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Dodonaea angustifolia – an alien invasive to the Auas Mountains in Namibia?

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Abstract

A population of Dodonaea angustifolia *was identified from the farm Regenstein south of Windhoek in the Auas Mountains. The largest population is estimated at 0.055 individuals/m² and appears to radiate from a core indicating possible introduction at some stage. This introduction could however not be determined accurately, but estimated to have occurred during the early 1980's. The fact that the Auas Mountains is important in terms of biodiversity and endemism makes this infestation of* Dodonaea angustifolia *potentially problematic.*

Keywords: *Dodonaea angustifolia*, alien invasive, Auas Mountains, Namibia

Introduction

Dodonaea angustifolia (Family Sapindaceae), or commonly referred to as Sand Olive, is a shrub or small tree with narrow shiny pale green leaves with a distinctive small winged fruit resembling those of *Combretum* species (Figures 1 & 2).

The natural distribution includes the Americas, the Asia-Pacific region, the Arabian Peninsula (pers. obs.) and from tropical to southern Africa (Edwards 1976, Eggeling 1951, Ghisalberti 1998, Pengelly n.d.). In Southern Africa it is found in Mozambique, South Africa and Zimbabwe (Palgrave 1981). *D. angustifolia* is widely distributed in South Africa except for the central parts (Macdonald & Nott 1987, Van Wyk, Van Oudshoorn & Gericke 1997, Van Wyk & Van Wyk 1998). Its habitat varies from arid, semi-desert regions to the margins of evergreen forests in high rainfall areas (Eggeling 1951, Palgrave 1981, Van Wyk, Van Oudshoorn & Gericke 1997).

The plant can withstand fires (Eggeling 1951, Møller n.d., Oosthuizen pers. comm.) and it reproduces itself from seed "very freely, even in dry rocky localities" (Eggeling 1951, Møller n.d.). Edwards (1976) states that it grows on dry rocky slopes between 1500 and 2100m throughout Ethiopia and is the only shrub, which grows on copper-rich soils.

Figure 1: *Dodonaea* trees/shrubs dominating the hillside at Regenstein. (Photo: P. Cunningham)

Figure 2: Typically winged *Dodonaea* seed, often reddish in colour. (Photo: P. Cunningham)

D. angustifolia has medicinal properties and is used for the treatment of colds, skin rashes, arthritis and even tuberculosis (Palgrave 1981, Pengelly n.d., Van Oudshoorn & Gericke 1997, Van Wyk, Van Oudshoorn & Gericke 1997, Van Wyk & Van Wyk 1998, Von Koenen 1996). Early Europeans used the "hop-like" fruit for home brewing in Australia (Mabberley 1997, Pengelly n.d.). The trees are used in various parts of the world to consolidate sand and reclaim marshes (Palgrave 1981, Van Wyk & Van Wyk 1998), cultivated as hedges (Anon 1999, Eggeling 1951, Møller n.d., pers. obs.), as ornamental plants (Mabberley 1997) and even as windbreaks (Møller n.d.).

Distribution in Namibia

D. angustifolia was first documented from Namibia - as an alien invasive - by Müller (1985). Macdonald & Nott (1987) note its "limited spread" in the vicinity of Outjo and Otjiwarongo, although no specific sites are provided. Craven (1999) includes it as a naturalized alien in Namibia. No mention of its existence in Namibia is however made by Van Wyk, Van Oudshoorn & Gericke (1997) and Van Wyk & Van Wyk (1998).

According to Müller (1985) this species was introduced as a garden ornamental with light to moderate infestations in the Grootfontein townlands and on adjacent farms. Feral trees have also been observed on the periphery of Otavi (pers. obs.) and Grootfontein (H. Kolberg pers. comm., Von Koenen 1996). Müller (1985) states that *D. angustifolia* grows in disturbed areas and occurs interspersed with the indigenous vegetation in Namibia, making control by chemicals difficult. It is ubiquitous as garden ornamentals and hedges throughout towns in Namibia (pers. obs.). No mention has previously been made of its presence in the Highland Savanna near Windhoek.

This paper records an additional population located approximately 20km south (22°42'50"S, 17°02'27"E) of Windhoek on the farm Regenstein at an elevation of 2026m in the Auas Mountains in what is generally referred to as the Highland Savanna vegetation type (Giess 1971). The paper notes some features of its distribution and population structure.

Methods

Previous landowners were interviewed to obtain as much information regarding when and how the plants established on the farm.

A brief survey was conducted in 2001 to determine the distribution and population structure of the main population. Seven transects, spaced at approximately 30 m intervals were walked up the slope. At every 10 steps, the distance to the nearest *D. angustifolia* was recorded. The distance to the nearest *D. angustifolia* neighbour was also recorded (to the nearest metre). These measurements were used to determine a rough population density using the following formula (Mueller-Dombois & Ellenberg 1974):

$$\text{Density of plants/m}^2 = 1 / (4 \times [\text{mean distance in m}]^2).$$

This method (formula) is biased, depending upon the degree of clumping but provides at least a comparative estimate. Each individual was classified as either below 2 m or above 2 m in height. The calculated densities in each transect, and the heights of individuals, were used to roughly determine whether the population was

radiating from a central point or not. This in turn would suggest whether the population was an invasive alien or an indigenous species.

Results

Regenstein population

This population has mainly established on a westward facing hill adjacent to a site that has been used for camping since at least 1990. Other individual plants and a smaller population have also been located in the vicinity, especially next to the road ascending the Gross-Herzog Friedrich Mountain towards the microwave station situated on the peak.

According to previous owners/occupants of the farm Regenstein, *D. angustifolia* did not occur in the area between 1965 and March 1978 (P. De Wet pers. comm.). Between 1978 and 1989 we could not determine anything regarding this plant, but from 1989 onwards the tree had already been established (W. Oosthuizen pers. comm.). It would thus seem that it became established during the period between 1978 and 1989.

The larger population has an estimated density of 0.055 individuals/m^2 (n = 70). It appears to radiate from a core, as indicated from the density estimates for the transects (Figure 3) and the height class data (Table 1) in which more individuals are above 2 m in height.

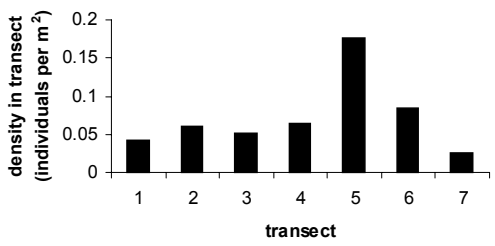

Figure 3. Density of individuals in transects. Transect 1 was the most southerly, and Transect 7 was the most northerly.

Table 1. Height class data for all transects. Transect 1 was the most southerly, and transect 7 the most northerly.

Transect	Percentages in height classes	
	0 m – 2 m	> 2 m
1	75	25
2	100	0
3	95	5
4	80	20
5	60	40
6	87.5	12.5
7	83.3	16.7
Overall	83.6	16.4

Transect 5 seems to go through the core of the population, showing both the highest density of individuals (Figure 3) and the oldest individuals (Table 1), suggesting that this is where the original individual established and that the population slowly radiated out from this point.

Discussion

According to W. Oosthuizen (pers. comm.) *D. angustifolia* it is not eaten by domestic cattle nor browsing game such as kudu and eland in the area (Regenstein farm). Møller (n.d.) supports this statement. Fire also seems to promote the population since they regenerate furiously after fire (Møller n.d., W. Oosthuizen pers. comm.). Also of concern is that it has an extremely aggressive root system (Møller n.d.) that will suppress growth of most plants growing within 3m from it. Macdonald & Nott (1987) state that it should be controlled while infestations are still light and should not be cultivated within nature conservation areas. If we assume that the population arose from one established individual on the westward facing slope above the camping site, it would appear that dispersal is normally inefficient (hence the dense population radiating from a core) but that longer-range dispersal (a few kilometers) does occur on occasion (hence the smaller population of smaller individuals a few kilometres eastwards and the small individuals on the road winding to the tower). It is not known whether this longer-range dispersal is wind or bird assisted or perhaps both.

The Auas Mountains currently rank as the second most important mountain group in terms of biodiversity and endemism potential in Namibia, after Brandberg (Irish, 2002). This is due to the elevation, altitude and topographic diversity. Some of the highest mountain peaks in Namibia occur here. The flora of the area have been understudied but it is expected that a number of species restricted to the mountain range occur, as well as species occurring as outliers from more easterly and southerly distributions (A. Burke, P. Craven and J. Irish, pers. comm., Rennie, 1936, Maggs *et al*, 1994). Some of the plants found in the Auas Mountains are outliers of Cape Flora (Rennie, 1936).

Unique species of fauna, which have so far been documented from the area, include a butterfly *Tylopaedia sardonyx* subsp. *cerita* (Woker 1999), "Gladiator" (Mantophasmatodea – new Insect Order) (E. Marais pers. comm.) and the Herero Girdled Lizard (*Cordylus pustulatus*) (Branch 1998, M. Griffin pers. comm.). There is concern that *D. angustifolia* might displace other plant species with similar ecological requirements. These species might have host specific relationships with restricted range fauna. The Auas Mountains is well outside the normal range and environment of the nominal race of *T. sardonyx*, which is well known and restricted to the winter rainfall areas of South Africa (Clark & Dickson 1971, Pringle et.al. 1994). *T. sardonyx* occurs in areas of South Africa where *Dodonaea* is found although no references could be located indicating it as the food plant of *T. sardonyx*. According to Woker (1999) the larval food plant of *Tylopaedia sardonyx cerita* did not include *Dodonaea* from Gross-Herzog Friedrich Mountain although it was strongly suspected that *Euclea undulata* (Common guarri) was the host plant. Although no ovipositioning was observed, eggs and larvae similar to those of *T. sardonyx* were observed on *E. undulata*. F. Swart (pers. comm.) mentioned that he was able to breed *T. s. cerita* through its life cycle on *E. undulata*. It is possible that *T. sardonyx* is more widespread in Namibia in association with *E. undulata*, but not yet sampled, or it may require the elevation associated with Gross-Herzog Friedrich Mountain. According to F. Swart (pers. comm.), the food plant for *T. sardonyx* in South Africa includes *Cespelathus spinosa*, *Euclea undulata* & *Phylica oleifolia* while *D. angustifolia* is the host plant for the moth *Stomphesis dodonaeae*. The possibility that *D. angustifolia* might be displacing the suggested food plant (*E. undulata*) for *T. sardonyx* on Regenstein would have to be investigated further. Further research into the possible association between *D. angustifolia* and *T. sardonyx* is thus suggested, before any control measures are taken.

Taking the nature of the plant into account in Namibia i.e. invasive potential as documented by Müller (1985), it would seem prudent to assume that this population south of Windhoek is also invasive and not a disjunct population and/or remnant population from a previous era. Above all, the fact that this population is spreading in the biodiversity important Auas Mountains is disconcerting and it is suggested that *D. angustifolia* be monitored to determine its invasiveness and rate of spread and be eradicated if it is determined that it poses a potential danger in Namibia.

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References

ANON. 1999. *Dodonaea viscosa*: Hopbush. http://www.plantadviser.com/azcentral/plants/dodvisc.htm

BRANCH, B. 1998. Field Guide to Snakes and other Reptiles of Southern Africa. Struik Publishers (Pty) Ltd, Cape Town, South Africa.

CLARK, C. & DICKSON, C.G. 1971. Life histories of the South African Lycaenid Butterflies. Purnell & Sons, Cape Town.

CRAVEN, P. (Ed) 1999. A Checklist of Namibian Plant Species. Southern African Botanical Diversity Network Report No. 7 SABONET, Windhoek, Namibia.

EDWARDS, S. 1976. Some wild flowering plants of Ethiopia: An Introduction. Addis Ababa University Press, Addis Ababa, Ethiopia.

EGGELING, W.J. 1951. The indigenous trees of the Uganda protectorate. The Government Printer, Entebbe, Uganda.

GIESS, W. 1971. A preliminary vegetation map of South West Africa. *Dinteria* 4: 1 – 114.

GHISALBERTI, E.L. 1998. Ethnopharmacology and phytochemistry of *Dodonaea* species. *Fitoterapia* LXIX: 99-113.

IRISH, J. 2002. Namibian Mountains: biodiversity potential based on topography. Report to the Mountain Working Group of the National Biodiversity Task Force.

MABBERLEY, D.J. 1997. The Plant Book. A portable dictionary of the vascular plants – II edition. Cambridge University Press, UK.

MACDONALD, I.A.W. & NOTT, T.B. 1987. Invasive alien organisms in central South West Africa/Namibia: Results of a reconnaissance survey in November 1984. *Madoqua* 15(1): 21-34

MAGGS, G.L., KOLBERG H.H. and HINES, C.J.H. 1994. Botanical diversity in Namibia - an overview. In: *Botanical Diversity in Southern Africa*, (B.J. HUNTLEY, ed.) *Strelitzia* 1: 93-104.

MØLLER, L. n.d. *Dodonaea*. Forest Awareness and Tree Planting Project, Oshakati, Namibia.

MUELLER-DOMBOIS, D. & ELLENBERG, H. 1974. Aims and Methods of Vegetation Ecology. John Wiley & Sons, Toronto.

MÜLLER, M.A.N. 1985. Invasive alien plants in the commercial grazing areas, urban areas, diamond areas and Hereroland. In: BROWN, C.J., MACDONALD, I.A.W. & BROWN, S.E. Invasive alien organisms in South West Africa/Namibia. South African National Scientific Programmes Report, CSIR, Pretoria, RSA, No 119: 1-5.

PALGRAVE, K.C. 1981. Trees of Southern Africa. Struik Publishers, Cape Town, RSA.

PENGELLY, A. n.d. *Dodonaea viscosa*: A review. http://www.nhaa.org.au/forum/text/dodvis2.html

PRINGLE, E.L.L., HENNING, G.A. & BALL, J.B. 1994. Pennington's butterflies of Southern Africa. Struik Publishers, Cape Town, RSA.

RENNIE, J.V.L. 1936. On the flora of a high mountain in South-West Africa. *Transactions of the Royal Society of South Africa*. 23: 259-263.

VAN WYK, B.R., VAN OUDTSHOORN, B. & GERIKE, N. 1997. Medicinal plants of South Africa. Briza Publications, Pretoria, RSA.

VAN WYK, B. & VAN WYK P. 1998. Field guide to trees of Southern Africa. Struik Publishers (Pty) Ltd, Cape Town.

VON KOENEN, E. 1996. Medicinal, Poisonous and Edible plants in Namibia. Klaus Hess Verlag Publishers.

WOKER, M.K. 1999. Study of the endemic butterfly *Tylopaedia sardonyx cerita* (Lepidoptera: Lycaenidae) on Gross-Herzog Friedrich Mountain. Unpublished report, Polytechnic of Namibia, Windhoek, Namibia.