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Comparative Analysis of Nutritional Components of Indigenous Plant Oils of Namibia

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ABSTRACT

Namibia has a rich biodiversity of plant species of which a great variety is used for food, cosmetics and medicinal applications. Oils from plants such as *Citrullus lanatus* (Kalahari melon), *Schinziophyton rautanenii* (Manketti) and *Ximenia americana* (Blue Sour plum) are produced by local people of Namibia according to age-old traditional methods for the use in food, cosmetics and health. On commercial scale, the *Acanthosicyos horridus* (!Nara) cold pressed oil is produced and developed into value-added products. A potential new oil of the *Moringa ovalifolia*, a tree indigenous to Namibia, is under investigation as a potential contributor to the natural products market. In this study, the fatty acids, major sterols and tocopherols compositions of the oils were analyzed and compared. The nutritional analysis revealed that the Manketti oil had the highest amount of total tocopherol (183.2 mg/100g) and major sterols (stigmasterol: 44.3 mg/100g and β -sitosterol: 586.6 mg/100g). The dominant tocopherols of the oils were γ -tocopherol, except for the *Ximenia* oil, for which the α -tocopherol was the dominant compound. Major fatty acids were determined to be Manketti oil (α -eleostearic acid: 34% and linoleic acid: 32%), *Ximenia* (oleic acid: 44.1%), Melon (linoleic acid: 57%), !Nara (linoleic acid: 53.1%), and *Moringa* (oleic acid: 55.2%). The analysis of the selected Namibian indigenous seed oils revealed their use as potential candidates to produce value-added products in the food and cosmetics industry.

INTRODUCTION

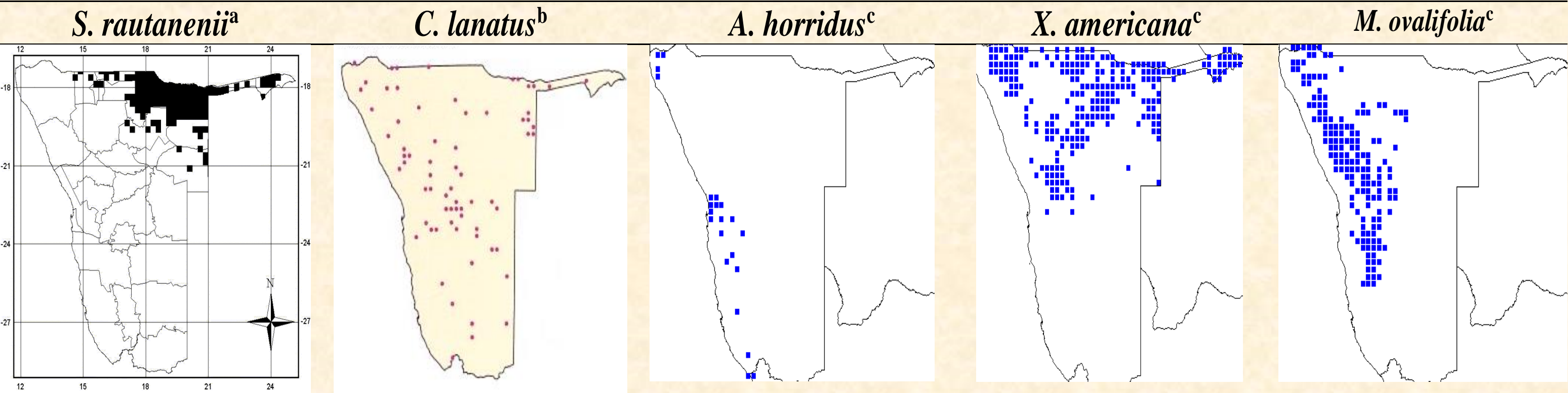
Schinziophyton rautanenii (Schinz) Radcl.-Sm., is a large spreading dioecious tree (15-20 m in height) in the family of the Euphorbiaceae with fruits appearing from February (Palgrave, 1983). The Manketti oil is used in food preparations and cooking and can also be used in skin formulations for cleansing and moisturising. The *Citrullus* genus is a member of the Cucurbitaceae family and consists of a number of melon varieties, from which, in particular fruit and seeds of the *C. lanatus* and the *C. colocynth*, are classified as great food sources in many parts of Africa (Mabaleha et al., 2007). Kalahari melon seed oil is used as moisturizers, in skin regeneration and restructuring formulations (Nyam et al., 2009). Rural women use the Kalahari melon seed oil for healing, massages, cooking oil and as a moisturizer (Lendelvo et al., 2012). The !Nara (Scientific Name: *Acanthosicyos horridus* Welw. Ex Hook.f.) is a leafless, thorny shrub that is endemic to the Namib Desert and is an important food source for the local Topnaar people and their livestock (Mizuni & Yamagata, 2005). *Ximenia americana* L. is a small spiny tree (about 4 m in height) from the family of Olacaceae (the sour plum family) with fruits appearing December to February, when ripe are yellow to red in colour (Palgrave, 1983). *Moringa ovalifolia* Dinter & A. Berger (African *Moringa*) is a species of the family of the Moringaceae, the *Moringa* family, and is a succulent, deciduous tree, about 7 m in height, with a characteristic swollen stem. In search of different varieties of unique seed oils, which could potentially contribute to the economy of the natural products sector of Namibia, the fatty acid composition and tocopherol content of selected indigenous plant species of Namibia were investigated and compared as potential contributor to the natural products sector.

Table 1: Description of plant species used for oil extraction and analysis

Plant species	Family name ^a	Common name ^a	Local name(s) ^b
<i>S. rautanenii</i>	Euphorbiaceae	Manketti	Omunkete, Omungete, Ngongo, Mungongo
<i>C. lanatus</i>	Cucurbitaceae	Kalahari melon	Tsamma
<i>A. horridus</i>	Cucurbitaceae	!Nara	!Narab, Omungaraha
<i>X. americana</i>	Olacaceae	Blue Sour Plum ^b	Ombeke, Omuninga, Kakukuru, Mungomba
<i>M. ovalifolia</i>	Moringaceae	African Moringo	Omuhete, Omutindi, Khaos

^aPalgrave, 1983; ^bCurtis & Mannheimer, 2005

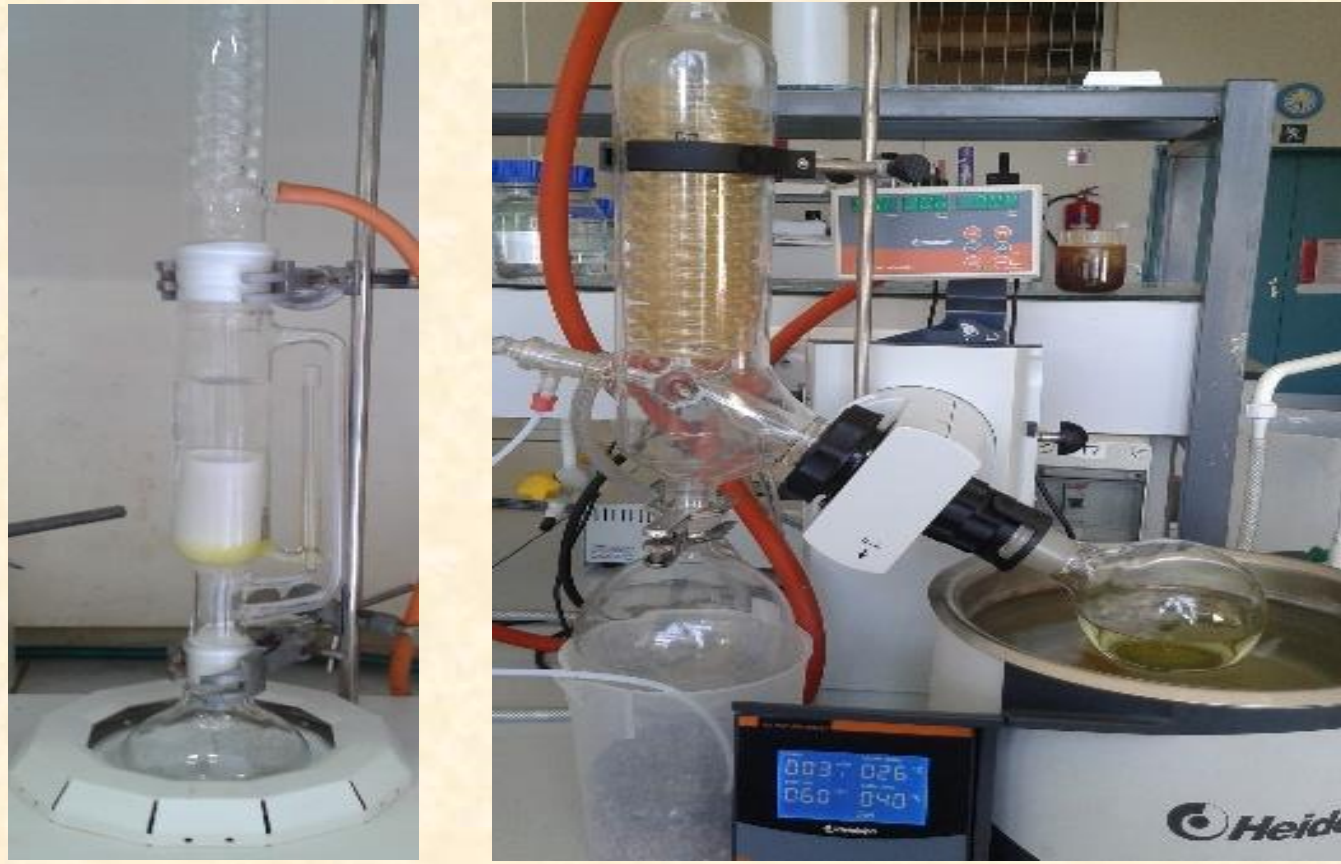
Table 2: Geographical distribution of plant species throughout Namibia



^aGraz, 2002; ^bMendelsohn, Jarvis, Roberts & Robertson, 2002; ^cCurtis & Mannheimer, 2005

METHODS

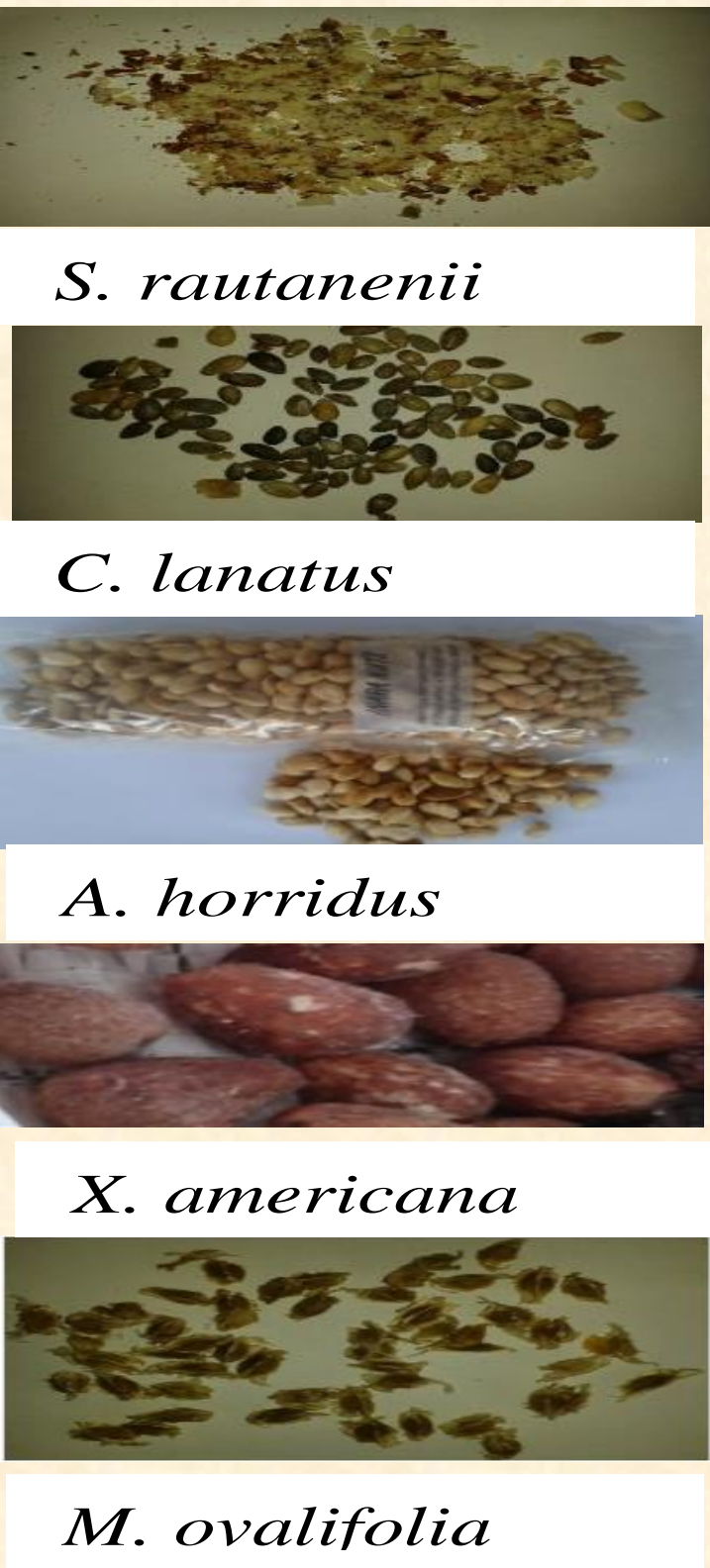
Soxhlet extraction (*n*-hexane) was used to remove oils from crushed seeds.



GC-MS



¹H-NMR

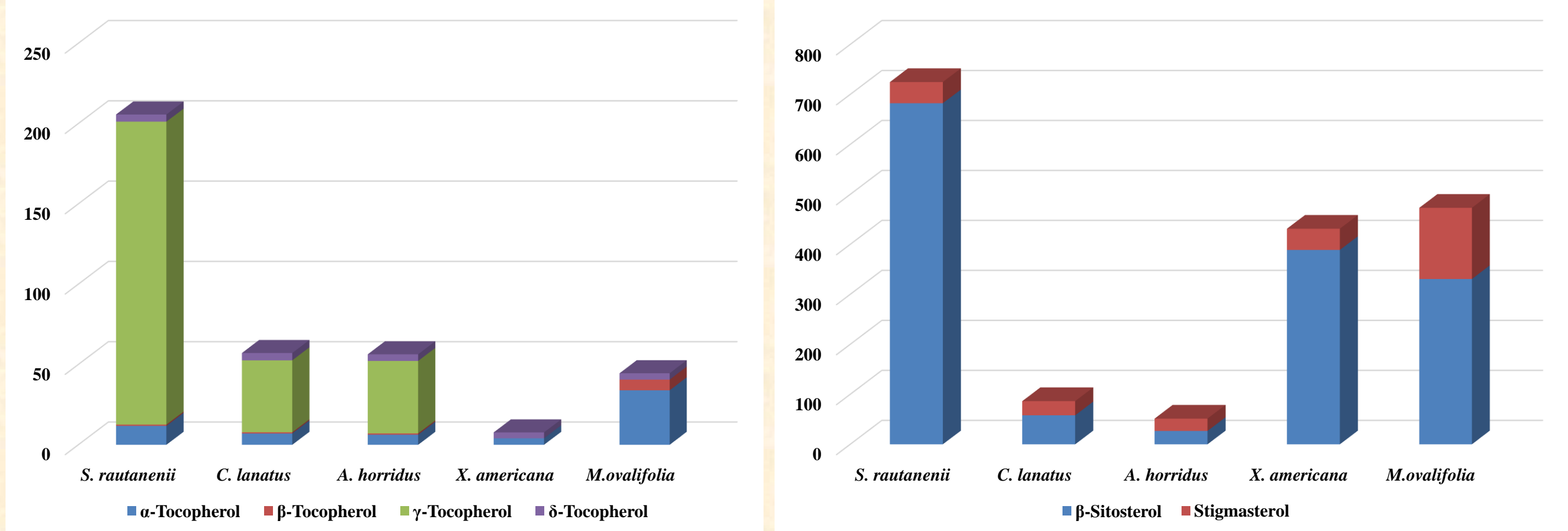


RESULTS

Table 3: Fatty acid percent composition of indigenous plant oils of Namibia

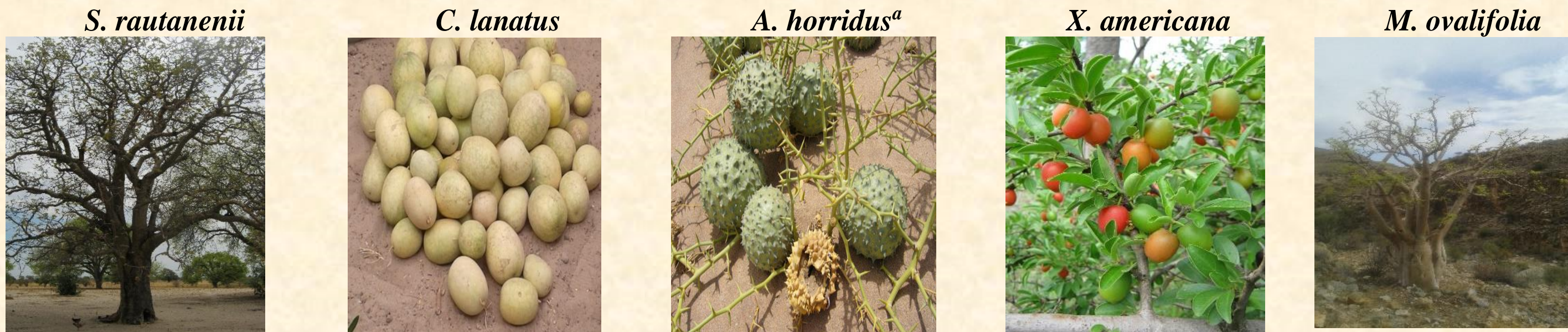
Fatty acid	<i>S. rautanenii</i>	<i>C. lanatus</i> ^a	<i>A. horridus</i> ^a	<i>X. americana</i>	<i>M. ovalifolia</i>
Palmitoleic acid	nd	nd	nd	nd	0.61
Palmitic acid	10.4	14.8	15.6	3	9.58
Stearic acid	9.3	13.8	11.7	18.4	13.2
Arachidic acid	0.5	1	nd	4.3	7.46
Behenic acid	nd	nd	nd	nd	7.75
Lignoceric acid	nd	nd	nd	nd	2.22
Oleic acid	11.2	17.7	12.8	46.3	55.2
Linoleic acid	32.1	52.6	54.5	nd	nd
11-Eicosenoic acid	0.8	nd	4.4	4.80	4.02
Ximenynic acid	nd	nd	nd	12.0	nd
Octadeca-9-yn, 11t, 13c/t-dienoic acid	nd	nd	nd	11.3	nd
α -eleostearic acid	35.7	nd	1.00	nd	nd

^aCheikhyyoussef et al. (2017)



Tocopherol content (mg/100g)

Major sterol content (mg/100g)



^aDesert Hills (2016) www.nara.com.na

CONCLUSION

The indigenous plant oils studied here presented unique fatty acid compositions and tocopherol contents confirming their use as potential candidates to produce value-added products in the food and cosmetics industry. Fatty acids such as linoleic acid, α -eleostearic acid, ximenynic acid (octadec-11-en-9-ynoic acid) and oleic acid have unique health-promoting abilities. The presence of octadeca-9-yn, 11t, 13c/t-dienoic acid provides for the potential of further research towards understanding its biological activities. The search for different sources and varieties of unique seed oils of indigenous origin has become popular and necessary as this contributes to the economy of the natural products sector of a country and in turn improves the livelihoods of rural communities through more improved income-generation mechanisms.

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