

Indigenous South African Medicinal Plants

Part 11: *Aspalathus linearis* ('Rooibos')

Cecilia van Niekerk (MSc Pharmaceuticals) and
Alvaro Viljoen (PhD), Department of Pharmaceutical Sciences, Tshwane University of Technology

Botany:

The Rooibos plant is a leguminous shrub native to the Cedarberg Mountains in the Western Cape region of South Africa.¹ The genus *Aspalathus* includes more than 200 species native to South Africa and the polymorphic species *A. linearis* (Family: Fabaceae) has various wild forms.² It has a strong taproot descending to 2 m or more and the branches are red-brown and about 60 cm long.³ The leaves are bright green and needle-shaped, 15 to 60 mm long and 0.4 to > 1 mm thick. The pea-shaped, yellow flowers are solitary or up to ten occur in racemes on the branch tips in early summer and are followed by single pods. Nodules of nitrogen fixing bacteria are found on the root systems and these bacteria convert nitrogen dioxide to biologically useful ammonia in a process known as nitrogen fixation.² The unfermented product remains green in colour, but changes to red with oxidation of the constituent polyphenols during fermentation.⁴

Traditional uses:

More than 300 years ago, the indigenous Khoi-Khoi tribe of the Cedarberg and Elephants river valley region of the Western Cape first discovered that the leaves of the Rooibos plant can be used as a tea, with an exceptional taste and aroma.¹ Marketing of Rooibos tea began in 1902 as a beverage beneficial to the human body, calming digestive disorders, reducing nervous tension and promoting sound sleep.³ In 1968,

Annie Theron, observed its ability to offer relief from colic and insomnia.⁵ Today, Rooibos tea is well known for its anti-oxidant activity and classified as a salubrious beverage.³ It is often used for children suffering from allergic skin conditions, such as eczema and nappy rash. In some of the rural black communities in South Africa, Rooibos tea is believed to enhance appetite and is thus very popular among mothers whose babies have difficulty breastfeeding.¹

Scientific studies:

Rooibos is famous for being naturally caffeine-free³ and its low tannin content minimises the risk of reduced iron absorption, a phenomena frequently found in tea drinkers due to iron-tannin complexation.^{2,3} Rooibos is rich in flavonoids, polyphenols, phenolic acids, oligosaccharides and polysaccharides.⁶ The major flavonoids found in Rooibos tea are aspalathin, iso-orientin, orientin and rutin.⁷ Aspalathin is a naturally occurring C-glycosyldihydrochalcone and found exclusively in *Aspalathus linearis*.^{8,9} It is the major monomeric flavonoid present in Rooibos and constitutes at

least 20% of the soluble material of the dried green leaves.¹⁰ Rooibos tea also contains various amounts of minerals and nutrients making it a health beverage ideal to use as fluid replacement for infants and athletes.³

During the normal processing of Rooibos tea, more than 93% of aspalathin is lost after the fermentation process.¹¹ Aspalathin undergoes cyclisation in the presence of oxygen and sunlight to form the flavanones 2,3-dihydro-iso-orientin and 2,3-dihydro-orientin, and with prolonged exposure to sunlight the flavanones convert to unknown brown products.¹² Dihydrochalcones are more effective antioxidants than their corresponding flavanones and this resulted in a decrease in the hydrogen-donating ability of the Rooibos tea with fermentation.¹¹

In recent years, extracts of both fermented and unfermented Rooibos have been tested for various biological activities. Both flavonoids and phenolic acids in Rooibos tea are powerful antioxidants and can be used to protect DNA from oxidative damage caused by peroxy radicals.¹³ Rooibos tea proved to have a mild estrogenic activity,⁷ inhibited tumour promotion in mouse skin¹⁴ and did not affect iron absorption significantly compared to ordinary tea.¹⁵ The polysaccharides from *A. linearis* almost completely blocked virus binding to the human MT-4 cells, however, none of the compounds in Rooibos tea have been found to have activity in clinical use on patients with HIV infection.¹⁶ Although Rooibos is sold internationally as a health drink, it has rarely been used outside South Africa as a cosmetic raw material. The skin is the largest organ of the body and is exposed to environmental oxidative stress. The incorporation of



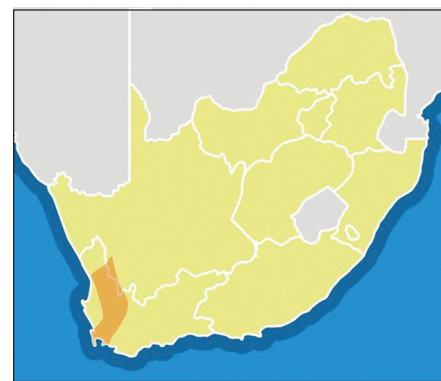
Harvesting of *Aspalathus linearis* near Clamwilliam. [photo: © Jeffrey Barbee/jeffbarbee.com]



A mature Rooibos plant (*Aspalathus linearis*). [photo: © Jeffrey Barbee/jeffbarbee.com]



The needle-like leaves and pea-shaped yellow flowers of *Aspalathus linearis*. [photo: © Jeffrey Barbee/jeffbarbee.com]



The natural distribution (orange) of *Aspalathus linearis* in South Africa.

Rooibos extracts in topical cosmetic formulations has become very popular in recent years because it can target the site of action to reduce ultraviolet radiation damage and photo-aging.¹⁷ Rooibos proved to exhibit anti-inflammatory and antimicrobial properties in cosmetic applications and hair growth and condition were improved with the use of hair care products containing Rooibos.¹⁸ Very recent studies conducted by Huang *et al* investigated the *in vitro* transport of aspalathin. The results obtained from the percutaneous permeation studies demonstrated that only 0.01% of the initial aspalathin concentration permeated through the skin.¹⁹

Surveys conducted by Oldewage-Theron *et al* showed that brewed Rooibos tea was one of the ten most frequently consumed foods in an informal settlement in the Vaal Triangle, South Africa.²⁰ Many indigenous people cannot afford the modern pharmaceuticals and thus rely on traditional remedies and herbal beverages for their various curative properties. These diverse natural resources, combined with indigenous knowledge of the uses of the flora gives bio-diverse developing countries a significant comparative advantage in the market for natural medicine and related health products.²¹ □

References:

1. Agribusiness in Sustainable Natural African Plant Products. s.a. Crop profile: Rooibos. http://www.asnapp.org/resources/plantlist/plantlist_download.php?id=15 Date of access: 7 April 2008.
2. Erickson, L. 2003. Rooibos tea: Research into antioxidant and antimutagenic properties. *The Journal of the American Botanical Council*, 59:34-45. Retrieved from <http://content.herbalgram.org/wholefoodsmarket/herbalgram/articleview.asp?a=2550&p=Y> Date of access: 7 April 2008.
3. Morton, J.F. 1983. Rooibos Tea, *Aspalathus linearis*, a caffeineless, low-tannin beverage. *Economic Botany*, 37(2):164-173.
4. McKay, D.L. & Blumberg, J.B. 2007. A review of the bioactivity of South African Herbal Teas: Rooibos (*Aspalathus linearis*) and Honeybush (*Cyclopia intermedia*). *Phytotherapy Research*, 21:1-16.
5. Annique. s.a. The Rooibos Story. <http://www.rooibos.com> Date of Access: 30 January 2007.
6. Dos, A., Ayhan, Z. & Sumnu, G. 2005. Effects of different factors on sensory attributes, overall acceptance and preference of Rooibos (*Aspalathus linearis*) tea. *Journal of Sensory Studies*, 20:228-242.
7. Shimamura, N., Miyase, T., Umehara, K., Warashina, T. & Fujii, S. 2006. Phytoestrogens from *Aspalathus linearis*. *Biological and Pharmaceutical Bulletin*, 29(6):1271-1274.
8. Koeppen, B.H. and Roux, D.G. 1965. Aspalathin: a novel C-glycosylflavonoid from *Aspalathus linearis*. *Tetrahedron letters*, 39:3497-3503.
9. Koeppen, B.H. 1970. C-glycosyl compounds in rooibos tea. *Food Industries of South Africa*:49, Apr.
10. Koeppen, B.H. 1963. Isolation and partial characterisation of aspalathin, the principle phenolic constituent of unfermented rooibos tea (*Aspalathus acuminatus*). *South Africa Journal of Laboratory and Clinical Medicine*:141-142, Sept.
11. Von Gadow, A., Joubert, E. and Hansman, C.F. 1997. Comparison of the antioxidant activity of rooibos tea (*Aspalathus linearis*) with green, oolong and black tea. *Food Chemistry*, 60(1):73-77.
12. Koeppen, B.H. and Roux, D.G. (1966) C-glycosylflavonoids. The chemistry of aspalathin. *Biochemistry Journal*, 99:604-609.
13. Lee, E.-J. & Jang, H.-D. 2004. Antioxidant activity and protective effect on DNA strand scission of Rooibos tea. *BioFactors*, 21:285-292.
14. Marnewick, J., Joubert, E., Joseph, S., Swanevelder, S., Swart, P. & Gelderblom, W. 2005. Inhibition of tumour promotion in mouse skin by extracts of Rooibos (*Aspalathus linearis*) and Honeybush (*Cyclopia intermedia*), unique South African herbal teas. *Cancer Letters*, 224:193-202.
15. Hesselting, P.B., Klopper, J.F. & Van Heerden, P.D.R. 1979. Die effek van Rooibostee op ysterabsorpsie. *SA Mediese Tydskrif*, 631-632, 14 Apr.
16. Nakano, M., Itoh, Y., Mizuno, I. & Nakashima, H. 1997. Polysaccharide from *Aspalathus linearis* with strong anti-HIV activity. *Bioscience, Biotechnology & Biochemistry*, 61(2):267-271.
17. Mavon A., Raufast, V. and Redoulès, D. 2004. Skin absorption and metabolism of a new vitamin E produg, γ -tocopherol-glucoside: *in vitro* evaluation in human skin model. *Journal of Controlled Release*, 100: 221-231.
18. Tiedtke, J. & Marks, O. 2002. Rooibos – The new “white tea” for hair and skin care. *Euro Cosmetics*, 6:16-19.
19. Huang, M., Du Plessis, J., Du Preex, J., Hamman, J. & Viljoen, A. 2008. Transport of aspalathin, a rooibos tea flavonoid, across the skin and intestinal epithelium. *Phytotherapy Research*, 22:699-704.
20. Oldewage-Theron, W.H., Dicks, E.G., Napier, C.E. & Rutengwe, R. 2005. Situation analysis of an informal settlement in the Vaal Triangle. *Development Southern Africa*, 22(1):13-26.
21. Ismail, Z. & Fakir, T. 2004. Trademarks or trade barriers? *International Journal of Social Economics*, 31(1/2):173-194.