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First record of the North African *Launaea arborescens* in southern Africa

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The first record of the non-native, naturalised *Launaea arborescens* (Batt.) Murb. in the Namib Desert raised questions of its origin and whether or not it could pose a threat to the indigenous vegetation. The North African plant was introduced in a forestry nursery in the Kuiseb Delta, and some individuals were also planted outside the nursery in the early 1970s. They have maintained a likely viable population for nearly 50 years but have so far not been observed elsewhere and thus appear not to be spreading.

Keywords: exotic plant; forestry; invasive alien; Kuiseb Delta; Namib Desert.

Introduction

Invasive alien plants displace native vegetation and change ecosystems all around the world (Chapin et al. 2000). Because of their harsh environments, deserts have so far been spared the deluge of invading plants typically encountered on islands and other ecosystems that are easy to invade (e.g. Duarte et al. 2005; Davies et al. 2011). However, even deserts are not immune to these invasions, and particularly habitats that are moister and receive water regularly such as ephemeral rivers, seeps and fountains can provide suitable habitats for invaders. All western-flowing rivers of the Namib Desert, for example, are locally invaded by numerous exotic species such as *Datura, Prosopis, Nicotiana* and *Ricinus* species (e.g. Boyer & Boyer 1989; Auala et al. 2014). The level of infestation varies and is currently localised, but the invasives are nevertheless there. The densest infestations are usually in the vicinity and downstream of settlements where human activities such as woodcutting and overgrazing have disturbed the natural balance.

However, exotic, non-native plants also turn up in unexpected places – for example, in the northwest corner of the Kuiseb Delta, far from settlements and in an area hardly ever touched by the infrequent Kuiseb River floods. This was not recognised for decades, though the spiky desert shrub *Launaea arborescens* (Batt.) Murb. was found here recently and this raised numerous questions: How did it get there? As this plant is not known in Namibia, has it been reported elsewhere in southern Africa and in similar habitats? Has it established a viable population, and does it pose a threat as an invader? Whether *Launaea arborescens* has established a viable population in the Kuiseb Delta was investigated by posing two subquestions: What is the extent and size of the population, and what is the size distribution of the plants. These questions are addressed and background information on the plant is presented in this article.

Materials and methods

The study area

The study area is situated in the central Namib Desert, in the Erongo Region of Namibia, just south of Walvis Bay (Figure 1). The central Namib lies between the ephemeral Ugab and Kuiseb rivers, and is bounded by the Atlantic Ocean in the west and the escarpment in the east. It falls into the Desert Biome (Irish 1994; Rutherford & Westfall 1994). The coastal zone at Walvis Bay lies within a 'cool desert' region of Namibia, an environment influenced by the South Atlantic Anticyclone, the cold, northward-flowing Benguela current and the divergence of the southeast trade winds along the coast. According to Mendelsohn et al. (2002), average daily temperatures vary between a minimum of 10°C in the coldest month and a maximum of 24°C in the warmest month in the area, although temperatures as low as 2°C have been recorded (Jürgens et al. 2013). Temperatures are variable both daily and seasonally, with the highest temperatures recorded during 'berg wind' episodes, when cold air from the interior flows towards the coast and is heated by compression (catabatic wind), resulting in temperatures of up to 40°C or more. Southerly, westerly, and southwesterly winds are prevalent, and are usually strongest between late afternoon and early evening (Mendelsohn et al. 2002).

Rainfall in the Namib Desert is highly variable, unpredictable and patchy. It varies from 0 to approximately 100 mm per annum, increasing from west to east. In the west, where precipitation from rain is lowest, fog is carried inland by wind passing over the cold Benguela current of the Atlantic Ocean. It is a vital source of moisture for many desert organisms. Walvis Bay has a mean annual rainfall of 13.5 mm, with most rain falling in summer between January and April, and the wettest month being March when about 50% of annual rainfall is recorded (Atlas of Namibia Team 2022).

Coastal dune hummocks are the prevalent habitat in the study area. They are important components of coastal ecosystems and are formed mainly by the shrub *Salsola nollothensis* Aellen, which traps windblown sand and results in the vertical formation of dune hummocks. These sand-stabilising hummocks are ecologically important, providing shelter, forage and habitats for the local fauna and flora.

The study plant

Launaea arborescens is growing in a dune hummock area, where hummocks are of medium size (1–2 m high). Most of the other plants in this area grow on these hummocks, but also in valleys in between. However, they are absent in valleys where the ground seems to be wet regularly (i.e. closer to the water table and likely saline conditions).

Vegetation cover in the dune hummocks averages approximately 20% and includes, in addition to *L. arborescens*, the shrubs *Salsola nollothensis* and *Lycium tetrandrum*, as well as the herb *Crotalaria colorata*, the grass *Odyssea paucinervis* and the sedge *Scirpus dioicus*. *Phragmites australis* reed beds adjoin the area to the west. A few isolated trees such as *Tamarix usneoides*, the exotic *Acacia cyclops, Myoporum serratum* and *Eucalyptus camaldulensis* appear to have escaped from the forestry nursery at Wortel and are also found in the hummock area nearby.

The plant was originally identified by recognition of its similarity in flower structure to its closest indigenous relatives in Namibia, namely *Launaea intybacea* (Jacq.) Beauverd and *Lactuca inermis* Forssk. They all belong

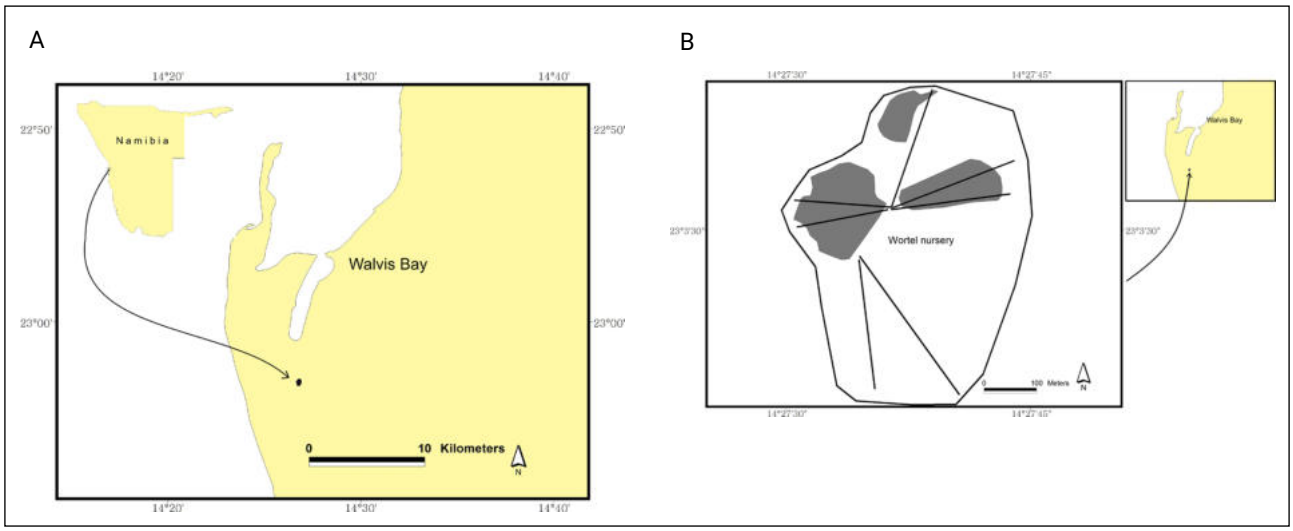

Figure 1. A, Position of the study area near Walvis Bay in Namibia; B, Extent of field survey of *Launaea arborescens* (outline), survey transects (lines), and area of occupancy of population (grey polygons) in the Kuiseb Delta in Namibia.

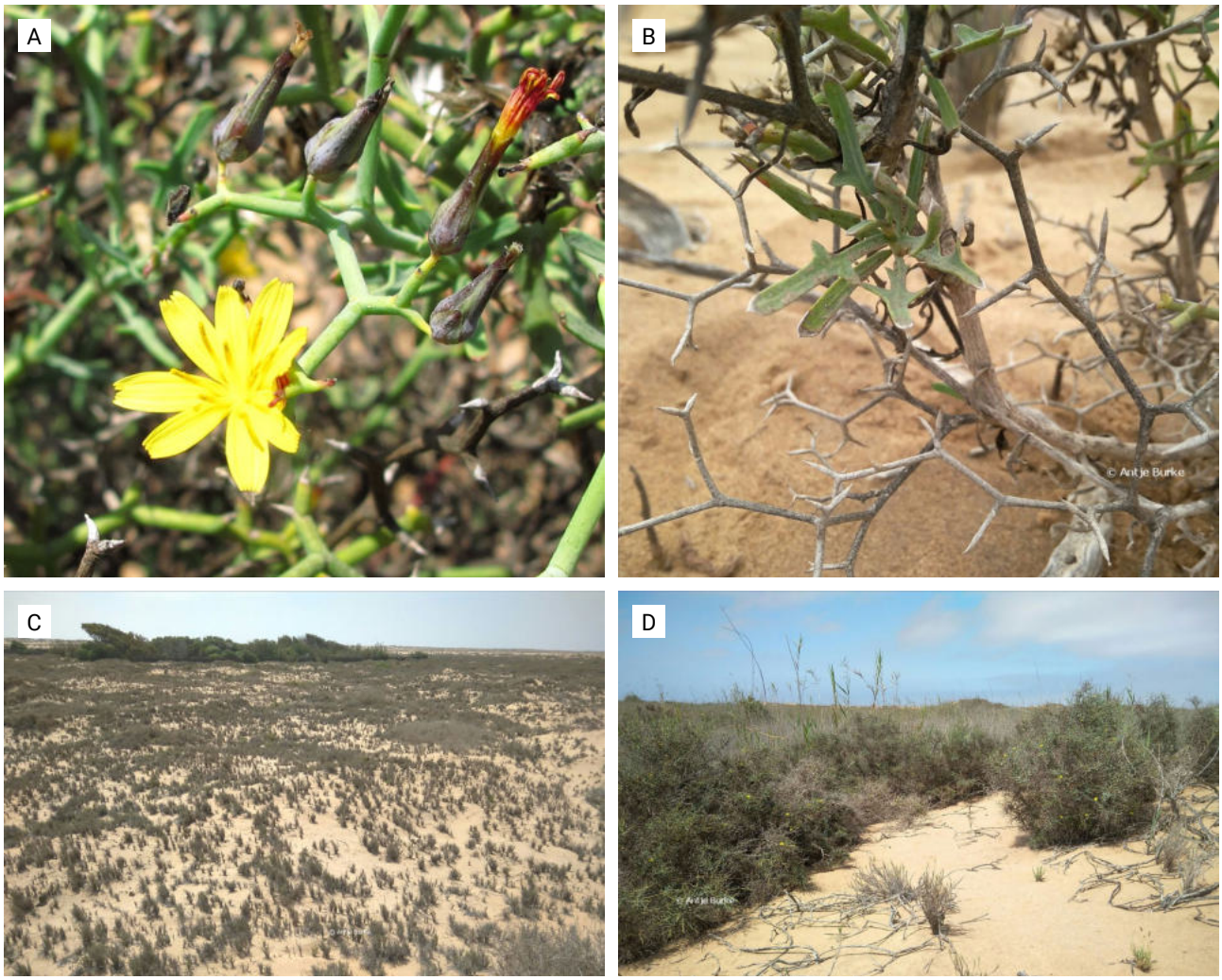

Figure 2. *Launaea arborescens* in the Kuiseb Delta; A, flower; B, leaves; C, general habitat with Wortel nursery in background; D, plant in habitat. Photographs: A, C. Mannheimer; B–D, A. Burke.

to the Tribe Cichorieae within the daisy family (Asteraceae), which is characterised by the presence of milky latex and (in most species) bisexual ligulate florets with five teeth at the tips (i.e., strap-shaped 'petals' with toothed tips. This tribe includes many edible, medicinal and weedy species, in genera such as *Lactuca* (lettuce), *Cichorium* (chicory/endive), *Sonchus* (milk thistle) and *Taraxacum* (dandelion). *L. arborescens* is native to Algeria, Baleares, Canary Islands, Cape Verde, Madeira, Mauritania, Morocco, Saudi Arabia and Spain (GBIF, January 2021; https://www.gbif.org).

Launaea arborescens (Batt.) Murb. (adapted from Kilian 1997)

Dense, intricate, spinescent, irregularly hemispherical shrub, usually up to 1 m high, almost leafless (Figures 2 and 3). Branches terete, divaricately and intricately branched, with distinct joints and spinescent terminal segments; young branches stiff, green, smooth, waxy, becoming greyish brown with age. Latex whitish with unpleasant smell. Leaves clustered at the bases of the lower branches, somewhat succulent, blue-green, mostly narrowly spathulate to linear in outline, soon deciduous, higher up the shoots reduced to inconspicuous, ovate-acute bracts. Capitulae ('flowers') bright yellow, up to 16 mm in diameter, always terminal and single on the peduncles, which persist as spines after shedding of the capitulae. Capitula with 7–19 florets ('petals'), each with five 'teeth' at the tip. Involucre up to 15 mm long, cylindrical to conical. Achenes with 5 main ribs accompanied by 2 secondary ribs, with transverse, roundish, and tuberculate wrinkles, often somewhat powdery-papillose, brown. Pappus 5–8 mm long, comprising numerous white, setaceous rays.

A specimen (*Antje Burke AB20007*) was deposited at the National Botanical Research Institute in Windhoek, which is the first record of the plant in southern Africa.

Review of information

To establish whether this plant is recorded for the first time in southern Africa, global biodiversity databases

Figure 3. *Launaea arborescens* in the Kuiseb Delta near Walvis Bay. Photograph: A. Burke.

(GBIF, GloNAF), citizen science databases (iSpot, iNaturalist), Namibia's National Botanical Research Institute records and the authors' own records of over 30 years of plant survey work across the entire Namibia were consulted.

Extent of the population

The extent of the population was established by mapping the occurrence of the plant in the field. The locality of all plants encountered was recorded with a geographic positioning device (GPS). These were then plotted, and the apparent centre determined, which appeared to be just outside the entrance to the nursery. From this centre transects were walked in all compass directions and the distribution boundary recorded. Seven transects of 150–320 m length were walked. The plants were counted along the transects and in the areas between these transects, which were also searched thoroughly. The nursery area was also surveyed (Figure 1B). The GPS positions of recorded individuals and groups of individuals were plotted and the area of occupancy (i.e., the habitat where the plant grows) mapped (Figure 1B).

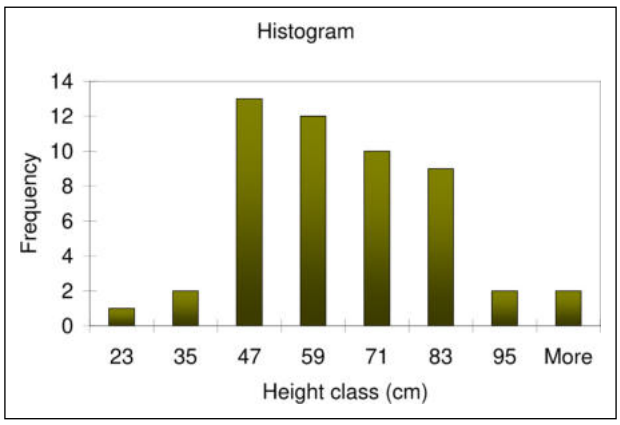

Figure 4. The distribution of mean height measurements of 51 random individuals of *Launaea arborescens* in the Kuiseb Delta.

Size distribution of the population

The dimensions of 51 haphazardly selected plants (by walking backwards and throwing a bottle over the shoulder and then selecting the nearest plant to where the bottle landed) were measured. At each plant, height and diameter of the plant was measured three times, resulting in six measurements for each individual. Repeated measurements were used to accommodate the irregularity of plant shape and the irregular surface. Height measurements were averaged per individual and plotted in a histogram (Figure 4). The data are provided in the supplementary (Appendix 1).

Results

The species' history in Namibia

This species' history in Namibia is directly linked to the forestry nursery at Wortel, which was established in the early 1970s to raise and test plants for dune stabilisation around Walvis Bay (Piet le Roux, pers. comm. January 2021). Considerable research was undertaken by Mr le Roux at the time, and plants from other deserts were tested as suitable candidates to stabilise the dunes around Walvis Bay (Le Roux 1974). As seawater irrigation was planned, only plants with a high salt tolerance were used. Seeds of selected species were obtained from North Africa and Australia, and this included the North African desert shrub *Launaea arborescens* (Le Roux 1974). Initially plants were raised at the forestry nursery in Grootfontein (19°30'S and 18°15'E) and then transplanted into the Walvis Bay dunes. However, a small nursery was eventually established in the Kuiseb Delta at Wortel (23°05'S and 14°45'E), and plants were also raised there and planted out in pilot sites around the nursery, on dunes in the delta and along the road between Wortel and Walvis Bay. Initially the plants were irrigated with treated sewage water or seawater (Le Roux 1974), but no watering has taken place for decades now. The current *Launaea arborescens* population originates from these trials.

Considering that this plant was introduced some 50 years ago and still likely maintains a sizable population, it is clear that the plant is well adapted to the conditions in the Kuiseb Delta (Figure 3). However, the question arises whether these are still the original plants that were planted in trials, or if the species has established a self-sustaining, or perhaps even an invading population. Unfortunately, Mr le Roux could not enlighten us on the exact number of plants per species used in the trials, nor the precise localities where these were planted in the study area. However, this is not surprising after such a long time.

Extent of population

The plants are growing to the west and north of the former forestry nursery at Wortel in three distinct local populations. The three mapped areas amount to approximately 3.49 ha. Some 360 individuals were counted. Although the survey aimed to count all individuals, there are possibly more plants as some may not have been discovered in the uneven terrain and between the other plants present. However, the survey provides a reasonably good estimate.

Size distribution of the population

The extent and size of the population contribute to determining whether a population can be considered self-sustaining and therefore viable. Isolated individuals of a species far from other individuals of the same species can hardly present a viable population, particularly if these are out-crossers and therefore rely on genetic exchange with other individuals (Harper 1977; Drew & Kaufman 2013). The size distribution of the plants provides an indication of the population status (Figure 4). A healthy population contains individuals of all size classes, usually with the majority in the medium range of sizes measured (Harper 1977; Barbour et al. 1987).

To facilitate incorporation of this new record into global databases (e.g., the Global Naturalized Alien Flora database (GloNAF) (Pyšek et al. 2017), we provide the available information on this species in Appendix 2. The parameters proposed by Zengeya and Wilson (2020) were used to structure the data as well as the criteria provided by the IUCN (2020), with adaptations to the terminology suggested by Groom et al. (2019).

Other observations

Launaea arborescens was not the only plant tested for dune stabilisation in Walvis Bay (Le Roux 1974) and other non-native plants in the study area were also noted. Outside the nursery area a few individuals of *Acacia cyclops, Eucalyptus camaldulensis* and *Myoporum serratum* were observed. Whether these had been planted originally at their current position or escaped from the nursery and established new plants, could not be established. There were also more trials along the road to Walvis Bay where various non-native *Atriplex* species had been planted. These have persisted for some 50 years without management intervention.

Discussion

Does *Launaea arborescens* form a viable population?

The current area of occupancy of the plant of over 3 ha and the well over 300 individuals suggest that this may be a viable population. Also, a bell-shaped size-class distribution of plant sizes is considered indicative of a healthy population in long-lived species such as trees and shrubs (Cousins et al. 2014). *L. arborescens* size class distribution in the Kuiseb Delta is close to this bell-shaped slope with a peak in the medium-sized height class (Figure 4).

Furthermore, the fact that this plant has been present in the Kuiseb Delta for several decades without irrigation or any other management, suggests that these now form a viable population. Although the plants were initially introduced and irrigated (Le Roux 1974), no maintenance has taken place for at least 40 years. This supports the notion that they may have established a self-sustaining population.

Is there a threat of invasion?

Because no detail was available regarding the number of plants initially planted on a trial basis, or exactly in which areas, it is impossible to establish whether the population has grown or spread. The question of whether the plant has invaded natural areas and replaced indigenous species, or whether they have only maintained their presence in the area where they were initially planted, cannot be answered. Although the plant has not been found in the broader area, monitoring of the population is required over several years (likely decades) to establish whether the plant does form a threat. This study provides a baseline against which future monitoring could be evaluated. However, the fact that the plant has to date also not been found further afield, suggests that it has not spread. However, there have been disturbances in the area since the field survey in the form of widening the two-spoor track to the nursery and beyond with a dozer to more than double the original width, which opens new areas to be occupied by the plant. Human disturbances such as the creation of roads often provide convenient pathways for invasive species (e.g. Higgins et al. 1999; Kumschick et al. 2020; Zengeya & Wilson 2020) and monitoring the plant now may be opportune timing.

Regarding the aspect of potential displacement of indigenous species, the dominant native plants in the surrounding area, which *Launaea arborescens* could have displaced, are *Salsola nollothensis* and *Lycium tetrandrum*. They occupy the same habitat and possibly the same niche, both being shrubs and in the case of *L. tetrandrum*, with a very similar growth form. The Namib-endemic *Crotalaria colorata* is a multi-seasonal herb and occupies a different niche. It grows in between the *L. arborescens* shrubs and is unlikely to have been displaced by *L. arborescens*.

The effect this exotic plant has on the environment (e.g., soils, water availability) and animals associated with (potentially displaced) indigenous plants in the area, is unknown and may deserve study. It is well known that exotic plants have the potential to alter the environment in many ways (e.g., Chapin et al. 2000) and this aspect should thus not be dismissed. In terms of potential pathways, like many Asteraceae, the diaspores are wind dispersed and this could potentially enable the plants to spread to new habitats.

At present monitoring rather than eradiation is proposed as management. As the risk of the plant spreading is currently considered low, the plant presents an interesting historic record of past forestry management practices and should thus not be eradicated, unless it can be shown that it does spread and presents a threat to the natural vegetation. Also the number of plants and extent of area occupied are small and thus eradication would be easy, if necessary.

Conclusions

It has taken 50 years for some 360 plants to establish and maintain a population in a very localised (3.49 ha) area and *Launaea arborescens* has so far not been found anywhere else in the Kuiseb River or other rivers or habitats in the Namib, or even southern Africa.

At present we consider the occurrence of the North African *Launaea arborescens* in the Kuiseb Delta an interesting record and testimony of the efforts that were made some 50 years ago to find solutions to the problem of sand intrusion into Walvis Bay. However, we encourage people to look out for this plant and report any further distribution records. Should plants appear in places other than near the Wortel nursery or former dune stabilisation trial sites, further study regarding the plants' invasive potential is recommended.

Acknowledgements

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Competing interests

The authors declare that they have no financial or personal relationship(s) that may have inappropriately influenced them in writing this article.

Authors' contributions

A.B. undertook the field work and analysis and developed the structure of the paper. C.M. identified the plant, provided taxonomic information and wrote part of the paper. Both authors corresponded with P. le Roux to obtain background information.

Ethical considerations

This article followed all ethical standards for research without direct contact with human or animal subjects.

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Data availability statement

Data sharing is not applicable to this article.

References

Atlas of Namibia Team, 2022, *Atlas of Namibia: its land, water and life*. Namibia Nature Foundation, Windhoek.

Auala, H., Cloete, C., Gottlieb, T., Haimbili, E.H., Hembapu, N., Kabajani, M., Ndjamba, J., Shekunyenge, A., Shipani, A. & Shuuya, T., 2014, 'Alien invasive *Prosopis*: A curse or blessing?', *Journal of the Namibia Scientific Society* 62, 83–128.

Barbour, M.G., Burk, J.H. & Pitts, W.D., 1987, *Terrestrial plant ecology*. 2nd ed., Benjamin Cummings Publishing Company, Menlo Park.

Boyer, D.C. & Boyer, H.J., 1989, 'The status of alien invasive plants in the major rivers of the Namib Naukluft Park', *Madoqua* 16, 51–58.

Chapin, III F.S., Zavaleta, E.S., Eviner, V.T., Naylor, R.L., Vitousek, P.M., Reynolds, H.L., Hooper, D.U., Lavorel, S., Sala, O.E., Hobbie, S.E., Mack, M.C. & Diaz, S., 2000, 'Consequences of changing biodiversity', *Nature* 405, 234–242.

Cousins, S.R., Witkowski, E.T.F. & Pfab, M.F., 2014, 'Elucidating patterns in the population size structure and density of *Aloe plicatilis*, a tree aloe endemic to the Cape fynbos, South Africa', *South African Journal of Botany* 90, 20–36.

Davies, T.J., Smith, G.F., Bellstedt, D.U., Boatwright, J.S., Bytebier, B., Cowling, R.M., Forest, F., Harmon, L.J., Muasya, A.M., Schrire, B.D., Steenkamp, Y., Van der Bank, M. & Savolainen, V., 2011, 'Extinction risk and diversification are linked in a plant biodiversity hotspot', *PLoS Biology* 9(5), e1000620, https://doi.org/10.1371/journal.pbio.1000620.

Drew, J. & Kaufman L., 2013, 'Functional endemism: population connectivity, shifting baselines, and the scale of human experience', *Ecology and Evolution* 3, 450–456, https://doi.org/10.1002/ece3.446.

Duarte, M.C., Rego, F. & Moreira, I., 2005, 'Distribution patterns of plant communities on Santiago Island, Cape Verde', *Journal of Vegetation Science* 16, 283–292.

Groom, Q., Desmet, P., Reyserhove, L., Adriaens, T., Oldoni, D., Vanderhoeven, S., Baskauf, S.J., Chapman, A., McGeoch, M., Walls, R., Wieczorek, J., Wilson, J.R.U., Zermoglio, P.F.F. & Simpson, A., 2019, 'Improving Darwin Core for research and management of alien species', *Biodiversity Information Science and Standards* 3, e38084, https://doi.org/10.3897/biss.3.38084.

Harper, J.L., 1977, *Population biology of plants,* Academic Press, New York.

Higgins, S.I., Richardson, D.M., Cowling, R.M. & Trinder-Smith, T.H., 1999, 'Predicting the landscape-scale distribution of alien plants and their threat to plant diversity', *Conservation Biology* 13, 303–313.

Irish, J., 1994, 'Biomes of Namibia', *Navorsinge van die Nasionale Museum (South Africa)* 10, 550–84.

IUCN, 2020, IUCN EICAT *Categories and criteria. The environmental impact classification for alien taxa*, 1st edn., Gland, Switzerland and Cambridge, UK, 22pp.

Jürgens, N., Oldeland, J., Hachfeld, B., Erb, E. & Schultz, C., 2013, 'Ecology and spatial patterns of large-scale vegetation units within the central Namib Desert', *Journal of Arid Environments* 93, 59–79.

Kilian, N., 1997, 'Revision of *Launaea* Cass. (Compositae, Lactuceae, Sonchinae)', *Englera* 17, 478 pp.

Kumschick, S., Wilson, J.R.U. & Foxcroft, L.C., 2020, 'A framework to support alien species regulation: the Risk Analysis for Alien Taxa (RAAT)', *NeoBiota* 62, 213–239, https://doi.org/10.3897/neobiota.62.51031.

Le Roux, P.J., 1974, 'Establishing vegetation in saline soil to stabilise aeolian sand at Walvis Bay, South West Africa', *Biologia contemporanea* I, 25–13.

Mendelsohn, J., Jarvis, A., Roberts, C. & Robertson, T., 2002, *Atlas of Namibia*, David Philip Publishers, Cape Town.

Pyšek, P., Pergl, J., Essl, J. et al., 2017, 'Naturalized alien flora of the world: species diversity, taxonomic and phylogenetic patterns, geographic distribution and global hotspots of plant invasion', *Preslia* 89, 203–274.

Rutherford, M.C. & Westfall, R.H., 1994, Biomes of southern Africa: an objective categorization, edn. 2, *Memoirs of the Botanical Survey of South Africa* 63.

Zengeya, T.A. & Wilson, J.R. (eds.), 2020, *The status of biological invasions and their management in South Africa in 2019*, South African National Biodiversity Institute, Kirstenbosch and DSI-NRF Centre of Excellence for Invasion Biology, Stellenbosch, http://dx.doi.org/10.5281/zenodo.3947613.

Supplementary Material

Appendix 1

Position and dimension measurements (in cm) of *Launaea arborescens* individuals in the Kuiseb Delta in Namibia (LAT S= latitude south, LON E= longitude east, H1–H3= height measurements in cm, L1–L3= length measurements in cm).

NO.	LAT S	LON E	H1	H2	H3	L1	L2	L3
1	-23.05808	14.45993	26	21	23	34	28	31
2	-23.05806	14.45994	64	53	58	70	67	68
3	-23.05804	14.45993	63	54	42	84	54	69
4	-23.05805	14.45992	67	42	43	86	71	62
5	-23.05803	14.45993	118	110	108	168	124	157
6	-23.05804	14.45989	40	39	32	43	58	45
7A	-23.05802	14.4599	57	47	50	72	79	86
7B	-23.05802	14.4599	56	50	45	58	48	56
8	-23.05801	14.4599	67	52	58	125	107	85
9	-23.05798	14.4599	27	20	18	34	32	30
10	-23.05799	14.45991	53	56	54	56	60	48
11	-23.05799	14.45991	54	53	41	74	95	78
12	-23.05799	14.45992	27	27	29	26	31	24
13	-23.05796	14.45996	98	80	85	109	117	109
14	-23.05798	14.45996	48	50	42	48	36	60
15	-23.05798	14.45998	34	30	27	52	26	42
16A	-23.05795	14.45999	64	56	58	132	80	78
16B	-23.05795	14.45999	42	39	34	32	39	42
17	-23.05795	14.45998	76	92	82	112	112	77
18	-23.05793	14.45998	48	45	42	48	54	52
19	-23.05794	14.45998	78	67	64	98	96	105
20	-23.05793	14.45998	77	80	90	100	107	100
N-01	-23.056073	14.460591	49	45	44	58	35	54
N-02	-23.056095	14.460461	68	56	48	136	95	132
N-03	-23.0561	14.460515	107	104	100	132	170	150
N-04	-23.056119	14.460367	97	88	77	138	77	132
N-05	-23.056119	14.460367	53	37	44	63	39	28
N-06	-23.056119	14.460367	83	92	78	116	121	106
N-07	-23.056271	14.460307	47	45	38	57	58	46
N-08	-23.056277	14.460316	45	32	40	36	23	21

NO.	LAT S	LON E	H1	H2	H3	L1	L2	L3
N-09	-23.05627	14.460281	53	47	42	63	57	62
N-10	-23.056283	14.460289	53	42	40	65	67	74
N-11	-23.056436	14.460311	65	68	62	68	50	69
N-12	-23.056382	14.46035	82	94	99	195	160	165
N-13	-23.056366	14.460312	57	56	58	96	80	74
N-14	-23.056322	14.460399	75	64	73	170	106	110
N-15	-23.056649	14.46024	65	50	50	63	67	54
N-16	-23.056708	14.460389	74	77	63	97	82	60
N19A	-23.057196	14.460645	36	27	36	40	47	39
N-16A	-23.057622	14.462044	53	38	49	49	54	41
N-17	-23.057575	14.461987	106	95	92	164	135	154
N-18	-23.057418	14.461989	60	59	50	73	65	64
N-19	-23.057142	14.461618	49	44	38	33	35	39
N-20	-23.057799	14.460538	108	93	112	186	180	160
N-21	-23.057669	14.460744	92	81	83	154	117	15
N-22	-23.057588	14.461224	142	120	124	202	215	172
N-23	-23.057582	14.46127	52	54	49	53	41	47
N-24	-23.057616	14.461241	36	22	27	35	33	23
N-25	-23.057627	14.46127	34	32	30	41	48	42
N-26	-23.057681	14.461358	15	17	14	16	14	12
N-27	-23.05774	16.461307	70	65	68	115	107	110

Appendix 2

Summary statistics of the first record of *Launaea arborescens* in Namibia.

Scientific name	*Launaea arborescens*
Taxon ID	AB20007
Vernacular name	*mol-albina* (Algerian Arabic); wicked dandy, barbed wire brush (English); *aulaga*, *cardaviejo*, *jadionda*, *rascavieja*, *volavientos* (Spanish)
Regulatory listing	Unlisted[1]
Is native	False
Occurrence status	Present
Degree of establishment	C3[2]
Introduction status	Naturalised
Pathway	Forestry planting
First record	1974
Range Broad Admin	Erongo Region
Range QDSC	1qds: 2314AB
Range Exact	3.49 ha
Organism Quantity	~360
Impact EICAT	Data deficient
Risk assessment	No
Realm	T[3]

1 New record for Namibia – so not listed on national plant species list, which also provides the status of each taxon.
2 Individuals surviving outside of captivity or cultivation in a location, reproduction occurring, and population self-sustaining.
3 T= terrestrial