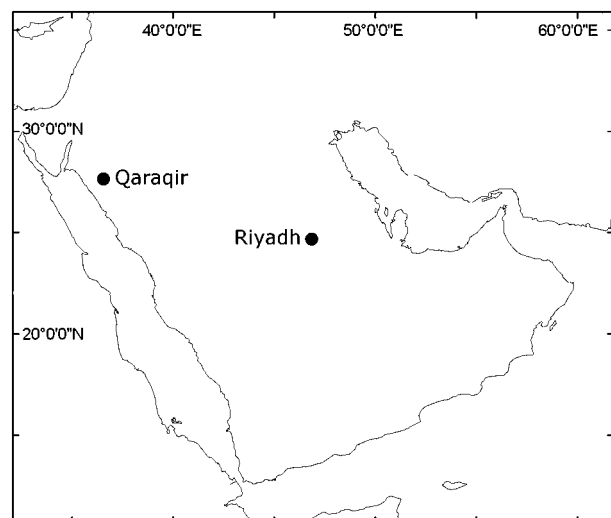


FIG. 1 The location of Jibal Qaraqir, the only known location of the endemic *Douepea arabica*, in north-west Saudi Arabia.



PLATE 1 *Douepea arabica* and its habitat: (a) flower, (b) habit, (c) immature fruits, (d) in Wadi Ghamrah on Jibal Qaraqir (Fig. 1), (e) seedling and (f) wadi bed habitat of seedlings and mature individuals.

in the Royal Botanic Garden Edinburgh herbarium) of *D. arabica* from Wadi Qaraqir state that it was locally common at c. 600 m. Our surveys in this locality only recorded a single plant, at a similar altitude. A survey of the nearby and less accessible Wadi Ghamrah revealed nine mature plants at a single site in the wadi bed together with > 30 seedlings, also at c. 600 m. At this newly recorded locality *D. arabica* appeared to be actively regenerating in habitats similar to those of Wadi Qaraqir, i.e. near to seepages and springs; no plants were recorded on the drier slopes. One individual was found growing above a spring in the sandy soils of the wadi channel, among red sandstone rocks. Others were in the wadi channel, among boulders or in sand. As in Wadi Qaraqir the dominant vegetation of Wadi Ghamrah is *Nerium oleander* L. shrubland with large stands of *Phragmites*, *Typha* and *Pennisetum divisum* (J.F. Gmel.) Henrard. In the vicinity of Wadi Qaraqir and Wadi Ghamrah there are a number of narrow wadi valleys that also hold perennial springs and seepages, such as Wadi Amdan and

Wadi Yanqad. As *D. arabica* is associated with wet habitats, it is possible that these wadis also hold significant populations.

D. arabica faces a number of threats. The seepages, pools and *Nerium* shrubland with which it is associated are gradually deteriorating as a result of expanding agricultural activities. New agricultural fields and wells are altering the stream course in Wadi Qaraqir, probably reducing the flow of groundwater. Evidence of the effect of local agriculture on the water table can be seen at the nearby town of Ad-Disah, where increased salinity has already been recorded (O. Llewellyn, pers. obs.).

Stochastic environmental events also pose a significant threat. *D. arabica* occurs predominantly in wadi valleys that are at risk from flash flooding. Although the species is probably adapted to such flooding, the reduction in the cover of the *Nerium* shrubland and the large stands of *Phragmites* and *Typha* is likely to increase the intensity of this stochastic threat. Anecdotal evidence suggests that

a decade of clearing has opened up dense stands of *Nerium-Phragmites-Typha* that were once practically impenetrable (O. Llewellyn, pers. comm.). As *D. arabica* is closely associated with this vegetation, clearance for agriculture is a direct threat to *D. arabica* habitat.

Destruction and deterioration of the dominant vegetation has also occurred as a result of a newly built road through Wadi Qaraqir that links Jibal Qaraqir to Tabuk (Llewellyn et al., 2010). Previous studies in the Arabian region indicated that road construction (increased opportunities for grazing, agriculture and tourism) threatens the existence of endemic and rare species such as *D. arabica* (Hall et al., 2008). As *D. arabica* is only recorded from the wadi floor and is unlikely to extend far up the wadi sides it is particularly vulnerable to anthropogenic disturbances such as road building and agriculture.

We determined the degree of threat to the persistence of *D. arabica* using the IUCN Red List criteria (IUCN, 2001), assessing the species as Critically Endangered based on criteria B1ab(ii, iii, v)+2ab(ii, iii, v); D. The species is currently found in two connected wadi systems that are treated as a single location because they are both threatened by the same factors. Even if expanded to include potential localities nearby, this covers an area of c. 85 km² (extent of occurrence; B1). Within these wadi systems, the *Nerium* shrubland habitat with which *D. arabica* is closely associated currently covers <10 km² (area of occupancy; B2). This habitat is presently declining in both extent and quality, leading us to infer that the area of occupancy and the number of mature individuals of *Douepea* are also decreasing. As the most recent surveys recorded only 10 mature individuals, it is reasonable to assume that there are <50 extant mature individuals (D).

Jibal Qaraqir has been proposed as a protected area under Saudi Arabian law but this is still awaiting legislative action. To ensure the persistence of this species we recommend that the Saudi Wildlife Commission develops an appropriate conservation strategy, with a number of specific actions:

(1) Limit and, if possible, reverse the impact of agriculture in Wadi Qaraqir and Wadi Ghamrah. Decreasing agricultural activity will reduce use of water resources in Jibal Qaraqir and reduce pressures on the *Nerium* shrubland with which *D. arabica* is associated.

(2) Reduce pressures on land and local resources by providing local people with viable alternatives to cultivating the land in these wadi systems (Llewellyn et al., 2010). One solution is to provide local communities with other agricultural lands. Socio-economic research is required to determine the viability of such action. Alternatively, following the success of conservation-based income generation in neighbouring Jordan (Irani & Johnson, 2000), provision of income for local people through conservation-related ecotourism employment, such as guides and

rangers for the Saudi Wildlife Commission, may be a possibility but again socio-economic research is required to examine this.

(3) Legislate to prevent the construction of further roads in the area at least until the full range and abundance of *D. arabica* are known and environmental impact assessments have been undertaken.

(4) Collect seeds from the wild populations for deposition in local and international seed banks as part of an ex situ conservation programme.

(5) Conduct horticultural/conservation studies on seed germination, establishment and growth conditions of *D. arabica*. The results of these studies could be used as part of an in situ restoration programme for *D. arabica* in areas that have been affected by agriculture and road construction.

(6) Investigate the impact of reduced vegetation cover on flood intensity and the feasibility of restoring *Nerium* shrubland vegetation or erecting artificial barriers to reduce flood intensity in the wadi valleys.

These recommendations will be presented formally as part of a technical report on *D. arabica*. We plan to conduct further studies in Jibal Qaraqir in 2011 to survey wadis adjacent to Wadi Ghamrah and collect seed of *D. arabica*. A further aim of this visit will be to discuss the implementation of a conservation strategy for *D. arabica*.

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Biographical sketches

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