

# **Natural Product network in Africa and their contribution to regional and interregional cooperation**

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# Why do so many networks on '**Natural Products**' exist on the continent?

'Natural Product' encompass Biodiversity related issues:

- Medicinal Plants
- Food Plants (Agriculture-related, Under-Utilised plant species)
- Marine products
- Etc.

One straightforward answer would be: ***Natural Products have a direct bearing on livelihoods***

By addressing the fields of '**Natural Products**', a few MDGs can be addressed: **Access to medicines, Poverty reduction, Access to food etc.**

## Networks operating in the field of Natural Products: both formal and informal

- NAPRECA
- PROTA
- AAMPS
- IFS
- WANPRESS
  
- FAO (CARENESA)
- NUSESA
- RUFORUM

# Natural Product Research in Africa - NAPRECA

- Isolation and characterization of bioactive molecules from Plants (including Medicinal Plants), Fungi, Marine organisms etc..

## **Applications would involve:**

- Development of new medicines either th' synthesis in the search for new leads or else act as 'marker molecules for the validation of standardized plant extracts
- Isolation and synthesis of marker molecules
- Characterization of essential oil composition
- Academic synthesis challenge
- Applications in veterinary medicines

**NAPRECA:** Imparts training & capacity building in young scientists in the field of Natural Products

# Plant Resources of Tropical Africa (**PROTA**)

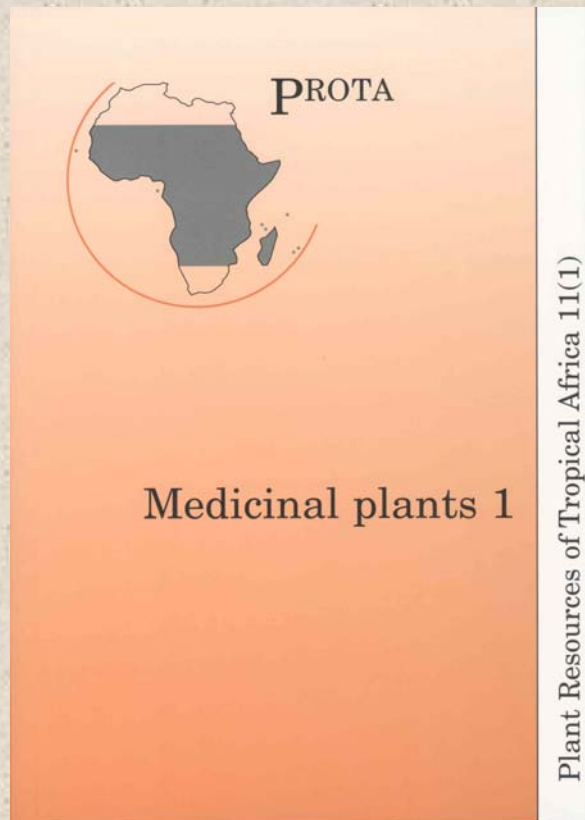
## Scope of the Medicinal Plants Commodity Group

**Commodity Group** 'Medicinal plants of Tropical Africa' (PROTA 11): Largest group to be treated by **PROTA** (estimated 2,800 species treated in 4 volumes)

It will contain about **700 comprehensive** illustrated articles, **700** shorter articles on lesser-known species and shortly mention about **1400** poorly known medicinal plant species.

- Each volume will highlight traditional and modern uses, phytochemical and pharmacological properties, will describe most convenient collection (harvest), cultivation and application methods, and will indicate the research and conservation status of the plants.

The first volume: 700 species in 375 manuscripts.



**Gaby Schmelzer & Ameenah Gurib-Fakim**  
**Co-Editors of the Medicinal Plants Series**

## **Medicinal Plants: Important arsenal to address health issues**

**WHO:** 80% of the world's population depend on medicinal plants for their primary health care

**In the Plant Kingdom:** Medicinal plants form the largest single grouping of plants. It is estimated that 30,000 species worldwide fall in this group, of which around 33% are trees.

Tropical & Subtropical Africa has 40-45,000 higher plant species that potentially hold considerable industrial value. This represents ***at least 25% of the global pool of plant genetic resources and has contributed significantly to the world's trade in genetic material.***

## **Contribution:** African Traditional Medicine to Modern Medicine

It is a fact that ancient African Healers had an elaborate *materia medica* and which consisted of mixtures of herbs, animal parts, minerals and clays...

The Eber's Papyrus – one of the oldest in Medical literature, listed several recipes used by the ancient African Healers

The list was dominated by numerous food items with the belief that “for every disease to which men are liable is occasioned by the substances whereon they feed”...

In Traditional African Medicine, many food plants are used for therapeutic purposes and medicines are not viewed as ‘necessary poisons which cure only at low doses!

Most unfortunate ironies of Herbal Medical Practice is that while African Medicine consists primarily of herbs and health foods, Modern Herbal Producers and phytopharmaceutical manufacturers seldom, if ever, include African Medicinal plants in their list!

**WHY? And yet there is no shortage of potent African Plants!!**

**Modern Pharmacopeia:** Madagascar Periwinkle, Calabar bean, Strophanthus, Salix, Kola, African Rauwolfia, Devil's Claw etc...

One of the issues highlighted by various networks:

**Documentation** is therefore a **priority** especially when conservation is also becoming an issue

Estimate show that the continent has 216 634 000 ha of closed forest areas.

- Calculated loss of 1% (Global rate is 0.6%) due to deforestation – direct implication is that **Many Medicinal Plants** will become extinct even before they are documented!

This makes Africa as having the **HIGHEST** rate of deforestation in the world.

## **Diversity in Sub-Saharan African and the Indian Ocean Islands**

Loss of plants also means loss of accompanying traditional knowledge.

Another underlying feature is that over 5.000 plants are known to be used medicinally. Yet so few are described and have been studied!

# *Harpagophytum procumbens* Devil's claw



**Traditional uses: Root:** treat sores, boils & general medicine for range of ailments

**Active ingredients:** Harpagosides, harpagide, procumbide & their cinnamic or coumaric acid esters



**Modern medicine: Clinical studies:** Benefits in the treatment of rheumatic conditions & low back pain

## Lesser known but Important African plants

- *Adansonia digitata*  
(Baobab)



*Cyclopia genistoides*  
(Honey bush)



*A. meleguata* (Grains  
of Paradise)



To date Africa has only contributed **83** of the world's **1100** leading commercial medicinal plants and which are of African origin.

Yet with so much potential and diversity in terms of plant resources – why is Africa ‘absent’ from the international scene?

However, is the absence of African Medicinal Plants on the market **ONLY** due lack of detailed study?

The answer lies elsewhere

The potential for the business and agricultural sectors is enormous but Africa will lag behind unless African countries prepare internationally recognised medicinal plant standards.

The **Medicinal Plants Forum** for Commonwealth Africa, Cape Town (2000), has shown that

Lack of **suitable technical specifications** and **quality control standards** for African Medicinal Plants and herbal medicines.

Lack of standards considered to be a **major barrier** to **regional** and **international trade** and an important reason why traditional medicine has not been widely integrated into the the African primary health care.

Lack of **official recognition from governments** generally have been the major handicap to what can be an important business for the continent.

# Association of Medicinal Plants Standards (AAMPS)

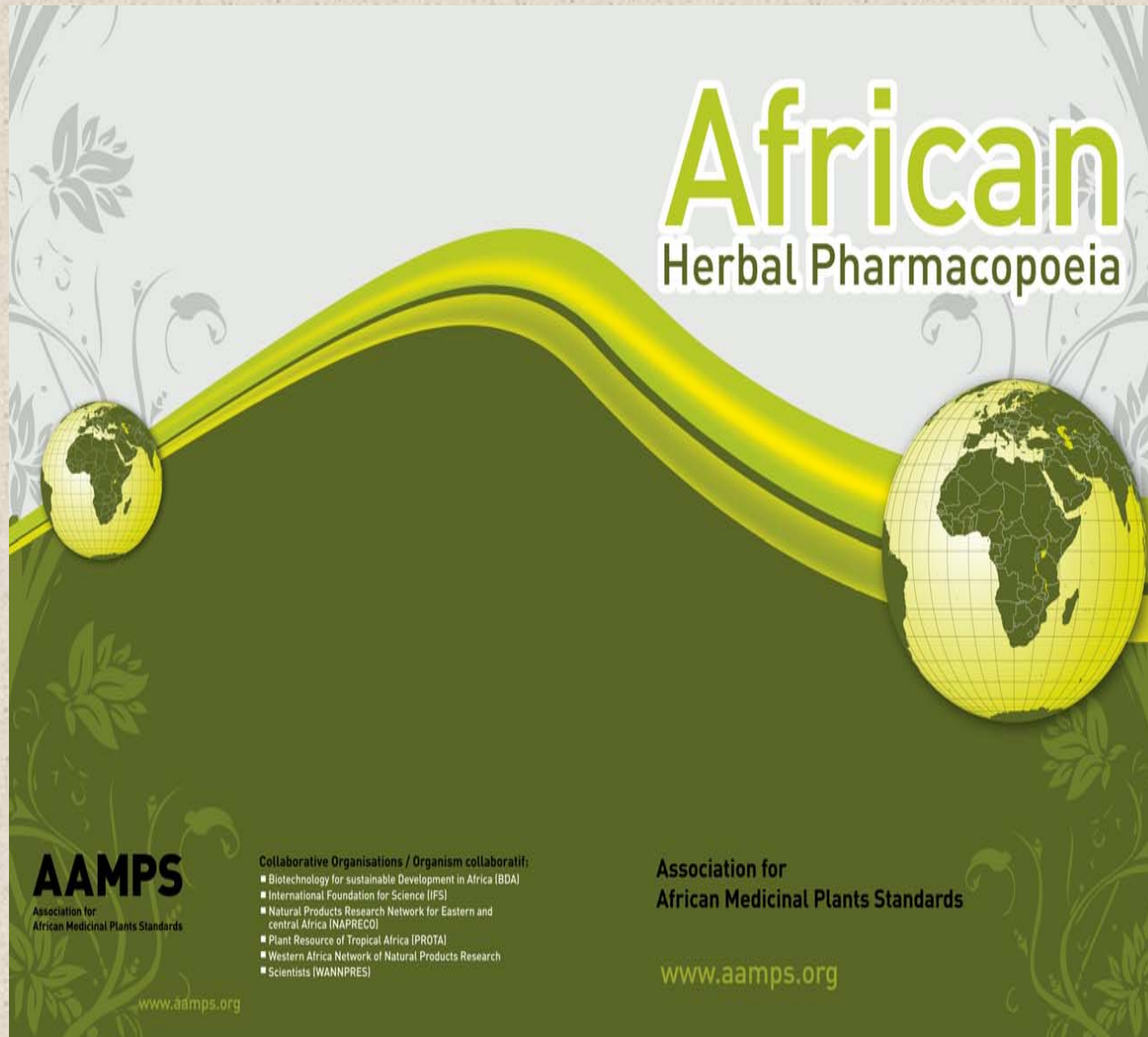
**AAMPS:** The company: Registered as a Non-Profit company registered in Mauritius & dedicated to the development of quality control & quality assurance for African Medicinal Plants and Herbal Products

One of the first objectives of AAMPS is to develop the:

**African Herbal Pharmacopeia**

**(AfrHP)**

# Book Cover - AfHP



How can the work of **AAMPS network of scientists** influence Policy vis a vis the use and mainstreaming of medicinal plants in health systems ?

Network between scientists of the North and those of the South especially on the African continent

Pan African contribution on the writing of monographs; but assays being centralised around one accredited laboratory – South Africa

**50** Important medicinal plants from the continent will make up the first volume of the African Pharmacopeia – with emphasis on trading standards!

## Pelargonium sidoides DC.

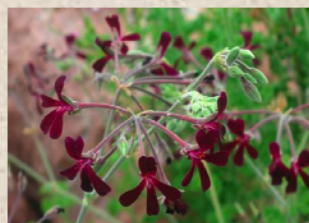
### GENERAL DESCRIPTION

Scientific Name: *Pelargonium sidoides* DC.

Synonyms: None.

Family: Geraniaceae

Vernacular Names: *Pelargonium sidoides* (English); *Pelargonium sidoides* (French); Umckaloabo (German); *Pelargonium sidoides* (Italian).



*Pelargonium sidoides* flowers (© Plantaphis)

Possible Alternative Source Species: none

### ETHNOBOTANICAL INFORMATION

**Major Ethnopharmacological Uses:** The traditional medicinal uses of *Pelargonium sidoides* are poorly recorded. The plant is traditionally used by Zulu people to treat gonorrhoea, diarrhoea and dysentery. A large number of *Pelargonium* species with tuberos rhizomes are used in traditional medicine against diarrhoea and dysentery, and only this use is well documented (Watt & Breyer-Brazdewijk 1962, Fudus 1986, Hutchings et al, 1996, Van Wyk et al, 1997).

Other Relevant Uses: none

### CHEMICAL CONSTITUENTS

**Composites:** The dried rhizomes contain at least eight different coumarins, of which umckalin and 5,6,7-methoxycoumarin are considered to be useful marker compounds (Kaysner & Kolodziej, 1994, 1995, 1997; Kolodziej & Kaysner, 1998; Kaysner et al, 2001). The herb also contains gallic acids and methyl esters of gallic acids, as well as flavonoids (quercetin), flavan-3-ols (catechin, gallicocatechin) and phytosterols (sitosterol-3-glucoside). Above-

**Botanical Description:** A small perennial herb with tuberos rhizomes, rounded to heart-shaped and slightly silky leaves on long petioles, and small tubular flowers that are dark maroon red to almost black. The closely related *P. roseiflorum* is morphologically very similar but has pink flowers (Van der Walt 1977, Van Wyk & Wink 2006).

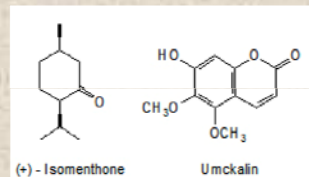
**Origin and Distribution:** Eastern parts of southern Africa (Eastern Cape Province, KwaZulu-Natal and Lesotho).

**Plant Part Used:** Dried tuberos rhizomes.



*Pelargonium sidoides* root, dried and cut (© Plantaphis)

ground parts contain a wider diversity of phenolic compounds but no coumarins. Minor phenolics such as isomenthone (common in *Pelargonium* species) appear to be absent. A comprehensive study of all the chemical constituents of both underground and aerial parts of *P. sidoides* and *P. roseiflorum* has been carried out by Kolodziej (2007).

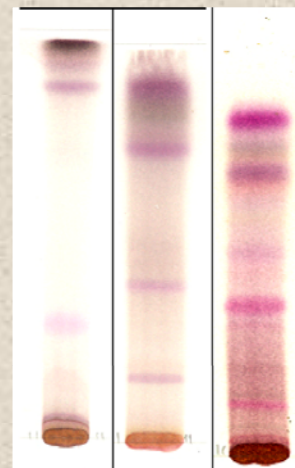


### QUALITY CONTROL

**TLC / HPLC / GC:** Extractability of dried material water, ethanol and acetone concentration in mg/ml from 1 g of plant material:

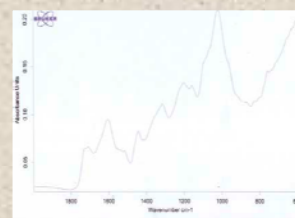
| extractant  | water | ethanol | acetone |
|-------------|-------|---------|---------|
| mg/g        | 86    | 72      | 48      |
| % extracted | 8.6   | 7.2     | 4.8     |

General TLC systems for coumarins can be used. No specialised systems for HPLC analysis appear to have been published.



Solvent systems from left to right:  $CH_2Cl_2$ , EtOAc, EtOH. The separation polar compounds, intermediate polarity compounds and non-polar compounds. Densitometric results available on request.

### NMR Spectroscopy



**Adulterants and Adulterations:** The dried product may be adulterated with the very similar-looking *P. roseiflorum*. Morphological distinction of the dried product is extremely difficult, so that chemical analysis is the only reliable method. Whereas *P. sidoides* contains umckalin and its 7-O-methyl ether (=5,6,7-trimethoxycoumarin) as major constituents, these are characteristically low or absent in *P. roseiflorum*.

**Standard Preparations:** EP® 7630.

African Herbal Pharmacopoeia (2006) - *Pelargonium sidoides*

Standard specifications (WHO, 1998)

### Microbiology:

*Solanum* spp. – negative  
*Escherichia coli* – negative  
 Acidic bacteria – not more than 10<sup>5</sup>/g or ml  
 Fungi – not more than 10<sup>4</sup>/g or ml  
 Enterobacteria and Gram-negative bacteria – not more than 10<sup>3</sup>/g or ml  
 Total ash: Not more than 5%  
 Acid-insoluble ash: Not more than 1%  
 Water-soluble extractive: Not less than 20%  
 Foreign matter: Not more than 2%  
 Pesticide residues: In accordance with national requirements. Aldrin and dieldrin – not more than 0.05 mg/kg.  
 Aflatoxins (B<sub>2</sub>, G<sub>1</sub>, G<sub>2</sub>, and B<sub>1</sub>): 4 ppb  
 Heavy metals: Lead in final dosage form – not more than 5 ppm, cadmium in final dosage form – not more than 0.3 mg/kg.

### PHARMACOLOGICAL PROPERTIES

Evidence for immune stimulation (Kaysner et al, 2001), NO induction (and antibiotic effects of the proprietary substance Umckaloabo have been published (Kaysner & Kolodziej, 1997; Kolodziej et al, 2003). Recent studies showed significant effects on nasal epithelial cells (Nemphauer et al, 2005) and against mycobacteria (Seidel & Taylor, 2004). The antibacterial and antiviral effects are attributed to gallic acids and other phenolic compounds, whereas the immunomodulatory activity is considered to be due to a combination of phenolic compounds and the numerous coumarins (umbelliferone and derivatives). For a comprehensive review of the known biological activities of *P. sidoides* see Brandler and Van Wyk (2006).

**Clinical Studies:** A total of 18 clinical trials have thus far been conducted, several of which were randomised, double-blind and placebo-controlled. EP® 7630, an extract of *P. sidoides*, has been shown to effectively shorten the severity and duration of acute bronchitis and tonsillopharyngitis, most notably in children. Several other randomised, double-blind, placebo-controlled studies of special extracts on children and adults have followed (Bosman et al, 2003; Heidvogel et al, 1996; Matthys et al, 2003). For a review of the clinical evidence see Agulhasika et al (2006) and Brandler and Van Wyk (2006).

**Pharmacokinetic Properties:** not investigated.

### SAFETY DATA

**Single Dose Toxicity:** Overall safety and a very low incidence of side effects have been confirmed (Coudat et al, 2007). An unpublished human shrimp test indicated complete safety. The observational study mentioned above (Heidvogel et al, 1996) also

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African Herbal Pharmacopoeia (2006) - *Pelargonium sidoides*

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indicates safety (very low incidence of side effects – only eight out of 742 patients).

**Clinical Safety Data:** Safety has been investigated in numerous clinical trials (see Clinical Studies) and was found safe for use in adults and children with a minimum number of adverse effects reported.

#### KEY USAGE

**Therapeutic Indications:** Acute bronchitis in children and adults.

**Dosage, Method and Duration of Administration:** Ethanolic extracts are used in a proprietary herbal tincture known as Unikalsin. The recommended dose of EP® 7630, a root extract from *F. sibirica*, for adults and children over the age of 12 years, is 30 drops (1.5 ml) three times per day for 7 days. Children aged 6-12 years may take 20 drops (1.0 ml) three times per day. Indications or contraindications are traditionally used, but dosage information on the crude herb is not available.

**Contraindications:** A theoretical risk of interaction with anticoagulants and antiplatelet drugs could not be confirmed.

**Special Warnings and Precautions for Use:** Can be safely consumed when used appropriately. A total of 34 case reports of allergic (hypersensitivity) reactions have been recorded through the WHO's pharmacovigilance programme, which may be associated with the use of *Polygonum sibiricum* extract, all originating from Germany (De Boer et al., 2007).

**Pregnancy and Lactation:** The extract of *F. sibirica* root (EP® 7630) is contraindicated during pregnancy and lactation, as no specific data on its effect on pregnant or lactating women are available.

**Evaluation of Efficacy:** Acute bronchitis in children and adults: efficacy clinically proven (Special extract) (Rundler & von Wyk, 2008).

#### TRACE INFORMATION

**History of plant material:** Conservation status: not listed. Origin: Eastern Cape Province. Most of the material is still wild crafted, but crop development has progressed to a point where significant quantities of raw material will soon be produced from cultivated plants. The plant flowers over a long period during the summer months. Harvesting usually takes place after the end of the growing season.

**Processing and storage:** The tubercous rhizomes are simply sliced and dried. Rapid life drying

yields a better-quality product. Stability of product: Unknown.

#### REGULATORY INFORMATION

**Pharmacopoeias / Monographs:** *Polygonum sibiricum*. Eur. European Pharmacopoeia 6.0 2008, 01/2008:2264 corrected 6.0, 2023.

**Regulatory / Registration Status:** Licensed as a herbal medicine with full drug status in Germany, as traditional herbal medicine in the UK.

**Patents:** Proprietary extracts of *Polygonum sibiricum* and their preparations are to date protected by a total of seven patents in various countries (WO/2006/028746, WO/2006/028737, EP1684773 - 2006, WO/2006/028718, EP1829548 - 2007, WO/2007/009446, EP1878484 - 2008).

#### REFERENCES

- Aphahisa, T.S., Gna, R., Ernst, E. (2006). *Polygonum sibiricum* for acute bronchitis: A systematic review and meta-analysis. *Phytotherapy* 15, 378-385.
- Bewany VV, Riley DS, Wimmer G, Hager M (2003). Efficacy of extract of *Polygonum sibiricum* in children with acute non-group A beta-haemolytic streptococci tonsillopharyngitis: a randomized, double-blind, placebo-controlled trial. *Alten Ther Health Med* 9(5): 66-79.
- Rundler, T., von Wyk, R.-E., A historical, scientific and commercial perspective on the medicinal use of *Polygonum sibiricum* (Guttiferaceae). *Journal of Ethnopharmacology* (2008), doi:10.1016/j.jep.2008.07.037.
- Conrad, A., Krolodziej, H., Scholz, V., 2007. [*Polygonum sibiricum*-extract (EP® 7630): registration confirms efficacy and safety]. *Wiener Medizinische Wochenschrift* 127, 331-336.
- De Boer, H.J., Hagemann, U., Bots, J., Meyboom, R.H. 2007. Allergic reactions to medicine derived from *Polygonum* species. *Drug Safety* 30, 677-680.
- European Pharmacopoeia, 2008. *Polygonum sibiricum*. *European Pharmacopoeia* 6.0 2008, 01/2008:2264 corrected 6.0, 2023.
- Periss VS (ed.) (1986) *Carl Peter Thunberg Travels at the Cape of Good Hope 1772-1775*. Van Riebeeck Society, Cape Town.
- Haldvogl M, Schuster R, Hager M (1996) *Altra Bronchitis im Kindesalter*. *Zeitschrift für Phytotherapie* 17: 1-8.
- Hutchings A et al. (1996) *Brit. Medicinal Plants*. Natal University Press, Pietermaritzburg, p. 149.
- Kapser G, Krolodziej H (1994) P14 Constituents from traditionally used roots of *Polygonum sibiricum*

# International Foundation of Science (IFS)

**IFS:** active on the African continent for the past 30 yrs, building capacity in the field of Natural Products Research

In order to ensure even more relevance of the network, AAMPS and IFS have decided to put in place the AAMPS/IFS Fellowship programme

- To **develop a network** of young African scientists and researchers
- To **stimulate** African based applied research in the field of **quality assurance** and **standardisation** of African medicinal plants and plant-based natural products
- Research subjects will primarily focus on **filling knowledge** gaps with regards to plants selected for AAMPS Monographs in terms of their botany, phytochemistry, pharmacology, traditional and modern uses as well as their safety and efficacy.

The range & diversity of research publications coming from institutions in Africa highlight the diversity and importance of the research taking place.

Some of the work done by Africans on African biodiversity have taken centre stage recently!

In **2004**: Dr. Monty Jones invented NERICA and was awarded the prestigious World Food Prize.

- Pioneering effort at recapturing the genetic potential of ancient African rices and offering hope to millions in West Africa by starting agricultural transformations there.

In **2009**, the World Food Prize has gone to the Prof. Gebista Ejeta – for his work on Sorghum hybrid resistant to drought and the devastating Striga weed – hence ensuring food supply of hundreds of millions of people in Sub-Saharan Africa.

## When will we see the equivalent of the WFP in Natural Product Research?

The potential of African plants have times and times again been recognised and near break throughs have been reached but many mired in controversy

There was the **Hoodia** case



**Hoodia:** used by the San People as a substitute for food & water

Work was done by CSIR and later licenced patent to PhytoPharm plc. Drug material approved for clinical trial.

Phytopharm then licensed the patent to Pfizer for further development and commercialization

**2002:** CSIR officially recognized the San tribes people's rights over Hoodia, allowing them to take a percentage of the profits and any spin-offs resulting from the marketing of Hoodia.

**2004:** Phytopharm sub-licensed to Unilever for development into a food ingredient for weight management

**End 2008:** Unilever cancelled the programme as it is claimed that Hoodia did not meet safety and efficacy requirements!

Is the Hoodia story over? ..... Time will tell

Another example is the *Swartzia madagascariensis* which shows not only molluscicidal properties but also anti-malarial activity. Observations made in Burkina Faso and Zimbabwe

***Swartzia madagascariensis***: initially antimalarial, then came the observation that this plant has molecules with potent antifungal properties against thrush/feet fungi

Unfortunately the patent that was deposited in Switzerland was for anti-fungal properties especially against athlete foot and thrush

## Legal system

Where net workings help the African scientists build capacity, the poor legal framework present in most countries are handicaps to these products developing into patentable products.

There are so many examples of 'failed attempts to derive benefits from local biodiversity'.

One such example is the eloquent headline of the 'Wall Street Journal'

**Bitter remedies:** The search for plants that heal generates international feuding' (2001)!

While the business around plant products is measured in billions of dollars, the intellectual property laws are vague on the subject of local plants & traditional medicinal recipes

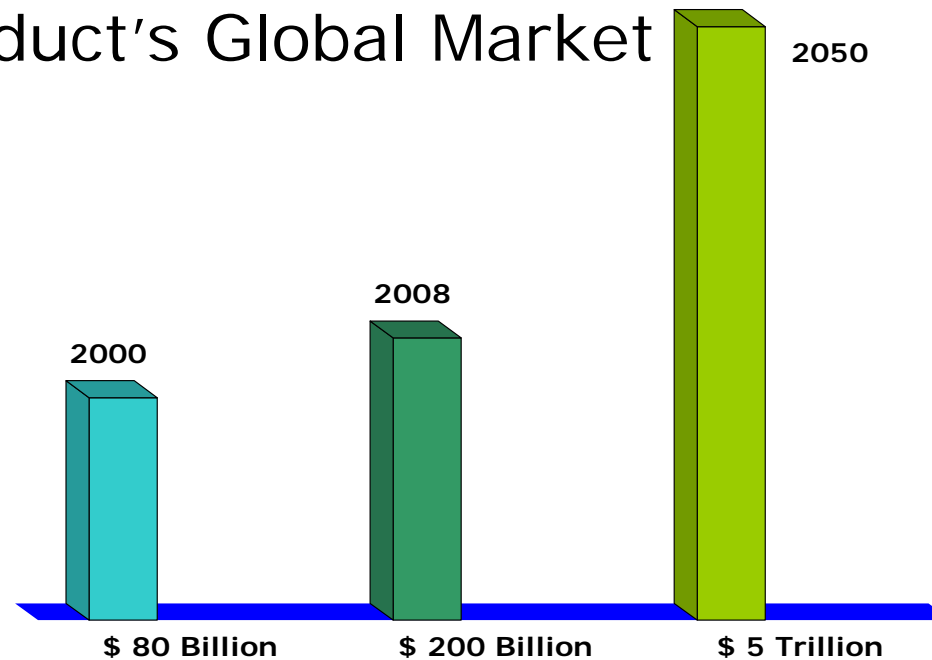
International laws offers conflicting intellectual-property rules; and the CBD which favours the developing world, has no enforcement mechanism.

Leaning on the other side, the WTO protects the property rights of whoever seeks a patent first – often big companies!

This is an area that networking MUST address as a matter of urgency if research & traditional knowledge are to work for the country and generate the riches that developing countries need and deserve

Is the legal system of African countries, *inter alia*, strong enough to defend the cause?

## Expected Growth in Natural Product's Global Market



**Global sales of herbal products, including herbal medicines, is already over \$100 billion and expected to cross over \$ 1 trillion in next 20 years with the present growth rate.**

## How can networks help?

Over and above sustaining capacity building and creating awareness:

In the field of Natural Products, one area that networks should promote actively is the **DOCUMENTATION** of traditional knowledge

**Documentation** constitutes prior art in this area and recognised by WIPO/WTO

Countries should re-look at their laws and ensure that they are WTO / TRIPs compliant if they are to benefit from their own biodiversity

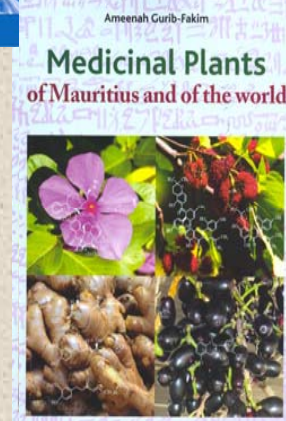
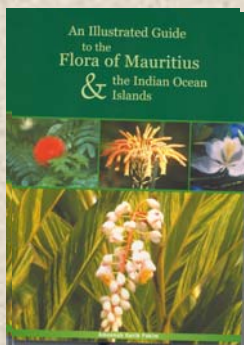
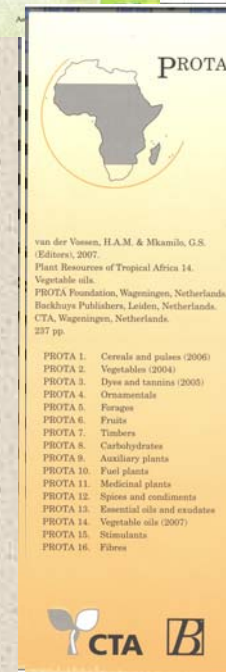
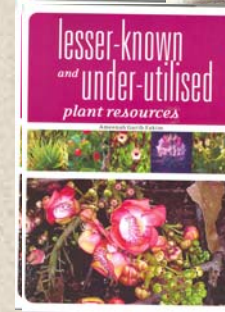
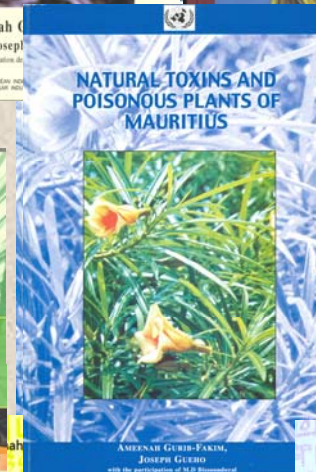
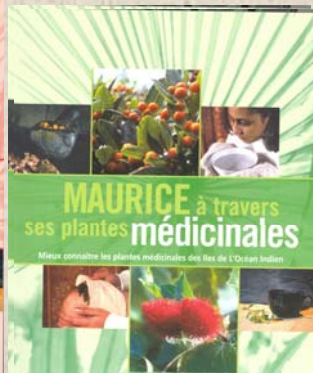
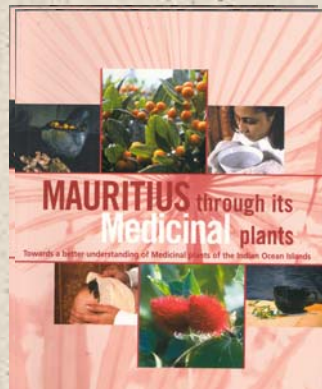
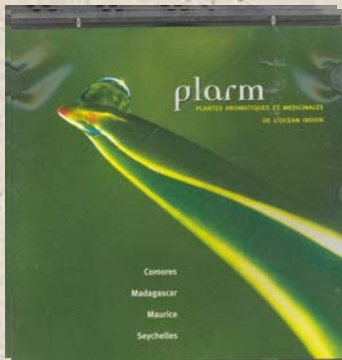
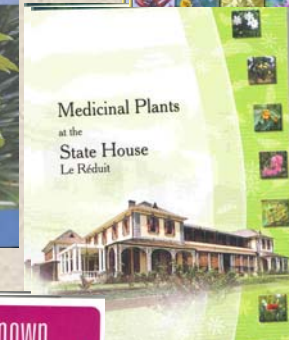
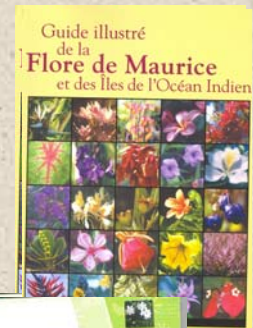
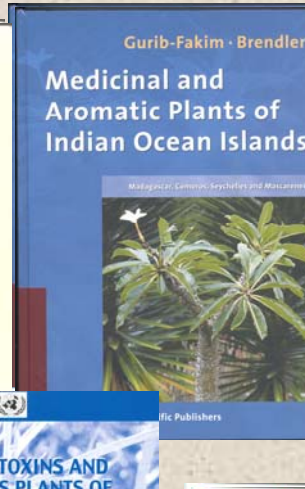
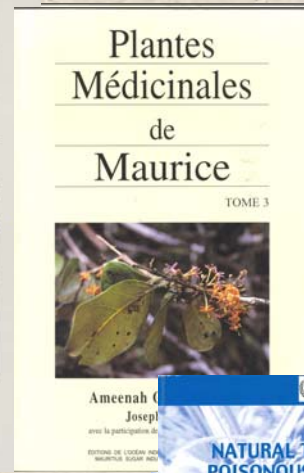
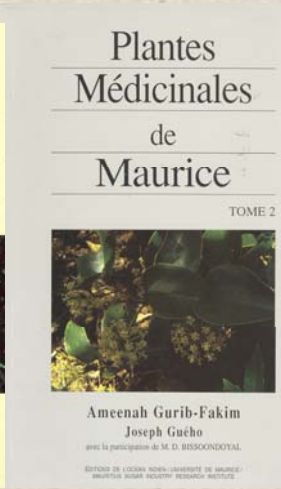
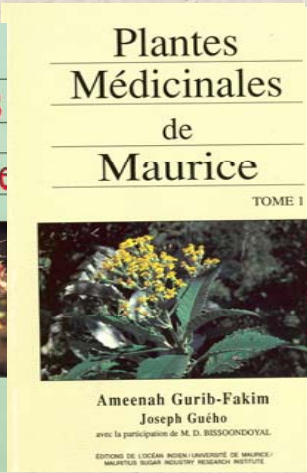
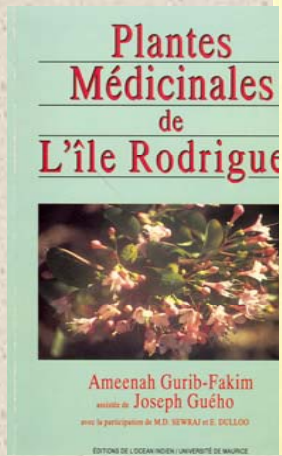
Another important piece of work that is being done at the moment on Biodiversity-medicinal plant related theme is the following:

***Green Gold: Success stories on the commercialisation of medicinal plants from the SADC region***

This work is important as it will again highlight the potential that African Plants present not only to Medicine but also in terms of other applications: Cosmetics, Fortified Foods etc.

10 Plants will be addressed here in the first instance and the book will be presented at the forthcoming conference in Pretoria in September 09.

# Another important network – Our own constituency!



# Acknowledgement



I thank you for your attention!!