ABS Compliant Biotrade in South(ern) Africa (ABioSA)

Selection of High-impact Value Chains – Report

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List of Acronyms

ABioSA	ABS compliant Biotrade in South(ern) Africa
ARC	Agricultural Research Council
BIDC	Biomanufacturing Industry Development Centre (of the CSIR)
BioFISA	Finnish-Southern African Partnership Programme (to strengthen the NEPAD-SANBio network)
BSOs	Business Support Organisations
CAGR	Compound Annual Growth Rate
CBI	Centre for the Promotion of Imports of the Netherlands Enterprise Agency
CSIR	Council for Scientific and Industrial Research
DAFF	Department of Agriculture, Forestry and Fisheries
DST	Department of Science and Technology
ECDC	Eastern Cape Development Corporation
EU	European Union
GEF	Global Environment Facility
HS	Harmonized Commodity Description and Coding System (of the World Customs Organisation)
IDC	Industrial Development Corporation
IPLCs	indigenous peoples and local communities
LEDA	Limpopo Economic Development Agency
MAPs	medicinal and aromatic plants
MEGA	Mpumalanga Economic Growth Agency
NPC	national project coordinator
PSC	Project Steering Committee
READ NW	North West Department for Rural, Environment and Agricultural Development
SMEs	small and medium sized enterprises
TK	traditional knowledge
UK	United Kingdom
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
VC	value chain
Wesgro	Tourism, Trade & Investment Promotion Agency for Cape Town and the Western Cape

1. Introduction

This is a report on the selection of value chains for the project to focus on. It should be read in conjunction with the Inception Phase Report of the ABioSA project.

In the project document (dated December 2017), a selection of high-impact value chains was to be carried out in the inception phase, and an assessment made on the basis of five key considerations:

- Market potential of products that are/can be derived from the species, including potential of impact through addressing targeted non-tariff barriers/market access regulations;
- The potential of processing and manufacturing of the products to create value adding opportunities and associated jobs throughout the value chain;
- Positive associated traditional knowledge and prospect of effective engagement with relevant IPLCs;
- Feedback from SMEs and their support organisations; and
- Species and value chains that have support from other funded projects and/or strong support organisations/councils (for example the GEF 6/UNDP project which plans to support communities and supply chain development) which could lead to mutually beneficial arrangements whereby resources are focussed on different parts of the value chain to ensure the entire value chain is given the necessary resources to reach commercial viability and sustainability.

Based on the above, two approaches were followed. On the one hand, a few value chains were selected, based on the above considerations, to study. These were (i) marula fruit, (ii) *Aloe ferox*, (iii) a cluster of 5 essential oils with a focus on rose geranium and (iv) a cluster of 5 seed oils with a focus on marula oil. At the same time, a survey was conducted, targeting SMEs and BSOs. The survey established the species covered by SMEs and BSOs, the level of activity throughout the value chain, support provided by organisations/institutions and support required, problems to grow the business as well as the level of ABS compliance and issues surrounding this.

Section 2 of the report covers the market potential of the sector, complemented by Annexes A, B and E-G. This section and annexes provide findings on the market trends for the categories that products from the selected value chains can enter, along with overall trends in export and import of essential oils and plant extracts based on the United Nations Comtrade database.

Section 3 looks at relevant value chains and the ecosystem of support by other projects or sources of value chain development, complemented by Annex C. Section 4 covers the survey results, complemented by Annex D. Section 5 summarises the conclusions, followed by recommendations in Section 6.

Regarding positive associated traditional knowledge, it can only be reported that at a general level there is almost always some form of supportive traditional knowledge, but that formal mechanisms of engagement need to be established, and that meaningful discussion needs to wait until detailed and specific products are “on the table” for discussion with stakeholders.

2. Market potential

Annex A presents research findings and market trends for categories relevant to the selected value chains. As expected, specific market research reports or other data on individual products such as marula fruit or oil are extremely difficult to locate on a free-to-access basis.

However, the two clusters of products – essential oils and seed oils – all have clear opportunities in the broader categories such as cosmetic ingredients, natural and organic products, and other specialty sectors.

Annex B presents selected data from the UN Comtrade database based on the Harmonized Commodity Description and Coding System (HS) codes. These data show that there is an upward trend in the value

of essential oils and other plant extracts from South Africa. Although these data are representative of commodity products such as eucalyptus and citrus essential oils, they provide a broader and positive context for the development of high-value products from the selected clusters of the project. Data on consumer cosmetic products are less positive. However, this can be seen as confirmation that niche natural and organic cosmetic products offer unique opportunity to the South African cosmetics sector.

Annex E presents information on regulatory barriers affecting EU market access for marula oil and fruit products. Recently revised regulations offer an opportunity for these products through Regulation EU 2015/2283 and a new procedure for "traditional foods from third world countries". A proposition on how to address this regulation, and then regulations in the USA and elsewhere, are presented.

Annex F presents a review on literature on marula and metabolic syndrome (medical disorder that increases risk of cardiovascular disease and diabetes). The literature shows a correlation that offers a potential market positioning for marula fruit products.

Annex G is the presentation provided to members and strategic partners of the Project Steering Committee on 26 and 27 September 2018. It contains information on traditional uses of marula, marula fruit chemistry and health impacts, a relevant marula fruit patent, marula fruit and potential consumer health targets, *Aloe ferox* and a patent overview as well as a recommendation on the value chain selection.

3. Support of other projects

Annex C presents a matrix of relevant value chains (species) and development projects and other organisations supporting the development of these value chains. The work is ongoing as partnerships with stakeholders develop.

The results show that the value chains and clusters under consideration all have good co-support that would enable "crowding in" of resources to the value chains, and to build much-needed momentum. Additionally, the findings show that other products, such as honeybush, warrant consideration as there appears to be development and commercialization momentum.

4. Survey results

The survey was sent to almost 200 SMEs and BSOs in South Africa and in the region. BIDC, CECOSA, SAOSA and PhytoTrade Africa have sent the survey to their members, BioFISA has published it on their website and DEA has provided their database of SMEs who were included in the mailing list. Other organisations also indicated their intention to forward the survey. Feedback from SAOSA was all but one of their members have also received the survey from other sources. One could therefore assume that the survey reached a wide coverage of SMEs and BSOs.

A total of 44 responses were received, of which 40 were analysed. The others either did not complete the survey, were not based in Southern Africa or only indicated the plant species worked with (one and the response was included in the plant species section). The 40 responses were classified according to SMEs (35) and BSOs (5). See Annex D for a presentation delivered to the Project Steering Committee on the survey results.

5. Conclusion

It is useful to reflect on the extent to which a comprehensive value chains analysis is actually required for directing project investment. There are general issues affecting most, if not all, value chains in the biotrade sector, even if each one may have unique specificities. The table below shows the relative importance of a value chain assessment for the ABioSA project components and sub-components.

Component	Relevance of comprehensive value chain analysis/assessment
1.1: Market access and development	Highly relevant
1.2: Supporting the role of IPLCs	Relevant, but not critical
1.3: Business planning support to SMEs	Relevant, but not critical
2.1: Facility design and set-up	Relevant, but not critical
2.2: Operation of facility	Relevant, but not critical
3.1: Policy improvement	Relevant, but not critical
3.2: Industry/sector best practices	Relevant, but not critical
3.3: Knowledge management and sharing	Relevant, but not critical

6. Recommendation

It is recommended that:

- The project focuses on marula fruit, *Aloe ferox*, essential oils and seed oils (including marula oil) but does not exclude other species;
- SMEs and/or their business support organisations convince project management and the Investment Committee that the fundamentals of their respective value chains they work in, not part of the above focal species, are operable;
- The project focuses on identifying those SMEs and support organisations with credible business propositions, having a high impact.

This approach allows for value chains and species to be included if there are credible business cases presented to the project by industry.

Annex A: Market trends research note, September 2018

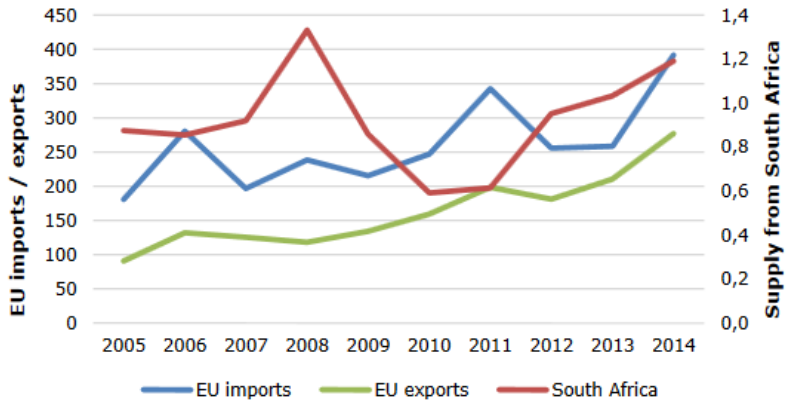
Purpose:

- *To obtain up-to-date market trend information on natural food, flavor, fragrance, cosmetic, health and related ingredients and consumer products*
- *To obtain specific market trend information on potential products from targeted species*

Findings:

"South Africa plays a small role, accounting for 0.3% of EU import volume [vegetable oils]. In 2014, total supplies to the EU amounted to 1,192 tonnes at €4.1 million. Imports fluctuated considerably, with a peak in 2008 and, more recently, in 2014. The Netherlands and France are the leading destinations, each accounting for 40% of EU imports from South Africa"[1] [see Figure 7[2]].

Figure 7: Total EU imports / exports and supply of vegetable oils from South Africa between 2005 and 2014, in 1,000 tonnes

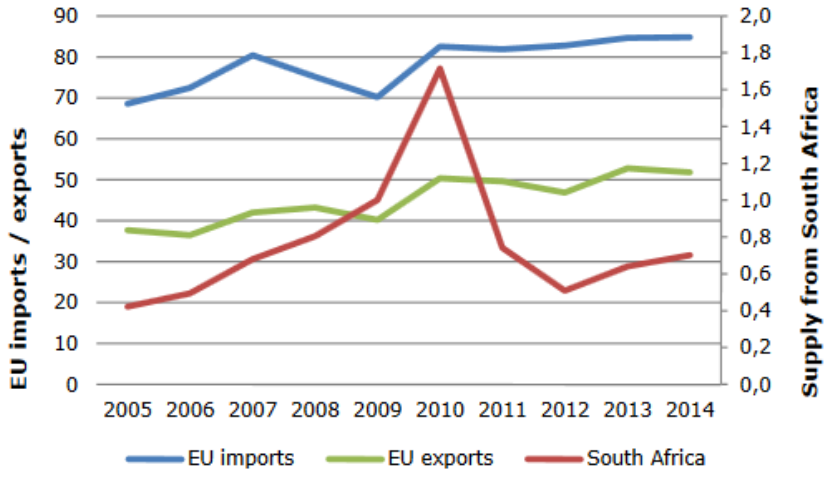


Source: Eurostat, 2015

"South Africa plays a small but (recently) growing role in terms of total essential oil supplies to the EU (< 2% of import volume). Although supplies from South Africa fluctuated strongly, overall, they grew faster than total EU imports. Essential oils from South Africa mainly consist of citrus fruit oils (mostly exported to the Netherlands and the UK) and essential oils that are not further specified (mostly exported to Germany and France). The latter category includes many oils used in the cosmetics industry."[3] [Trade statistics for essential oil are based on the HS code 3310] [see figure 10[4]].

[1] CBI Tailored Study: Natural Ingredients for Cosmetics from South Africa (2015), p. 26. https://www.cbi.eu/sites/default/files/market_information/researches/tailored-study-natural-ingredients-cosmetics-south-africa-2015_redacted.pdf
[2] Natural Ingredients for Cosmetics from South Africa, p. 25.
[3] Natural Ingredients for Cosmetics from South Africa, p. 30.
[4] Natural Ingredients for Cosmetics from South Africa, p. 30.

Figure 10: Total EU imports / exports and supply of essential oils from South Africa, in 1,000 tonnes

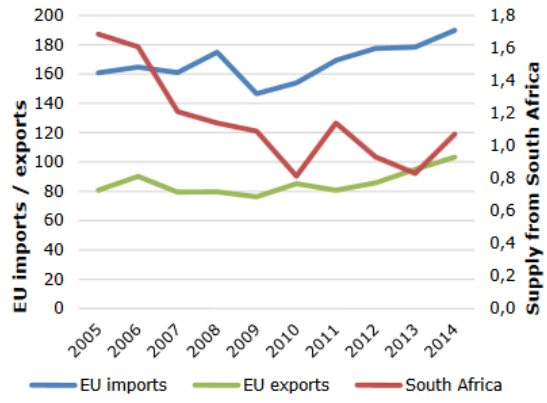


Source: Eurostat, 2015

"Although South African supplies of MAPs and extracts varied considerably from 2005 to 2014, the data show clear trends. In recent years, the EU increasingly imported extracts from South Africa, instead of MAPs. Overall, South African supplies of extracts increased by 4% annually from 2005 to 2014, while supplies of MAPs decreased by 4% in the same time frame. This development was especially strong from 2009 to 2014, when EU imports from South Africa increased by 36% annually.

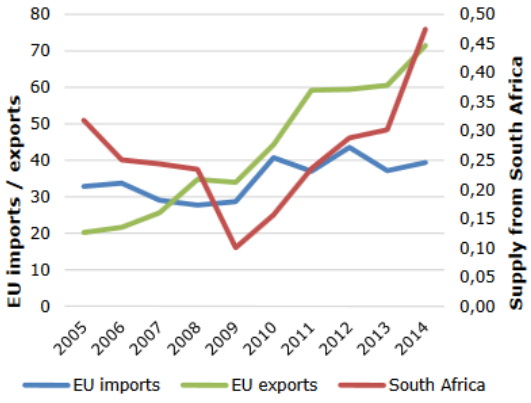
South Africa mainly exports MAPs to the Netherlands, Germany and Spain. Germany and Italy are the main importers of South African extracts; a small proportion of South African extracts end up in Italy and France."[5] (See Figure 13 &14[6])

Figure 13: Total EU imports / exports and supply of MAPs from South Africa, in 1,000 tonnes



Source: Eurostat, 2015

Figure 14: Total EU imports / exports and supply of botanical extracts from South Africa, in 1,000 tonnes



Source: Eurostat, 2015

"According to the research report [Natural Fragrance Ingredients Market], the opportunity in the global natural fragrance ingredients market is expected to be worth US$5.3 bn by 2024 as compared

[5] Natural Ingredients for Cosmetics from South Africa, p. 36.
[6] Natural Ingredients for Cosmetics from South Africa, p. 36.

to US$3.3 bn in 2015. During the forecast years of 2016 and 2024, the global market is expected to surge at a CAGR of 5.8%."[7]

Rose geranium

"According to industry sources, demand for rose geranium oil is growing and currently outstripping the growth in supply. World market demand for the various geranium oils is estimated at 400 tonnes per year. Of that, the market for rose geranium oil is about 100 tonnes."[8]

"In the coming years, demand is expected to grow between 8.4% and 11.3% annually until 2024–2025, reaching between $14.0 and $15.8 billion."[9]

"Industry sources indicate that supplies cannot keep up with the growing demand for rose geranium oil, offering opportunities for new producers. In particular, supplies from Réunion Island have been falling. This is the main supplier of Bourbon rose geranium oil, high-quality rose geranium oil. Réunion Island produces around 10 tonnes. To fill this gap, South African producers have increased their production of rose geranium in the last five years from a few tonnes to 20–25 tonnes."[10]

Moringa

"Indian media reported that the global *Moringa oleifera* market amounted to around € 363 million in 2016. They expect this market to reach € 626 million by 2020. India is also Europe's main supplier of *Moringa oleifera*. The country's exports of *Moringa oleifera* are reported to grow by 26-30% annually."[11]

Aromatherapy (*Helichrysum italicum*)

"Future Market Insights expects that the global aromatherapy market will grow by 7.7% annually from 2016 to 2026 to reach just over $ 8 billion in 2026 (€ 7 billion). North America and western Europe are the two dominant markets. In 2026, they will account for more than half of the global market."[12]

Natural cosmetics

"According to the Kline group, the global market for natural cosmetics amounted to $ 33 billion in 2015 (€ 29 billion). This figure is 13% of the total cosmetics market (Brands with a Conscience, Ind & Horlings, 2016). The market is predicted to grow to $ 50 billion (€ 44 billion) in 2019. Certified natural cosmetics make up 45% of this market, while the remaining 55% consists of near-natural cosmetics."[13]

"Persistence Market Research predicts that the global market for organic cosmetics will grow by 8–10% annually from 2016 to 2022. The same company estimates that this market reached $ 11 billion in 2016 and expects the market to amount to almost $ 22 billion in 2022."[14]

"Technavio estimates that the smaller organic cosmetic market will grow by almost 10% annually until 2021, when it will reach $ 17.6 billion (€ 15 billion). In 2016, hair care products accounted for 25% of the organic cosmetics market, while skin care represented 32%."[15]

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[7] https://www.transparencymarketresearch.com/natural-fragrance-ingredients-market.html (retrieved 5th Sept. 2018)
[8] CBI: Exporting rose geranium oil to Europe, p. 2. https://www.cbi.eu/node/2156/pdf/.
[9] Exporting rose geranium oil to Europe, p. 3.
[10] Exporting rose geranium oil to Europe, p. 3.
[11] CBI: Exporting Moringa to Europe, p. 4. https://www.cbi.eu/node/2613/pdf/.
[12] Exporting essential oils for aromatherapy to Europe, p. 3. https://www.cbi.eu/node/2533/pdf/.
[13] CBI: Exporting fruit seed oils to Europe, p. 5. https://www.cbi.eu/node/2107/pdf/
[14] CBI: Which trends offer opportunities on the European market for natural ingredients for cosmetics?, p. 3. https://www.cbi.eu/node/2397/pdf/
[15] CBI: Exporting skin conditioning extracts to Europe, p. 3. https://www.cbi.eu/node/2069/pdf/.

"Markets and Markets predicts that the global skin care segment will register the strongest growth among cosmetics market segments in the coming years."[16]

"The global cosmetic products market was valued at USD 532.43 billion in 2017 and is expected to reach a market value of USD 805.61 billion by 2023, registering a CAGR of 7.14% during 2018-2023."[17]

"The global market for beauty supplements was valued at $ 2.9 billion in 2016. It is a small but growing market segment in Europe, growing at around 4% annually."[18]

Fragrances

"Transparency Market Research estimates that in 2016, this market amounted to just over $ 1 billion. The global market for natural fragrance ingredients amounted to $ 3.3 billion in 2015. From 2016 to 2024, the global market for natural fragrance ingredients is expected to grow by 5.8% annually, reaching $ 5.3 billion in 2024.The European market for natural fragrance ingredients is projected to grow even more quickly than the global market, by 6.5% annually from 2016 to 2024."[19]

[16] Exporting skin conditioning extracts to Europe, p. 3.
[17] http://orbisresearch.com/reports/index/global-cosmetics-products-market-analysis-of-growth-trends-and-forecasts-2018-2023 (retrieved 5th Sept. 2018)
[18] Which trends offer opportunities on the European market for natural ingredients for cosmetics?, p. 6.
[19] CBI: Exporting essential oils for fragrances to Europe, p. 5.https://www.cbi.eu/node/2066/pdf/.

Annex B: Trade trends in South Africa for exported goods – UN Comtrade, September 2018

Plant raw material [HS Code 1211]:

The five-year trend shows a decreasing trade value and decreasing net weight of exports. On the other hand, the ratio of export values and net weight is increasing. This could be an indication for:

a) Increasing prices of commodities;
b) Higher value plants;
c) Higher value addition in South Africa;

Plants and parts of plants (including seeds and fruits), of a kind used primarily in perfumery, in pharmacy or for insecticidal, fundicidal or similar purposes, fresh, chilled, frozen or dried, whether or not cut, crushed or powdered. [HS-Code 1211]					
	2013	2014	2015	2016	2017
Trade Value US $	5.302.229	3.899.619	8,770,711	4,365,393	4,316,392
Net weight kg	1.103.179	844,723	1,670,884	590,602	612,021

Essential oils [HS-Code 3301]:

The export value is increasing significantly for the time period of five years while the export volume is decreasing. Once more this can result from higher prices, higher value plants and/or higher value addition in South Africa.

Essential oils (terpeneless or not), including concretes and absolutes; resinoids; extracted, oleoresins; concentrates of essential oils in fats, in fixed oils, in waxes or the like, obtained by enfleurage or maceration; terpenic by-products of the deterpenation of essential oils, aqueous distillates and aqueous solutions of essential oils. [HS-Code 3301]					
	2013	2014	2015	2016	2017
Trade Value US $	27,800,000	35,771,988	36,737,275	34,124,239	43,943,858
Net weight kg	4,600,00	3,517,994	3,163,734	2,576,760	*2,848,663*

Assumption: The two tables above have shown that there possibly is an increasing trend on the markets to buy ingredients from South Africa with higher value and/or respectively higher value added.

Manufactured products [3303 – 3307]:

The majority of the classical South African (non-biotrade) economy faces decreasing export values while simultaneously the net weight of exports is decreasing or remains static. Perfumes and toilet waters must be seen as an exception.

Perfumes and toilet waters. [HS-Code 3303]				
	2014	2015	2016	2017
Trade Value US $	18,418,373	21,397,665	20,651,581	22,804,799
Net weight kg	1,473,463	2,435,806	1,760,658	*1,654,059*

Beauty or make-up preparations and preparations for the care of skin (other than medicaments), including sunscreen or sun tan preparations; manicure or pedicure preparations. [HS-Code 3304]				
	2014	2015	2016	2017
Trade Value US $	254,722,884	243,941,819	229,088,582	253,125,581
Net weight kg	46,596,723	50,400,154	47,838,194	*50,932,577*

Preparations for use on the hair. [HS-Code 3305]				
	2014	2015	2016	2017
Trade Value US $	85,226,169	65,072,276	57,586,630	62,422,836
Net weight kg	24,475,088	21,594,900	19,933,350	*21,496,692*

Preparations for oral or dental hygiene including denture fixative pastes and powders; yarn used to clean between the teeth (dental floss), in individual retail packages. [HS-Code 3306]				
	2014	2015	2016	2017
Trade Value US $	59,642,773	56,810,837	40,114,350	38,240,151
Net weight kg	20,067,506	20,395,509	15,504,513	10,245,288

Pre-shave, shaving or after-shave preparations, personal deodorants, bath preparations, depilatories and other perfumery, cosmetic or toilet preparations, not elsewhere specified or included; prepared room deodorizer, whether or not perfumed or having disinfectant properties. [HS-Code 3307]				
	2014	2015	2016	2017
Trade Value US $	110,614,673	91,253,673	89,554,720	95,005,330
Net weight kg	23,136,225	24,395,772	24,960,898	*25,144,119*

Annex C: Value chain/species and support project matrix – September 2018

VC/Plant species (bold = current focus of ABioSA project)	ARC	BioFISA	BIDC CSIR DST	GEF 6	Grounded	READ NW	UNEP	UNIDO
African ginger								
Agathosma (buchu)								
Agave								
Aloe ferox								
Baobab oil								
Buchu essential oil								
Citrillus lanatus **(Kalahari Melon) oil**								
Devil's claw								
Eriocephalum punctulaturs **(Cape chamomile) essential oil**								
Gwenge (sisal)								
Helichrysum essential oil								
Honeybush								
Imphopho								
Lippia essential oil								
Manketti/Mongongo oil								
Marama / *Tyloseam esculentum*								
Marula fruit and oil								
Melia azedarach								
Moringa								
Morogo								
Resurrection bush								
Rooibos								
Rose geranium essential oil								
Sutherlandia								
Ximenia oil								

Notes:

Dialogue and exchange with DAFF, ECDC, ARC, TIKZN, LEDA, MEGA and WESGRO ongoing

IDC to potentially invest in SMEs working on species as per CSIR/BIDC/DST, eg: marula

Baobab SMEs supported by the African Baobab Alliance, and moringa SMEs the Moringa Development Association of South Africa

Annex D: Stakeholder Survey Results

THE ABS CAPACITY DEVELOPMENT INITIATIVE

L'INITIATIVE DE RENFORCEMENT DES CAPACITES POUR L'APA

ABS (Access & Benefit-sharing) Compliant Biotrade in South(ern) Africa

– Stakeholder Survey –

Building a high-growth innovative biotrade sector that create jobs and contribures to sustainable use of biodiversity in South Africa and the region

funded by

Federal Ministry for Economic Cooperation and Development

la francophonie

IFDD

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs, Education and Research EAER
State Secretariat for Economic Affairs SECO

implemented by

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

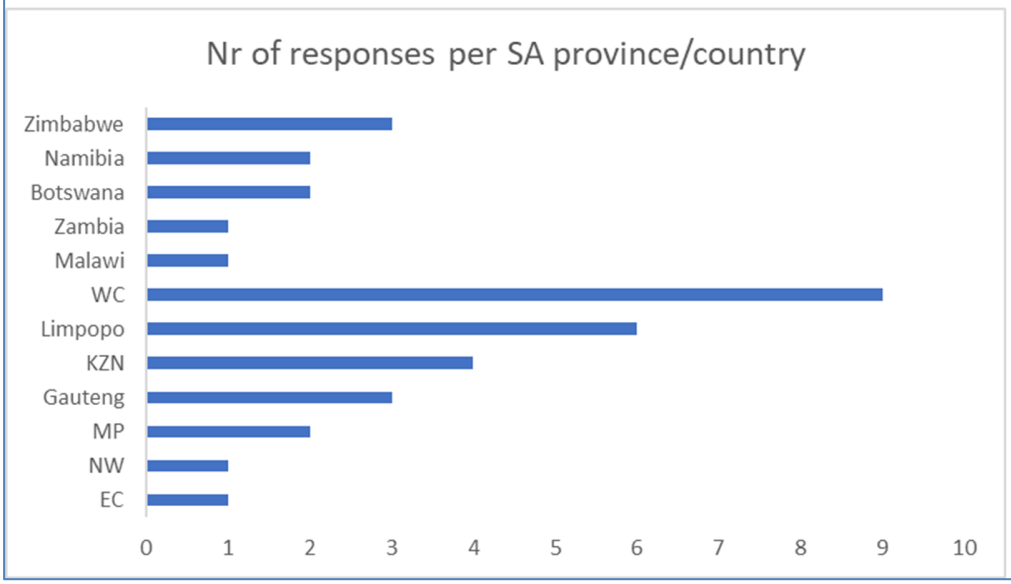
Survey results

- Quality and quantity an issue
- Funding
- Several species' VC relatively developed, requires additional assistance
- Formulators start to exclude certain species due to quality/quantity issues still not being addressed/ABS
- Issuing of permits, identification of TK holders
- High compliance cost (this programme can't fill all the gaps)
- Requires industry specific fund
- SMEs very low level, need a programme more focussed on lower level and local market
- Need funding to launch and run national awareness
- Numerous associations/organisations - improved collaboration required
- Industry specific body required

Survey

- Sent to almost 200 SMEs and BSOs (the latter requested to complete it, as well as send it to their members)
- Analysis: 35 SMEs (+1 for plant species) and 5 BSOs
- 2017 t/o:
  - >R10m 11%
  - <R10m 17%
  - <R2,5m 34%
  - unknown 37%

Survey: SME geographic spread



Species / Common name		Wild harvest-ing	Cultiva-tion*	Nursery *	Producti on of ingre-dients for formulati on into consu-mer products *	Product-ion of consum-er goods *	Market-ing agent	Distribu-tion	Incuba-tor *	R&D on plants *	R&D on process-ing tech-niques *	R&D on product develop-ment
Pelargonium reniforme / kidney leaved pel	1	1										
Tylosema esculentum / marama bean	1	1										
Agathosma crenulata / buchu	2		2		1							
Helichrysum odoratissimum / Imphepho /	4	3	2		1	1						
Hoodia gordonii / hoodia	4	1	3		2	1		1		1		
Lobostermon fruticosus / pyjama bush	4	3	2	1	2	1		1		1	1	
Pelargonium sidoides / kalwerbossie	4	4	1	1	2	3		2		1	1	1
Sceletium tortuosum / kanna	4	3	4	1	2	2		1		2	1	1
Erisema kraussianum / bangalala	5	5	1		2	2		1				
Sutherlandia frutescens / cancer bush	5	3	3	1	1	2	1	2				
Warburgia salutaris / pepperbark tree	5	3	3		2					2		
Eriocephalus punctulatus / Cape camomile	6	1	3	1	2	3	1			1	1	1
Siphonochilus aethiopicus / wild ginger	6	3	5	1	3	1		2		2		
Agathosma betulina / buchu	7	2	3		5		1	2		1	2	1
Aspalathus linearis / rooibos	7	1	4		4	3	1					
Bulbine frutescens / bulbine / burn jelly	7	4	5	3	4	4	1	1		2	2	2
Cyclopia genestoides / honeybush	7	3	5	1	3	2	1	1		2	2	1
Ximenia America / sour plum	7	4	1	1	4	3	2	1	1	1	3	3
Cyclopia intermedia / honeybush	8	2	4	1	3	2	2	2		2	2	1
Hypoxis hemerocallidea / African potato	8	4	5	1	4	2		2		2	1	
Myrothamnus flabellifolia / resurrection bu	8	8	2	1	5	1	3	1		4	3	3
Trichillia emetic / mafura	8	4			1	2	2				1	
Ximenia caffra / sour plum	8	7		1	1		2			2	1	1
Aloe ferox / African aloe	9	5	2		4	4	1	3				
Harpagophytum procumbens / devil's claw	9	7	4	2	6	4	3	3		2	2	1
Kigelia Africana / sausage tree	9	7			4	2				2	3	1
Schinziophyton rautanenii / mongongo / m	9	3			2	4	2	1			1	2
Citrullus lanatus / Kalahari melon	12	3	2		4	6	4	3	1		2	1
Lippia javanica / Lippia / fever tree / koorst	13	6	9	4	7	5	1	2	1	4	3	4
Pelargonium graveolens / rose geranium	13	3	7	5	4	9	2	2	2	3	2	2
Adansonia digitata / baobab	14	9	1	3	8	8	5	5		3	5	5
Moringa olifeira / moringa	15	2	10	3	6	7	2	1		4	1	1
Sclerocarya birrea/ marula	15	6	1	1	3	8	4	2	1	2	3	2

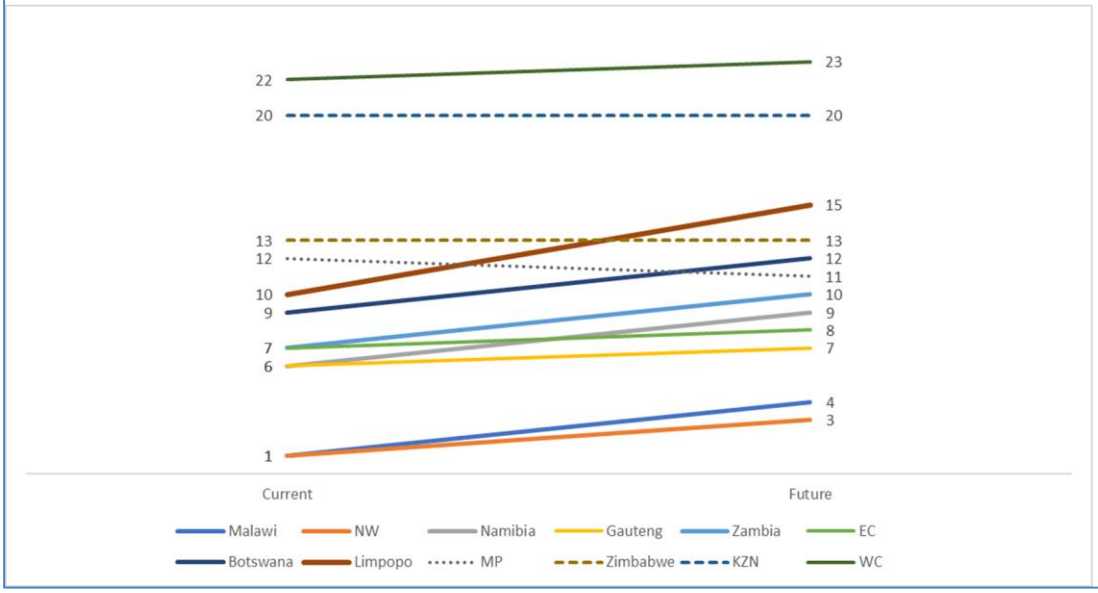
Reasons for future exclusions

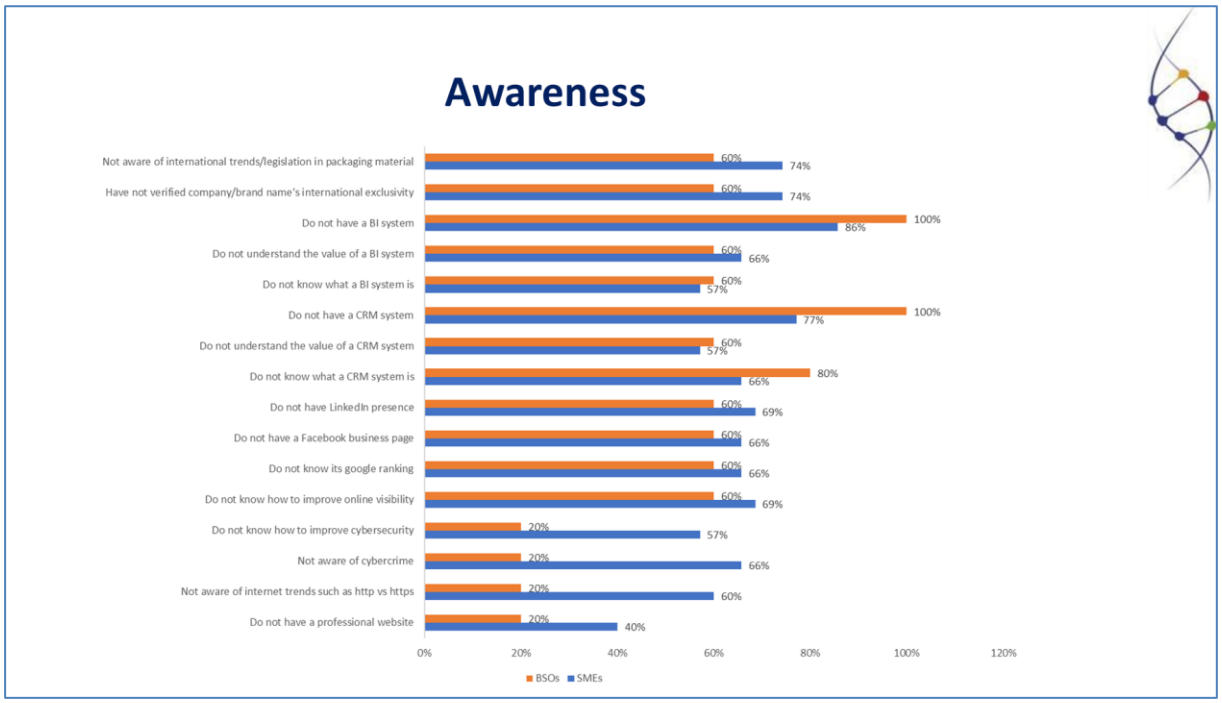
- **Aloe ferox: CITES, legislation (will focus on exotics)**
- **Cape Camomile: lack of supply**
- **Lippia javanica: CSIR patent issues**
- **Marula: no clean oil**
- **Sutherlandia: medical world keeping it out**
- **Mafura: no clean oil, insufficient safety data for exports to EU**
- **Ximenia Americana: single supplier = high risk**

Species with (net) increased inclusion in the future

Specie	Total	Nr SMEs	Nr BSOs
Trichillia emetic / mafura	-2	-2	0
Aspalathus linearis / rooibos	0	0	0
Cyclopia genestoides / honeybush	0	0	0
Cyclopia intermedia / honeybush	0	0	0
Siphonochilus aethiopicus / wild ginger	0	0	0
Agathosma betulina / buchu	1	0	1
Eriocephalus punctulatus / Cape camomile	1	0	1
Harpagophytum procumbens / devil's claw	1	2	-1
Myrothamnus flabellifolia / resurrection bush	1	1	0
Sclerocarya birrea/ marula	1	1	0
Sutherlandia frutescens / cancer bush	1	1	0
Ximenia America / sour plum	1	1	0
Aloe ferox / African aloe	2	0	2
Bulbine frutescens / bulbine / burn jelly	2	2	0
Hypoxis hemerocallidea / African potato	2	2	0
Lippia javanica / Lippia / fever tree / koorsbossie	2	2	0
Schinziophyton rautanenii / mongongo / manketti	2	2	0
Ximenia caffra / sour plum	2	1	1
Adansonia digitata / baobab	3	2	1
Citrullus lanatus / Kalahari melon	3	3	0
Pelargonium graveolens / rose geranium	3	3	0
Kigelia Africana / sausage tree	4	4	0
Moringa olifeira / moringa	4	3	1

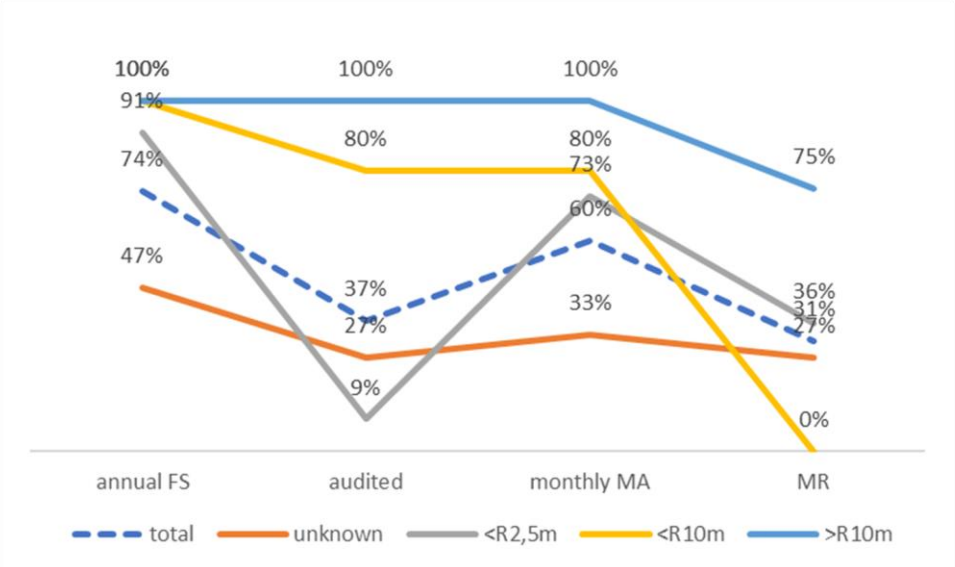
Change per geographic area





Constraints

Compliance per category



Thank you!

Annex E: Marula – Note on Market Access Regulations

Review of market access regulations affecting marula products and EU market, and opportunities to establish legal access

Cyril Lombard, September 2018

Marula fruit products:

SMEs seeking access to the EU market would need to comply with regulations for the intended use such as traditional herbal medicine, food supplements, food additives, and novel foods.

Apart from novel foods, there appears to be no record of compliance dossiers and associated applications and approvals for any of these possible intended uses for marula fruit products. The fact that a product is on the market does not automatically imply that it has legal access. Many SMEs misunderstand these regulations, as do their clients and it sometimes takes time for the regulator to catch up with non-compliant products on the market.

For novel foods, under the "old" regulation EC 258/97, the European Food Safety Authority (EFSA) listed "marula berries" as being consumed on the EU market to a significant degree prior to May 1997. Therefore, according to this list and regulation, marula berries are "not novel" and may therefore be placed on the market.

Regulation EC 258/97 has recently been revised to EU 2015/2283. Under this regulation a new procedure for "traditional foods from third countries" is created. The application criteria can make it simpler and easier for food products such as those from marula fruit to be approved. See attached revised regulation and revised procedure.

Both these points potentially represent an opportunity for marula producers. However, any application dossier would need to address multiple issues such as:

- Specifications of the product;
- Characterisation of the traditional food, technical and scientific data;
- Chemical substances found in the product;
- Detailed description of the production process;
- Compositional data;
- Stability of the product;
- Specifications of the product to be placed on the market;
- Experience of continued food use in the third country;
- Extent of use in third country;
- Characteristics of the population group(s) of consumers;
- Role in the diet;
- Information on the handling and preparation of the food;
- Precautions for the preparation and restrictions of use;
- Proposed conditions of use for the EU market;
- Target population;
- Proposed uses and use levels; and
- Precautions and restrictions of use.

Therefore, it would be necessary for the project to support the sector to define the product, or products, which would be the subject of the dossier and application. This would entail product development work as it is not feasible to consider "marula berries" as a consumer product since the shelve life of marula fruits is too short, and the product not suitable for target consumers.

Additionally, any application process would need to overcome challenges posed by scientific papers with data suggesting a concern for consumer safety. For example; "Acute and Subchronic Toxicity

Studies of *Sclerocarya birrea* Peels Extract in Rats, Muhammad et al, International Journal of Sciences: Basic and Applied Research, 2014".

Once a dossier has been successfully submitted to the EU, many of these data can be applied to market access dossiers in other territories.

Marula oil:

Over the period 1999 to present day marula oil has been increasingly introduced to cosmetics markets. Generally speaking, marula oil is accepted on the market for cosmetic applications.

In the context of seeking to develop a marula oil sector in Southern Africa, it would be prudent to consider broadening the scope of market possibilities for SMEs to be able to access. An obvious consideration is marula oil for food consumption. This is actually the earliest traditional use of marula oil. Additionally, the success of argan oil is partly due to the fact that it is a culinary oil and a cosmetic ingredient.

Under the "old" regulation there was a "simplified" procedure call a "substantial equivalence notification" which enabled certain types of products to be approved on the basis that the product was essentially and substantially the same as other products already accepted on EU market. An earlier project, funded by then GTZ, presented this as a major opportunity for marula oil to obtain rapid market access.

Additionally, the "new" regulation EU 2015/2283 with its traditional foods from third countries procedure, also represents an opportunity based on marula oil's known use as a food oil in Southern Africa. This approach could also be used for other oils of interest to the project.

As with marula fruit, it would be necessary for the project to support a product development process whereby the product specification and production processes are defined and known safety concerns are addressed.

In summary:

Global market access regulations impact of the growth of the sector and SMEs producing these products. However, in the EU there are clear opportunities to use newly revised regulations which should make it easier to have products obtain legal access to significant markets.

Opinion of the project advisor:

Seen in context with the literature and patent review for marula fruit, an important new product category could be facilitated, and this could be positioned in an interesting and growing health area. Once EU dossiers are compiled it is easier to address regulators in the USA, China, Japan and other Asian markets. Therefore, market access for marula fruit products should be considered for support by the project.

Additionally, marula oil should be supported to gain market access in the EU as a speciality culinary oil. To amortise costs and reach higher efficiency and cost / time effectiveness, other seed oils could be included into the scheme. Further, these studies and dossiers can be used to improve access to the oils for cosmetic applications in the EU, and elsewhere, thereby contributing to efficiency and impact.

An operational network of regulatory experts, laboratories and other service providers should be set up for deployment by the project. Interaction with SMEs, and R&D, will be required, and this should therefore include CSIR BIDC.

If impact is to be achieved by the end of the 3-year project period, implementation of this scheme would need to commence at the earliest time.

Annex F: Marula – Reference to Metabolic Syndrome

Marula (*Sclerocarya birrea*): Reference to metabolic syndrome

Cyril Lombard, September 2018

Metabolic syndrome is a combination of medical disorders that together increase the risk of developing cardiovascular disease and diabetes. Oxidative stress, which has been implicated in the pathogenesis of cardiovascular disease and diabetes, is a common feature of metabolic syndrome.

The literature reviewed includes papers focussing on the fruits, bark, leaves and other plant parts of Marula, and which show finding relevant to the treatment of metabolic syndrome. Marula oil is not covered in this review.

This is a comprehensive review of published literature up to 2012. Subsequent literature has been subject to a rapid and less thorough review and is not written up. However, that the published papers continue to report on same or similar molecules and compounds and continue to contribute meaningfully to a case for marula fruit and other products in the metabolic syndrome area. Recent key literature reviewed is noted at the end of this table.

Publication/Report	Research focus/method	Main findings/comment
Borochov-Neori *et al*. (2008). Phenolic antioxidants and antiatherogenic effects of Marula (*Sclerocarya birrea* ssp. *caffra*) fruit juice in healthy humans. *Journal of Agriculture and Food Chemistry* **56** (21): 9884-9891	• Investigates the antioxidant activity and composition of Israeli marula fruit juice on serum lipids and lipoproteins in healthy volunteers. • Fruit of varying ripening dates and cultivation dates were used • Juice given as a dietary supplement • Fruits collected from various sites in the Israeli Negev and southern Arava Valley.	• Juice found to be potent antioxidant (382 mg vitamin C equiv dL^{-1} • 3-week administration of the juice significantly reduced their serum total cholesterol (reduced by 8%), LDL cholesterol conc. (by 17%), triglyceride level (by 7%) • Serum HDL-cholesterol level increased by 10% • Observed protection against atherosclerosis risk factors possibly due to antioxidant presence (hydrolysable tannins, catechins, hydroxycinnamic acid derivatives • Some inconsistency was found in the habitual positive correlation between phenolic content and radical scavenging activity. • Suggested that Marula fruit juice is a hypocholesterolemic nutrient which favourably affects blood lipids • Other parameters investigated blood pressure, serum glucose, calcium levels, kidney function and liver function
Chong *et al* (2010). Fruit polyphenols and CVD risk: a review of human intervention studies. *British Journal of Nutrition* **104**(Suppl. 3): S28-S39	• To provide a summary of the evidence for the effect of fruit polyphenols on four risk factors of CVD: platelet function, blood pressure, vascular function and blood lipids.	• Some evidence to suggest that fruits with high conc. of flavonols, anthocyanins, and procyanindins, were effective at reducing CVD risk factors, particularly with respect to anti-hypertensive effects, inhibition on platelet aggregation and increasing endothelial-dependent vasodilation.

Publication/Report	Research focus/method	Main findings/comment
(Abstract only – full paper requested)	• Human dietary intervention methods used	• Flavanone-rich fruits reported hypocholesterolaemic effects • Note that the evidence is said to be limited and often inconclusive. There was also some lack of controls. • Suggested long-term human dietary studies are required to investigate further.
Dimo *et al*. (2007). Effect of *Sclerocarya birrea* (Anacardiaceae) stem bark methylene chloride/methanol extract on streptozotocin-diabetic rats. *Journal of Ethnopharmacology* **110**(3): 434-438	• Study examines the antidiabetic activity of low doses of the organic (methanol/methylene choloride) extract of the stem bark of *Sclerocarya birrea* on streptozotocin (STZ)-induced diabetic rats. • Fresh stem bark was harvested from northern Cameroon and air-dried and powdered prior to being macerated into a mix of methanol/methylene chloride (1:1).	• The stem bark extract showed a significant reduction in blood glucose and increased plasma insulin levels in diabetic rats • Elevation in plasma insulin levels could be due to substances present in the extract which stimulate insulin secretion, or which protect the intact functional beta-cells from further deterioration and they remain active. • The extract prevented body weight loss in diabetic rats • The effective dose of the plant extract (300mg/kg) tended to reduce plasma cholesterol, triglyceride and urea levels towards normal levels. • Rats treated with the extract also showed significant improvement in glucose tolerance. • The extract has demonstrated a hypoglycaemic effect on the diabetic rats.
Dr Duke's *Phytochemical and Ethnobotanical Databases* (Online Database) 16 January 2012	• The database provides a list of chemicals found in *Sclerocarya caffra* SOND, and a list of activities which are linked to the chemicals	• Total of 228 activities are listed. Several examples are given below. • Antianginal (Niacin), antiatherosclerotic (ascorbic acid, calcium, citric acid, malic acid), anticardiospasmic (thiamine), anticoagulant (citric acid), antidiabetic (ascorbic acid, fibre, niacin), antihypertensive (ascorbic acid, calcium, fibre, tannin), antioxidant (ascorbic acid, riboflavin, tannin), cardioprotective (ascorbic acid, fibre, niacin), circulotonic (niacin), hypoglycaemic (ascorbic acid, niacin), hypolipidemic (niacin), vasodilator (ascorbic acid, calcium, fibre, niacin)
Ford (2006). Intake and circulating concentrations of antioxidants in metabolic syndrome. *Current Atherosclerosis Report*. **8**(6): 448-452		• Oxidative stress, which has been implicated in the pathogenesis of cardiovascular disease and diabetes, is a common feature of metabolic syndrome. Limited evidence suggests that circulating concentrations of antioxidants are decreased among people with metabolic syndrome.
Garba *et al.* (2006). The effect of aqueous stem bark extract of *Sclerocarya birrea* (Hoechst) on alcohol carbon tetrachloride induced liver	• Given the many uses of marula stem bark in Africa, this study investigates the effect of the aqueous extract of *Sclerocarya birrea*	• Many studies indicate the stem bark has antidiarrhoel, antibacterial, anti-inflammatory, antimalarial and anthelminthic properties. • Results showed that the aqueous extract of the stem bark extract possesses hepatotoxic and antihepatotoxic activity at low and high doses, respectively.

Publication/Report	Research focus/method	Main findings/comment
damage in rats. *Pakistan Journal of Biological Sciences* **9**(12): 2283-2287	against alcohol-carbon tetrachloride induced hepatocellular injury in rats. • Material collected from the Savannah region of Nigeria.	• Tested parameters include serum levels, Alanine aminotransferase, Aspartate aminotransferase, alkaline phosphatase, bilirubin, albumin, and protein levels. Liver tissue was also tested for damage.
Glew *et al*. (2004) Nutritional analysis of the edible pit of *Sclerocarya birrea* in the Republic of Niger (*daniya,* Hausa). *Journal of Food Composition and Analysis* **17:**99-111.	• The study reports on the fatty acid, amino acid, mineral and trace elements content of Marula pits (part of the seed). • Plant material collected in Niger.	• (Certain nutrients, minerals, and trace elements can be beneficial for the avoidance, and treatment, of conditions such as metabolic syndrome). • The pit contained large amounts of copper (24.8µg/g dry wt), magnesium (4210 µg/g dry wt) and Zinc (62.4 µg/g dry wt). Protein faction was high but contained low proportions of leucine, phenylalanine, lysine and threonine. • Fatty acids accounted for 47mg/g dry wt of the pit, two-thirds was oleic acid. • Oleic acid has cardioprotective effects. • Essential fatty acid linoleic acid was present (24.5 mg/g dry wt) but α-linolenic acid was absent. • Linoleic acid is a precursor to arachidonic acid which is involved in regulation of blood pressure.
Hassan *et al*. (2011). Serum biochemical response of rats fed with *Sclerocarya birrea* juice extract. *African Journal of Food Science* **5**(4): 208-212.	• Investigates the effect of *S. birrea* juice on the body weight, liver and kidney biochemical parameters of albino rats. • Marula fruits from Nigeria were used in the study	• Rats fed extracts 1000, 2000 and 3000 mg/kg body weight experienced an increase in body weight over the study time. • Rats fed 4000mg/kg body weight decreased in body weight. • Higher doses of the extract led to increased levels of serum albumin and total bilirubin, and high doses also caused increases in serum enzyme activities, aspartate amino transferase, serum alanine amino transferase and alkaline phosphatase. Although this is said to be an indication of organ toxicity, it is concluded that the juice has relatively low or no toxicity profile. • NOTE: Several typing errors are present and lack of full discussion points. Review methods further.
Hillman *et al*. (2008). Evaluation of nutrients in selected genotypes of Marula (*Sclerocarya birrea* ssp. *caffra*). *Scientia Horticulturae* **117**: 321-328.	• The study compared seven Marula genotypes for their horticultural characters and antioxidant capacity. • Plant material collected from the arid Negev desert, Israel.	• Marula is known to be rich in ascorbic acid. It was found to vary between 7 and 21 mg/g dry wt, depending on clone and fruit ripening stage. • Polyphenol content peaked at 3 weeks post-abscission • Evidence of the antioxidant content of Marula fruits
Mdluli (2005). Partial purification and characterisation of polyphenol oxidase	• The paper looks at enzymatic browning of Marula fruit.	• Catechins are included as a parameter.

Publication/Report	Research focus/method	Main findings/comment
and peroxidise from marula fruit (*Sclerocarya birrea* subsp. Caffra) *Food Chemistry* **92**: 311-323.	• Polyphenol oxidase and peroxidise from the fruit were partially purified. • Marula native to sub-Saharan Africa.	• Marula had Km values of 1.41, 1.43, 3.73 and 4.99 mM for catechin, 4-methylcatechol, 3,4-dihydroxyphenylpropanoic acid and catechol, respectively.
Mariod, A. *et al*. (2008). Antioxidant properties of methanolic extracts from different parts of *Sclerocarya birrea*. *International Journal of Food Science and Technology* **43**: 921-926.	• The study examines methanolic extracts from *Sclerocarya birrea* leaves (SCL), roots (SCR), barks (SCB), and kernel oil cake (SCK) for radical scavenging capacities and antioxidant activities. • Plant material collected in Western Sudan	• Total phenolic compounds for the components were; SCB 593 mg/g, SCR 367.5 mg/g, SCL 304.5 mg/g, and SCK 148 mg/g. • The methanolic extracts were effective in inhibiting the oxidation of linoleic acid and subsequent bleaching of β-carotene. • Phenolics were shown to be present in the extracts and to have significant antioxidant activity.
Moyo *et al* (2010). Phenolic composition, antioxidant and acetylcholinesterase inhibitory activities of *Sclerocarya birrea* and *Harpephyllum caffrum* (Anacardiaceae) extracts. *Food Chemistry* **123**: 69-76.	• The study investigates the total phenolic content, proanthocyanidins, gallotannins, flavanoids, and antioxidant activities of methanolic extracts using *in vitro* assays. • Leaf, stem bark and opercula of *Sclerocarya birrea* were included. • Plant material from South Africa.	• *S. birrea* young stem extract contained the highest levels of total phenolic content (14.15 mg GAE/g), flavonoids (1.21 mg CE/g) and gallotannins (0.24 mg GAE/g). • Marula extracts are said to be a source of natural antioxidants and acetylcholonesterase inhibitors and may be beneficial to consumer health.
Ndhlala, A. *et al.* (2006). Antioxidant potentials and degrees of polymerization of six wild fruits. *Scientific Research and Essay* **1**(3): 87-92.	• Aqueous methanolic extracts of six wild fruits, including Marula, were assayed for radical scavenging effect on DPPH radical, reducing power, superoxide anion radical scavenging effect and the inhibition of phospholipids peroxidation. • Fruits were obtained from Zimbabwe.	• Radical scavenging activities for all fruits were dose dependent. • Marula is shown to have a significant difference in the quality of phenolic compounds in the peel and pulp. • Degree of polymerisation (monomer units of catechin per polymer of phenolic compounds) were 6.8 for peel, and 15.4 for pulp. • In general, fruits with high degrees of polymerisation present lower antioxidant activities, and vice versa. Therefore, the peel is expected to have high antioxidant activity.
Ndhlala *et al* (2007). Phenolic composition of *Flacourtia indica*, *Opuntia megacantha* and *Sclerocarya birrea*. *Food Chemistry* **103**: 82-87.	• The phenolic acid composition of the peel and pulp of the fruits of Marula from Zimbabwe were analysed using traditional colorimetric and HPLC methods.	• *S. birrea* pulp had the highest total phenolics, flavanoids and condensed tannins (2262 µg GAE/g, 202µg catechin/g, and 6% condensed tannins, respectively). • Ferulic acid, caffeic acid *p*-coumaric acid were identified in the pulp of Marula • Caffeic acid, vanillic acid, *p*-hydroxybenzaldehyde, ferulic acid, *p*-hydrocybenzoic acid and *p*-coumaric were identified in the peel.

Publication/Report	Research focus/method	Main findings/comment
Ndifossap *et al.* (2010.) *Scelrocarya birrea* (Anacardiaceae) stem-bark extract corrects glycaemia in diabetic rats and acts on β-cells by enhancing glucose-stimulated insulin secretion. *Journal of Endocrinology* **205**: 79-86.	• The study tests the aqueous extract of *S. birrea* on insulin-secreting cells and also *in vivo* in diabetic rats • Plant material collected in northern Cameroon.	• Marula has been used as a traditional medication for the treatment of diabetes in sub-Saharan regions. • Hypoglycaemic effects of marula stem bark extract have been reported in diabetic rats. • Following 24 h treatment at 5µg/ml, the extract markedly potentiated glucose-stimulated insulin secretion. • Mechanism of action related to glucose metabolism as both ATP generation and glucose oxidation were enhanced following treatment. • Extract administration corrected glycaemia and restored plasma insulin levels after 2 weeks of treatment indicating action on pancreatic β-cells. • 150mg/kg stem bark extract efficiently reduced glycaemia although plasma insulin levels were similar to diabetic controls. • Results show direct action of stembark extract on insulin-secreting cells • Toxicity assays and gene expression analysis showed the absence of cytotoxicity at effective concentrations.
Ojewole *et al*. (2009). *Sclerocarya birrea* (a.rich) hochst. (Marula) (Anacardiaceae): A review of its phytochemistry, pharmacology and toxicology and its ethnomedicinal uses. *Phytotherapy Research* **24**(5): 633-639.	• The review aims to compile information relating to marula's chemical constituents, ethnomedicinal, toxicological and pharmacological properties.	• Provides a comprehensive collation of information and sources. • Reports on actives including antidiarrhoeal, antidiabetic, anti-inflammatory, antimicrobial, antiplasmodial, antihypertensive, anticonvulsant, antinocieceptive, and antioxidant. • References studies which have investigated the various activities.
Ojewole *et al* (2004). Evaluation of the anti-inflammatory properties of *Sclerocarya birrea* (A. Rich) Hochst. (family: Anacardiaceae) stem-bark extracts in mice and rats. *Phytotherapy Reseach* **18**: 601-608.	• The study investigates the analgesic, anti-inflammatory and anti-diabetic properties of plants stembark aqueous extract. • Plant material collected at the University of Durban-Westville campus, South Africa.	• The results indicate that the stem bark extract possesses analgesic, anti-inflammatory and hypoglycaemic properties. • Reports results given in other studies.
Ojewole *et al* (2004). Evaluation of the analgesic, anti-inflammatory and anti-diabetic properties of Sclerocarya birrea (A.Ricj) Hochst. stem bark aqueous extract in mice and rats. *Phytotherapy Research* **18** (8): 601-608.	• The study evaluates the anti-inflammatory effect of *S. birrea* stem bark aqueous and methanolic extracts in rats. • Plant material collected at the University of Durban-Westville campus, South Africa.	• Both extracts progressively and time-dependently reduced rat paw oedema. • Methanolic extract produced greater anti-inflammatory effect than aqueous extract. • *S. birrea* is reported to contain tannins and flavanoids, sterols, triterpenoids, sesquiterpenes, ascorbic acid, oleic acid, mysteric, stearic, glutamic and

Publication/Report	Research focus/method	Main findings/comment
		amino acids. However, the chemical constituents that give the anti-inflammatory effect is not stated.
Ojewole (2003). Hypoglycemic effect of *Sclerocarya birrea ((*A. Rich.) Hochst.) (Anacardiaceae) stem-bark aqueous extracts in rats. *Phytomedicine* **10** (8): 675-681.	• Study to evaluate the hypoglycaemic effect of *S. birrea caffra* stem bark aqueous extract in normal and STZ-treated diabetic rats. • Plant material collected at the University of Durban-Westville campus, South Africa.	• Following acute treatment, moderate to high doses of stem bark extract (100-800 mg/kg p.o.) produced dose dependent, significant reductions in blood glucose concentrations. • Results suggest that the aqueous of Marula stem bark possesses hypoglycaemic activity. • It is suggested that arginine and glutamic acid may have contributed to the effects. • Insulin secretion by the pancreatic β-cells could have been increased by glutamic acid metabolism.
Ojewole (2006). Vasorelaxant and hypotensive effects of *Sclerocarya birrea* (A Rich) Hochst (Anacardiaceae) stem bark aqueous extract in rats. *Cardiovascular Journal of South Africa.* **17** (3): 117-123.	• The study investigates the vasorelaxant and hypotensive effects of *S. birrea* stem bark aqueous extract in rats.	• Qualitative phytochemical analysis of the crude stembark extract showed tannins (including procyanidins), flavanoids, phenols, triterpenoids, steroids and alkaloids. • Stembark extract caused transient, dose-dependent and significant reductions in systolic, diastolic and mean arterial blood pressure and heart rates of normotensive and hypertensive rats. • The extract showed a vasorelaxant property and would likely contribute to the antihypertensive effect. • Responsible compounds were not identified. • Finding support use of the extract as a natural supplementary remedy for the management, control and treatment of hypertension and associated cardiovascular disorders.
Ojewole (2007). Anticonvulsant effect of *Sclerocarya birrea* (A. Rich.) Hochst. subsp. *caffra* (Sond.) Kokwaro (Anacardiaceae) stem bark aqueous extract in mice. *Journal of Nat Med*. **61**: 67-72.	• Investigates the anticonvulsant activity of the plant's stem bark aqueous extract against induced seizures in mice. • Plant material collected at the University of Durban-Westville campus, South Africa.	• Administration of the extract significantly delayed the onset of and inhibited induced seizures. • The average duration on convulsion was not significantly altered. • Stem bark extract mimicked, to a large extent, the anticonvulsant action of the reference drugs • Marula stem bark extract has the potential to manage, control, and treat epilepsy and childhood convulsions.

Publication/Report	Research focus/method	Main findings/comment
Trovato *et al* (1995). Effects of *Sclerocarya birrea* Hochst. extract on some metabolic activities in the rat. *Phytotherapy research* **9**: 591-593.	• Investigates the effect of bark decoction on blood glucose and plasma IRI in normoglycaemic and rats with a glucose load. • The activity on diet-induced hypercholesterolaemia in rats was also studied. • The bark material was obtained by African commercial sources (a specific location is not stated).	• The bark decoction was found not to be toxic. • At a dose of 0.5g/kg blood glucose was lowered in normoglycaemic rats. • Decrease in blood glucose was accompanied by an increase in plasma IRI. • The extract was also found to lower cholesterol plasma levels and so it is active against diet induced hypercholesterolaemia. • Active principles were not identified.

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ANTIHYPERGLYCAEMIC ACTIVITY OF SCLEROCARYA BIRREA IN RATS

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Anti-aging potential of extracts from *Sclerocarya birrea* (A. Rich.) Hochst and its chemical profiling by UPLC-Q-TOF-MS

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Abstract

Background

Degradation of components of the extracellular matrix such as elastin and collagen by elastase and collagenase accelerates skin aging. Phytochemicals that inhibit the activity of these enzymes can be developed as anti-aging ingredients. In this study, an investigation of the anti-aging properties of *Sclerocarya birrea* (A. Rich.) Hochst (Marula) extracts was conducted in vitro with the aim of developing chemically characterized anti-aging ingredients.

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Qualitative and Quantitative Phytochemical Analyses of *Sclerocarya birrea and Sterculia setigera* in Kem and Yola, Adamawa State, Nigeria

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Abstract The stem, roots and leaves of the plants *Sclerocarya birrea* and *Steculia setigera* collected from Kem and Yola, Adamawa State, Nigeria, were analyzed for the presence and amounts of different phytochemicals. The qualitative phytochemical analysis showed that alkaloid, tannin, phenol and flavonoids were present in the extracts of the stems, roots and leaves of both plants. Glycoside was only absent in the leaves of *Sclerocarya birrea* while saponin was absent in the root of *Sclerocarya birrea* and the leaves and stems of *Steculia setigera.* The comparative quantitative analysis carried out using UV-visible spectroscopy, showed that the plants are rich in phytochemicals and tannins, flavonoids and saponins (1.92±0.05, 50.33±0.03 and 2.77±0.010 mg/dl respectively) were found to be higher in Kem than those in Yola (1.73±0.09, 22.14±0.08, and 1.78±0.08 mg/dl respectively). Alkaloids, phenols and glycosides from Kem (3.47±0.01, 19.94±0.05, 0.54±0.03 mg/dl respectively) were lower compared to those from Yola (3.95±0.00, 22.19±0.06 and 0.85±0.06 mg/dl respectively). The phytochemical composition of the stem, roots and leaves of the plants indicate their medicinal properties.

Keywords: *phytochemical, tannin, alkaloid, flavonoid, Sclerocarya birrea, Steculia setigera*

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Metabolomic analysis of Sclerocarya birrea (A. Rich) Hochst: to determine the differences in chemical profile and anti-diabetic properties in relation to geographical distribution

Marokane, Cynthia Kwena

URI: http://hdl.handle.net/10500/22560

Date: 2015-09

Type: Dissertation

Abstract:

Metabolomics is a discipline where metabolites are assessed, identified and quantified in different samples. Metabolites are crucial components of the biological system and highly informative about its functional state due to the closeness to functional endpoints and to the organism's phenotypes. 1H NMR and LC-MS, the commonly used metabolomics analytical platforms were used to annotate the metabolites found in Sclerocarya birrea (S. birrea) leaves from five South African provinces, Limpopo (L), Gauteng (G), North West (NW), Mpumalanga (M) and KwaZulu-Natal (KZN). Supervised Orthogonal Partial Least Square – Discriminant Analysis (OPLS-DA) of the full spectra revealed a clear differentiation of S. birrea leaves from five provinces. In addition, the level of common metabolites were measured and compounds previously found to have anti-diabetes potential ((-)-epicatechin 3-0-galloyl ester, myricetin-3-0-α-L-rhamnopyranoside, gallic acid and Kaempferol-3-0-α-L-rhamnopyranoside) were annotated in the samples. The samples from the five provinces showed anti- diabetic activity when exposed to an in-vitro glucose uptake assay, with the highest activity observed in male samples from M. The sample presented high concentrations of (-)-epicathechin 3-0-galloyl ester, one of the metabolites with anti-diabetes activity. Overall 1H NMR and LC-MS metabolic profiling were successfully applied to discriminate all five sources of S. birrea leaves, and obtained qualitative information of many common metabolites.

The ABS Compliant Biotrade in South(ern) Africa Project

Project Steering Committee Meeting
26 & 27 September 2018

Further information on Marula fruit and oil and *Aloe ferox* Recommendations

Cyril Lombard

Content

Marula traditional uses

Marula fruit chemistry and health

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Market fruit and potential consumer health targets

Aloe ferox – regulatory issues

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Conclusion on value chain selection

Marula traditional uses

Many uses across all ethnic groups where the resource occurs, truly a "transboundary" TK and IKS example

These include the fruit for food and beverages, and the kernel as a food and condiment, and the oils from the kernel as an emollient

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DOI: 10.1080/87559129.2012.660716

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Sclerocarya birrea (Marula), An African Tree of Nutritional and Medicinal Uses: A Review

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Sclerocarya birrea *(Anacardiaceae) is a popular African wild tree distributed in many African countries where the leaves, stem bark, root, and fruits are used in food and traditional medicine; the fruit is rich in ascorbic acid. The fruit juice contains sesquiterpene hydrocarbon, which are terpenes found in plants that are reported to have bacteriostatic properties. The fruit contains a hard brown seed. The seed encloses a soft white kernel rich in oil and protein. The oil contains oleic, palmitic, myristic, and stearic acids: the kernel protein contains amino acids, with a predominance of glutamic acid and arginine. The extracts from different parts showed high total phenolic compounds and radical-scavenging capacities and antioxidant activities.* Sclerocarya birrea *is widely studied with regard to its antidiabetic, anti-inflammatory, analgesic, antiparasitic, antimicrobial, and antihypertenisve activities.*

Keywords Antidiabetic, Anti-inflammatory, Antimicrobial, Antioxidant, Phenolic compounds, Protein, Oil, *Sclerocarya birrea*

Bark and roots include: "hypertension" and diabetes mellitus" as well as "anti-inflammatory conditions" (Ojewole, 2003) and "type 2 diabetes mellitus" (Ojewole, 2004)

Marula fruit chemistry and health

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Phenolic composition of *Flacourtia indica*, *Opuntia megacantha* and *Sclerocarya birrea*

A.R. Ndhlala, A. Kasiyamhuru, C. Mupure, K. Chitindingu, M.A. Benhura, M. Muchuweti *

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J. Agric. Food Chem. XXXX, xxx, 000

JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY

Phenolic Antioxidants and Antiatherogenic Effects of Marula (*Sclerocarrya birrea* Subsp. *caffra*) Fruit Juice in Healthy Humans

HAMUTAL BOROCHOV-NEORI,*,† SYLVIE JUDEINSTEIN,† AMNON GREENBERG,† BIANCA FUHRMAN,§ JUDITH ATTIAS,§ NINA VOLKOVA,§ TONY HAYEK,§ AND MICHAEL AVIRAM§

Southern Arava R&D, Mobile Post Hevel Eilot 88820, Israel, and Lipid Research Laboratory, Rappaport Faculty of Medicine, Technion–Israel Institute of Technology, Haifa 32000, Israel

Marula fruit chemistry and health

Convincing array of publications supporting a health positioning around the metabolic syndrome. Molecules and compounds such as phenols, polyphenols, catechins, epigallcatechins, flavonodis, seem to be responsible

This is supported by a body of grey and confidential literature

Thesis

Submitted in fulfilment of the requirements for the degree of doctor
at Wageningen University
by the authority of the Rector Magnificus
Prof. dr. M. J. Kropff,
in the presence of the
Thesis committee appointed by the Academic Board
to be defended in public
on Friday 25 October 2013
at 11 a.m. in the Aula

Penny Hiwilepo-van Hal

Processing of marula (*Sclerocarya birrea subsp. Caffra*) fruits: A case study on health-promoting compounds in marula pulp

Food Reviews International, 28:375–388, 2012
Copyright © Taylor & Francis Group, LLC
ISSN: 8755-9129 print / 1525-6103 online
DOI: 10.1080/87559129.2012.660716

Sclerocarya birrea (Marula), An African Tree of Nutritional and Medicinal Uses: A Review

ABDALBASIT ADAM MARIOD[1] AND SIDDIG IBRAHIM ABDELWAHAB[2]

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[2]Department of Pharmacy, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia

Marula fruit chemistry and health

Table 2. Potassium content of Marula and other commonly consumed fruits

Fruit	K content (mg)	Fruit weight (g)
Marula flesh	**1250**	**50**
Marula Peel	**900**	**50**
Apricots (dried)	814	70
Banana	467	118
Dates	542	83
Kiwi	252	76
Melon, cantaloupe	494	160
Orange	237	131

efsa
European Food Safety Authority

Summary: EFSA Journal 2010; 8(2):1469

SCIENTIFIC OPINION

Scientific Opinion on the substantiation of health claims related to potassium and maintenance of normal muscular and neurological function (ID 320, 386) and maintenance of normal blood pressure (ID 321) pursuant to Article 13(1) of Regulation (EC) No 1924/2006[1]

EFSA Panel on Dietetic Products, Nutrition and Allergies (NDA)[2, 3]

BOX 1: European Food Safety Authority (EFSA) Claims

Scientific Opinion on the substantiation of health claims related to potassium and maintenance of normal muscular and neurological function (ID 320, 386) and maintenance of normal blood pressure (ID 321) pursuant to Article 13(1) of Regulation (EC) No 1924/2006

Muscular and neurological function

The claimed effects are "signal transduction and muscle contraction" and "nerve function". The target population is assumed to be the general population. The Panel considers that maintenance of normal muscular and neurological function is a beneficial physiological effect. On the basis of the data presented, the Panel concludes that a cause and effect relationship has been established between the dietary intake of potassium and normal muscular and neurological function.

Blood Pressure

The claimed effect is "blood pressure". The target population is assumed to be the general population. The Panel considers that maintenance of normal blood pressure is a beneficial physiological effect. On the basis of the data presented, the Panel concludes that a cause and effect relationship has been established between the dietary intake of potassium and the maintenance of a normal blood pressure.

It may be possible to position marula fruit products as "high in Kalium" / "high in Potassium"

Marula fruit – relevant patent

- EP: Withdrawn with legal effect as of April 2017, no divisionals
- US: Granted, claims limited to treatment of atherosclerosis, no divisionals
- IL: Granted
- RSA: Granted as filed with PCT

Option 1: Proceed, and if challenged by applicant we point out invalidity of claims, and possibly ABS issues too; they may seek to license, but they're in a weak position
Option 2: Challenge in court – but expensive
Option 3: To discuss…

US008445040B2

(12) **United States Patent**
Borochov-Neori et al.

(10) **Patent No.: US 8,445,040 B2**
(45) **Date of Patent: May 21, 2013**

(54) **EXTRACTS OF *SCLEROCARYA BIRREA***

(75) Inventors: **Hamutal Borochov-Neori**, Eilat (IL); **Amnon Grinberg**, Kibbutz Yotvata (IL)

(73) Assignee: **Management and Holdings—Ardom**, D.N. Eilot (IL)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **12/867,756**

(22) PCT Filed: **Feb. 19, 2009**

(86) PCT No.: **PCT/IL2009/000192**
§ 371 (c)(1),
(2), (4) Date: **Aug. 16, 2010**

(87) PCT Pub. No.: **WO2009/104184**
PCT Pub. Date: **Aug. 27, 2009**

(65) **Prior Publication Data**
US 2010/0311828 A1 Dec. 9, 2010

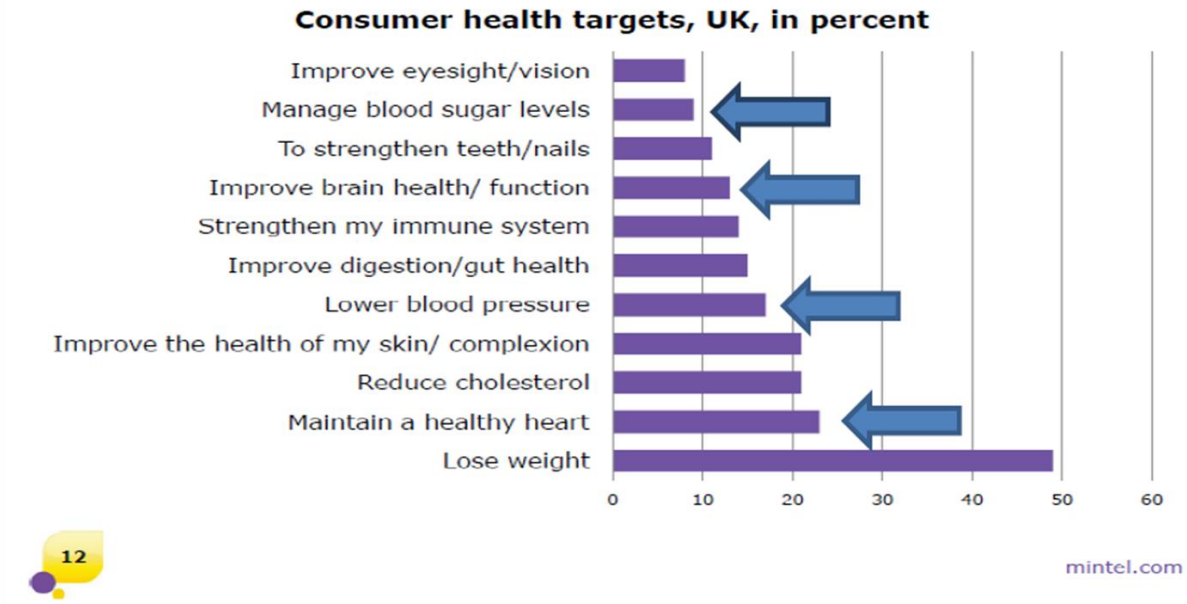
Fundira (J. Agric. Food Chem. (2002), vol. 50, pp. 1535-1542).*
Mason (Vascular Health and Risk Management (2011), vol. 7, pp. 405-416).*
Ndhlala (Food Chemistry (2007), vol. 103, pp. 82-87—available online Oct. 2006).*
Gorinstein (Journal of the Science of Food and Agriculture (2002), vol. 82, pp. 1166-1170).*
Emborg (Journal of Neuroscience Methods (2004), vol, 139, pp. 121-143).*
Mdluli, Kwanele, M., et al., "Enzymatic Browning in Marula Fruit 1: Effect of Endogenous Antioxidants on Marula Fruit Polyphenol Oxidase," Journal of Food Biochemistry, (2003), pp. 67-82, vol. 27.
Pretorius, Victor, et al., "Volatile Flavour Components of Marula Juice," Z Lebensm Unters Forsch, (1985) pp. 458-461, vol. 181.
Borochov-Neori, Hamutal, et al., "Phenolic Antioxidants and Antiatherogenic Effects of Marula (*Sclerocarrya birrea* Subsp. caffra) Fruit Juice in Healthy Humans," Journal of Agricultural and Food Chemistry, (2008), pp. 9884-9891, vol. 56.
Dimo, Théophile, et al., "Effect of *Sclerocarya birrea* (Anacardiaceae) stem bark methylene chloride/methanol extract on streptozotocin-diabetic rats," Journal of Ethnopharmacology, (2007), pp. 434-438, vol. 110.
Ojewole, John, A. O., "Evaluation of the Analgesic, Anti-inflammatory and Anti-diabetic Properties of *Sclerocarya birrea* (A. Rich.) Hochst. Stem-Bark Aqueous Extract in Mice and Rats," Phytotherapy Research, (2004) pp. 601-608, vol. 18.
International Search Report, International Publication No. WO 2009/104184 A3, International Application No. PCT/IL2009/000192, mailed on Oct. 28, 2009, 6 pages.

(57) **ABSTRACT**

Provided are extracts obtained from the marula fruit (*Sclerocarya Birrea*) and uses thereof in a great variety of applications, e.g., use in food supplements for engendering an anti-atherogenic effect in healthy and non-healthy subjects (humans and non-human animals) and as agents for treating or preventing various diseases and disorders.

Marula fruit and potential consumer health targets

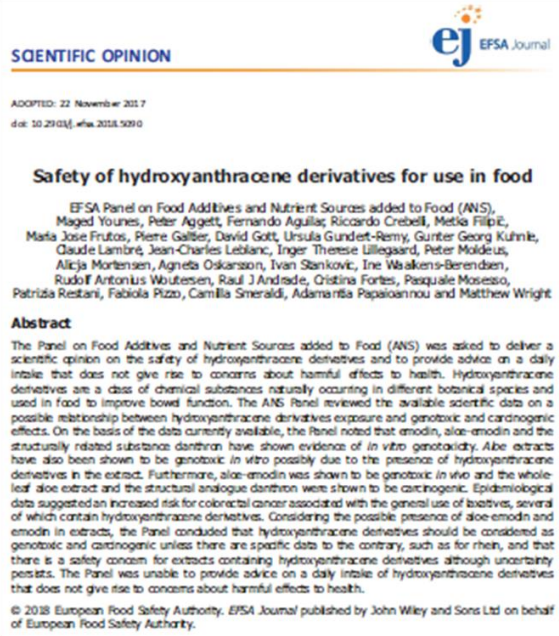
Figure 1: Possibilities for positioning marula fruit products in health sectors



Aloe ferox – market access regulatory issues

Aloe ferox: An initial market access and safety review, February 2014, PhytoTrade Africa, found numerous contradictory and uncertain positions for many product categories and territories. Usually the market access dossiers held by clients, not by producers in South Africa.

This means a whole category of products containing *Aloe ferox* could fall away – specialised advice required; project may need to focus of topical applications.



SCIENTIFIC OPINION

EFSA Journal

ADOPTED: 22 November 2017

doi: 10.2903/j.efsa.2018.5090

Safety of hydroxyanthracene derivatives for use in food

EFSA Panel on Food Additives and Nutrient Sources added to Food (ANS), Maged Younes, Peter Aggett, Fernando Aguilar, Riccardo Crebelli, Metka Filipič, Maria Jose Frutos, Pierre Galtier, David Gott, Ursula Gundert-Remy, Gunter Georg Kuhnle, Claude Lambré, Jean-Charles Leblanc, Inger Therese Lillegaard, Peter Moldeus, Alicja Mortensen, Agneta Oskarsson, Ivan Stankovic, Ine Waalkens-Berendsen, Rudolf Antonius Woutersen, Raul J Andrade, Cristina Fortes, Pasquale Mosesso, Patrizia Restani, Fabiola Pizzo, Camilla Smeraldi, Adamantia Papaioannou and Matthew Wright

Abstract

The Panel on Food Additives and Nutrient Sources added to Food (ANS) was asked to deliver a scientific opinion on the safety of hydroxyanthracene derivatives and to provide advice on a daily intake that does not give rise to concerns about harmful effects to health. Hydroxyanthracene derivatives are a class of chemical substances naturally occurring in different botanical species and used in food to improve bowel function. The ANS Panel reviewed the available scientific data on a possible relationship between hydroxyanthracene derivatives exposure and genotoxic and carcinogenic effects. On the basis of the data currently available, the Panel noted that emodin, aloe-emodin and the structurally related substance danthron have shown evidence of *in vitro* genotoxicity. *Aloe* extracts have also been shown to be genotoxic *in vitro* possibly due to the presence of hydroxyanthracene derivatives in the extract. Furthermore, aloe-emodin was shown to be genotoxic *in vivo* and the whole-leaf aloe extract and the structural analogue danthron were shown to be carcinogenic. Epidemiological data suggested an increased risk for colorectal cancer associated with the general use of laxatives, several of which contain hydroxyanthracene derivatives. Considering the possible presence of aloe-emodin and emodin in extracts, the Panel concluded that hydroxyanthracene derivatives should be considered as genotoxic and carcinogenic unless there are specific data to the contrary, such as for rhein, and that there is a safety concern for extracts containing hydroxyanthracene derivatives although uncertainty persists. The Panel was unable to provide advice on a daily intake of hydroxyanthracene derivatives that does not give rise to concerns about harmful effects to health.

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- MHRA – Products granted Traditional Herbal Registration (THR) which contain *A. ferox*
  - THR 00250/0220 Potter's Cleaning Herb Tablets
  - THR 00904/0005 Kerbina CASSILAX
  - THR 15670/0046 Napiers Sennamix Constipation Relief (specifies Cape Aloe leaf)
  - THR 15670/0044 Napiers Herbease Laxative Tablets (specifies Cape Aloe leaf)

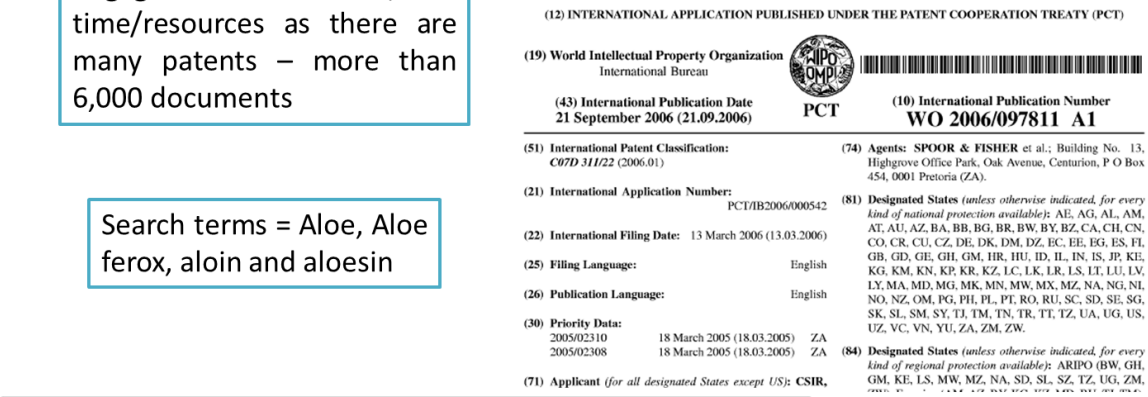
e derivatives, food supplements, genotoxicity, carcinogenicity, bowel tives

Aloe ferox – patent review

Not a definitive "freedom to operate" report as that requires a high level of engagement with sector, and time/resources as there are many patents – more than 6,000 documents

Results : Aloe = 6,000
Aloe ferox = 42
Aloesin = 36, 7 families
Aloin = 117, 1 family

Search terms = Aloe, Aloe ferox, aloin and aloesin



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(54) Title: METHOD FOR CONVERTING ALOERESIN A TO ALOESIN

(57) Abstract: The invention provides a process for hydrolytically converting aloeresin A to aloesin by the following reaction: The amount of aloesin available for extraction from sap of aloe plants is thereby increased and the extraction and purification of the aloesin is also made easier and less costly. As aloesin is more commercially valuable than aloeresin A, the process also increases the commercial value of the sap or aloe bitters from the aloe plant. The process optionally also includes the step of separating the aloesin from the p-coumaric acid. Typical hydrolysis steps that are used in the process are acid hydrolysis, base hydrolysis and enzymatic hydrolysis. In the case of acid hydrolysis, the acid is any suitable organic or inorganic acid, such as hydrochloric acid, sulfuric acid, nitric acid or phosphoric acid. In the case of enzymatic hydrolysis, the hydrolytic enzyme is typically an esterase, a lipase or a protease.

Many in Asia – skin lightening, numerous expired or dropped, worth looking at successful "Carrington family"

Recommendation on value chain selection

Based on reports presented in July and September: Project should now more towards requiring SMEs and/or their support organisations to convince project management that the fundamentals of their respective value chains they work in are operable, and for the project to focus on identifying those SMEs and support organisations with credible business propositions. This approach allows for other value chains and species to be included if there are credible business cases presented to the project by industry.

Aloe ferox – yes – pay attention to regulatory risk reference EFSA – good fit with GEF6/UNDP project

Marula – yes – momentum with other institutions - candidate for Component 1.1 – weakness = no trade association, time to impact?

Seed oil cluster – yes – good fit with UNIDO project, could add others like mafura at low additional cost?

Essential oil cluster – yes – good fit with UNIDO project

Consider: Moringa – MDASA, growing market, diversification / domestication prospects

Consider: Baobab – growing market, dynamic support by African Baobab Alliance

Consider: Myrothamnus – SME support, growing market for herbal teas

Honeybush tea: Market, SAHTA, HCP, Grounded