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Unmasking the succulent plant trade at the Faraday traditional medicinal market in Johannesburg, South Africa

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ABSTRACT

Background: The Faraday traditional medicinal market is dedicated to the trade of plant and animal material used in traditional African medicine (‘muthi’). The materials traded are accessible and affordable to most African communities and are often preferred over western medicines. Quantifying the illegal trade of succulent plant species at the Faraday medicinal market has not yet been undertaken exhaustively. Most succulents are commonly used to treat ailments such as arthritis, eczema and constipation. However, it remains challenging to distinguish between the various succulent species at the market due to the majority being either dried, crushed or withered. Here, DNA barcoding was used to identify succulent plants currently traded at the Faraday market. **Results:** Plant samples were collected and sequenced using the standard DNA barcoding regions (*matK* and *rbcLa*). Two identification methods, BLAST and the tree based method, shown that the majority of traded succulents are from the Asphodelaceae, Crassulaceae, Apocynaceae, Mesembryanthemaceae and Euphorbiaceae families. **Significance:** This study provides an important list of succulent plant species currently traded at the Faraday market that are endangered or likely to become endangered due to over-exploitation and highlights the importance of sustainable management of wild medicinal plants sold at the market.

INTRODUCTION

In South Africa, approximately 3,000 plant species are used for medicinal purposes from plants that are either exported or traded at local traditional markets (Van Wyk *et al.*, 1997). Southern Africa is famous for its plant diversity, with almost 30,000 species of flowering plants accounting for about 10% of the world’s vascular plants. Of these, an estimated 3,500 species are succulents occurring throughout South Africa and Namibia (Van Wyk and Gericke, 2000). The Faraday traditional medicinal market is dedicated to the trade of plant and animal materials used in traditional medicine (‘muthi’). Quantifying the illegal trade of succulent plant species at the market has not yet been undertaken exhaustively. It remains challenging to distinguish between the various succulent species due to the majority of traded species being either dried, crushed or withered.

AIMS:

This study aims to identify the various succulent species traded at the Faraday medicinal market and to determine their conservation status by using DNA barcoding as an identification tool.

MATERIAL AND METHODS

Market sampling

Plants were collected for the first six months of 2017 from different stalls found at the Faraday medicinal market (Fig. 1). In total, 18 samples were collected and stored in silica gel after which voucher numbers were assigned to each.

Figure 1: A) Traded bark at market, B) Succulents traded, C) Variety of traded succulents, D) Trader’s stole at the market

DNA barcoding

DNA extraction using the 10×CTAB method described by Doyle and Doyle (1987) was conducted. Standard DNA barcoding protocols (CBOL Plant Working Group, 2009) were carried out to sequence the core barcoding regions.

DNA barcode library of succulents

A total of 136 sequences representing 22 taxa were aligned to create the library. Consisting of the following families: Apocynaceae, Asphodelaceae, Crassulaceae, Euphorbiaceae and Mesembryanthemaceae. Succulents recorded on Williams *et al*. (2001) and Court’s (2010) lists were also added to further refine the library.

Data analysis of market samples

Basic Local Alignment Search Tool (BLAST) was used to compare query samples to sequences on GenBank and BOLD. The Tree-based method was employed to further verify samples to species level.

RESULTS AND DISCUSSION

BLAST algorithm searches using *rbcLa* (55%) resulted in high numbers of ambiguous species level identifications. However, when ”BLASTing” queries using *matK*, 72% of the samples were successfully identified to species level.

Using the SANBI Red list, we were able to confirm that the majority of species traded (44%) are categorised as Least Concern. A further 6% are categorised as Endangered, 25% are Vulnerable and 12% are Near Threatened. Limited data is available for 13% of the species sampled (Fig. 2A).

Court (2010), identified eight (8) succulent flora families in southern Africa, 5 of these 8 families were found to be traded at the market (Fig. 2B).

Also, *Optunia wilcoxlii* (Cactaceae, indicated in red; Fig. 2B), a category 1b species on the NEM:BA invasive species list was identified on the market (Fig. 2B). Cactaceae is a family that is native to the America’s with the exception of a single species, *Rhipsalis baccifera* that is native to both the America’s as well as Central and southern Africa.

Williams *et al*. (2001) identified 22 succulent taxa traded at the market. Using only morphological features, 27% of these samples could be identified to species level. In this study using DNA barcoding, 72% of the 18 taxa collected was identified to species level (Fig. 2C).

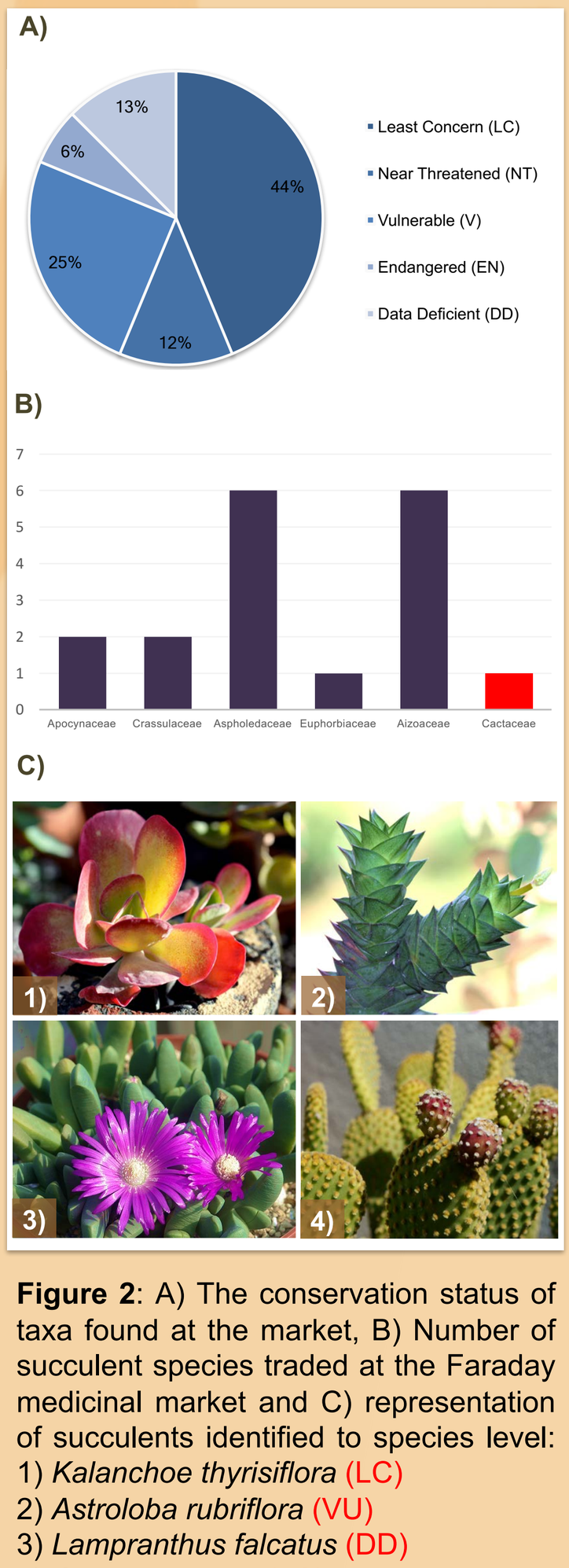

Figure 2: A) The conservation status of taxa found at the market, B) Number of succulent species traded at the Faraday medicinal market and C) representation of succulents identified to species level:
1) *Kalanchoe thyrisiflora* (LC)
2) *Astroloba rubriflora* (VU)
3) *Lampranthus falcatus* (DD)
4) *Optunia wilcoxli* (LC)

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CONCLUSION

This study provides an important list of succulent plant species currently traded at the Faraday medicinal market that are endangered or likely to become endangered due to over-exploitation and highlights the importance of sustainable management of wild medicinal plants sold at the market.

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