

# BIOPROSPECTING RESEARCH

## A case study

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The logo for the Council of Scientific and Industrial Research (CSIR) is displayed in a dark blue, stylized font. The letters are bold and interconnected, with the 'S' and 'I' being particularly prominent.

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# Convention on Biological Diversity

## -three central principles:

- conservation of biological diversity
- sustainable use of its components
- fair and equitable sharing of the benefits arising out of the utilization of genetic resources

# Bioprospecting: a definition

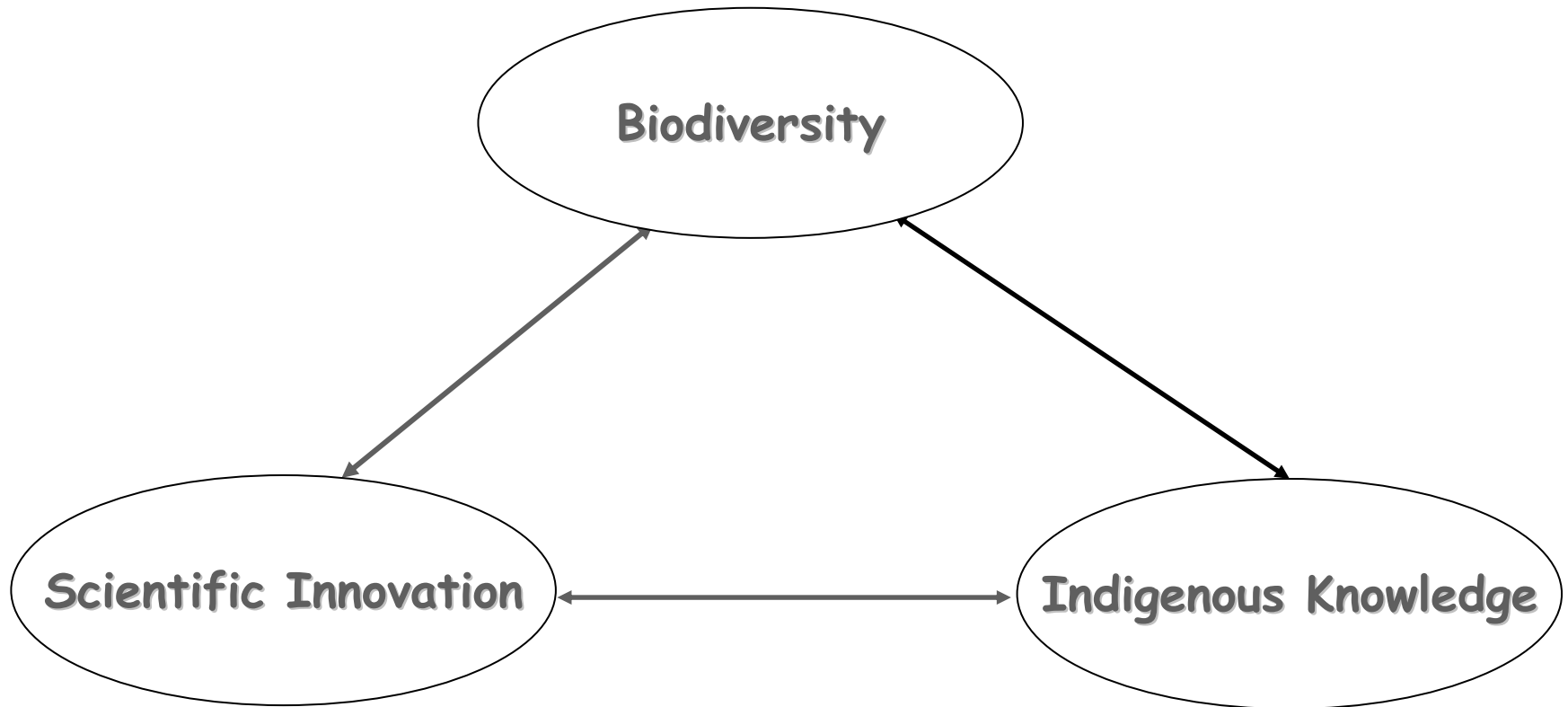
'The search and sustainable use of chemical and genetic components of biodiversity'

# CSIR Vision for Bioprospecting

*Create economic and social benefit for the nation and the region based on its biodiversity and indigenous knowledge*

Add maximum value to bio-resources through consortium-based research within South Africa

# CSIR Bioprospecting strategy



# South Africa's plant biodiversity

- 24 000 indigenous plant species
- 10% of the world's plants
- High endemism
- Mainly unexplored as source of natural medicines
  - 25% of world's pharmaceuticals are derived from plants

# Indigenous Knowledge

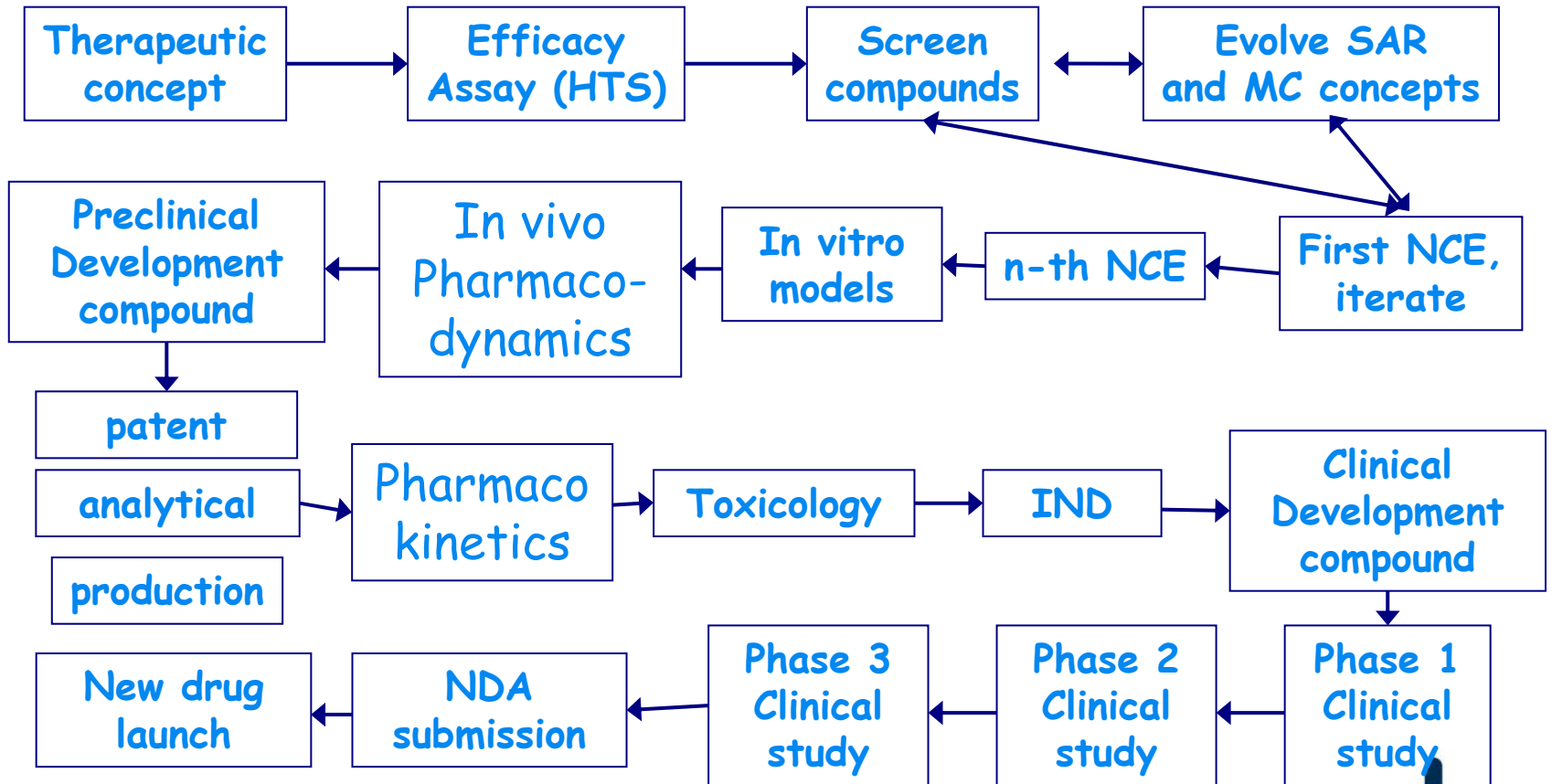
- South Africa has a long tradition of medicinal use of indigenous plants
- >200 000 Traditional Healers active throughout country
- >70% of South Africans consult a Traditional Healer

# Bioprospecting key focus in natural products

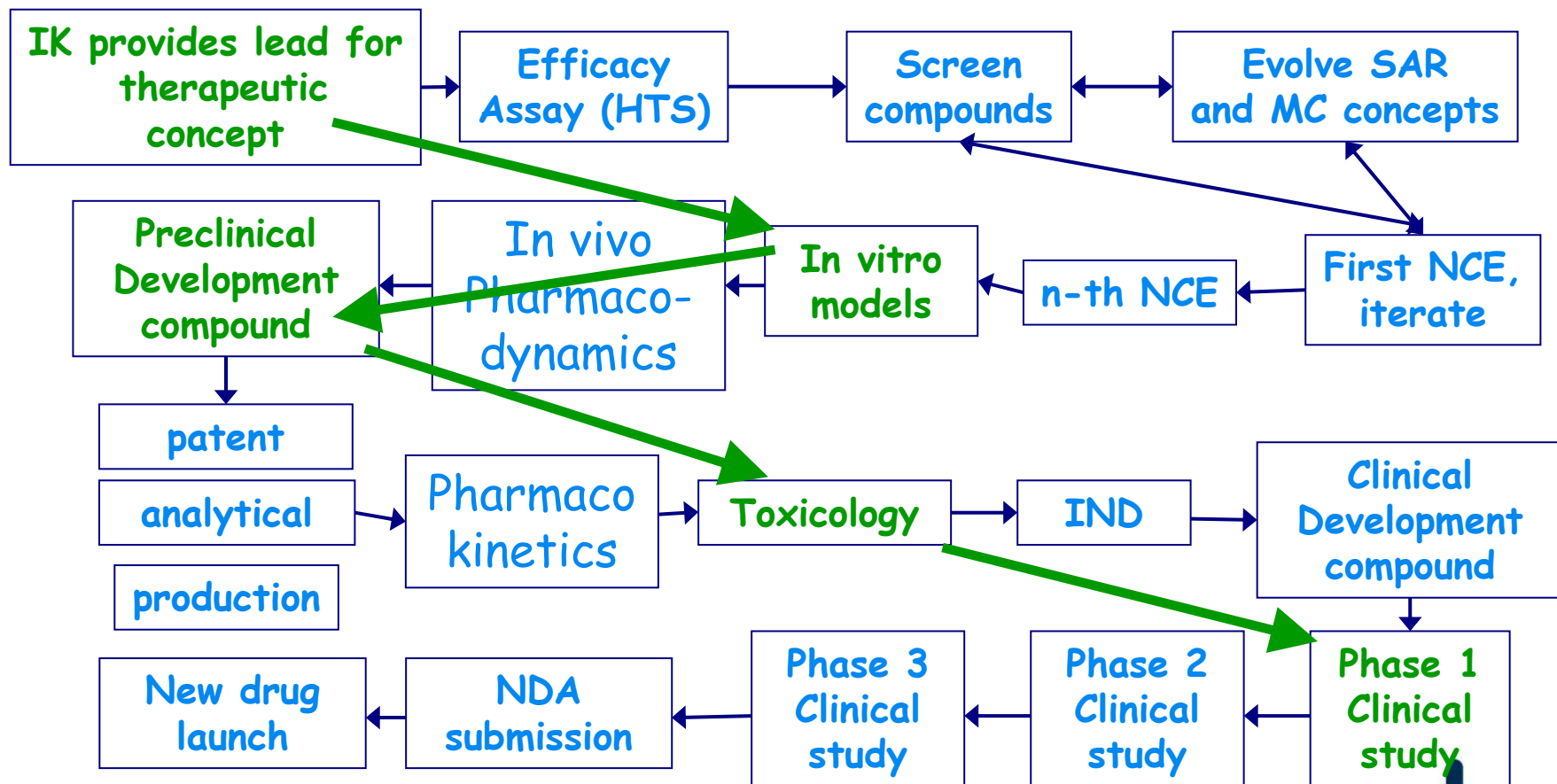
- Drug lead discovery, based on research informed by Indigenous Knowledge (IK) on medicinal plants
- Development of minimally processed herbal remedies based on traditional medicines
- Establishment of new agro-processing opportunities for farmers and communities



# Classic, rational approach to drug discovery



# Accelerated discovery based on IK of medicinal plants



# Research Focus Areas

- Gathering of indigenous knowledge and biodiversity samples
- **Therapeutic/product concept identification**
- Bio-assay screening of plant extracts
- Identification of active ingredient/s
- Elucidation of mode of action/effect
- Lead optimization as single chemical entities and **herbal remedies**
- Research and development studies for registration of herbal medicines (National Reference Center for African Traditional Medicines)

# Research Focus Areas

- Developing technologies to establish community-owned agro-processing businesses based on medicinal and aromatic plants
- Emphasis on biologically active molecules with therapeutic value of relevance to South Africa e.g. malaria, TB and HIV

# Bioprospecting consortium

Consortium consists of:

- Biosciences team including structural biologists, discovery chemists, natural product and analytical chemists
- Traditional Healers
- Universities and Research Institutes (e.g Novel Drug Discovery Platform funded by Department Science and Technology for discovery of anti-malarials, anti-TB, anti-diabetes drug leads from plants)
- South African National Botanical Institute
- Communities (S A San Council, etc)
- International collaborators (National Cancer Institute, etc., SANBio stakeholders)



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# Case study

- BP1: a patented mosquito repellent exploited via private sector and community enterprises

# BP1: Traditional use

- Based on a plant used by Traditional Healers to repel mosquitoes
- Traditional use is by hanging plants in dwellings to repel mosquitoes
- Burning of the plant in open fires to keep away mosquitoes
- Use pointed to a product based on the volatile components of the plant
- MOU signed in 1999
- Benefit sharing agreement signed in 2003

# CSIR signs agreement with Traditional Healers (1999)

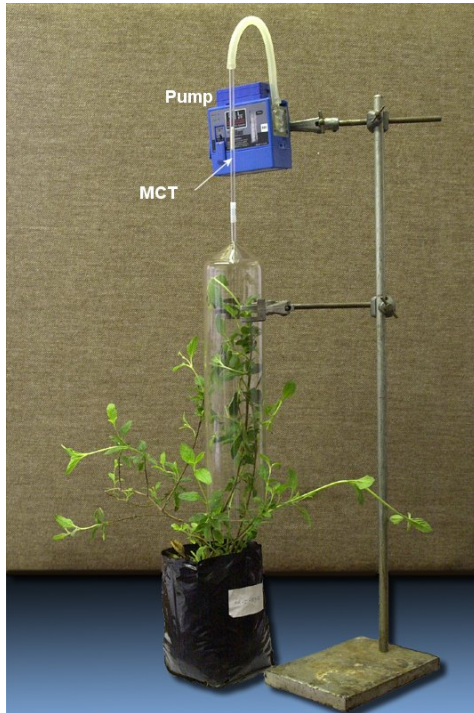




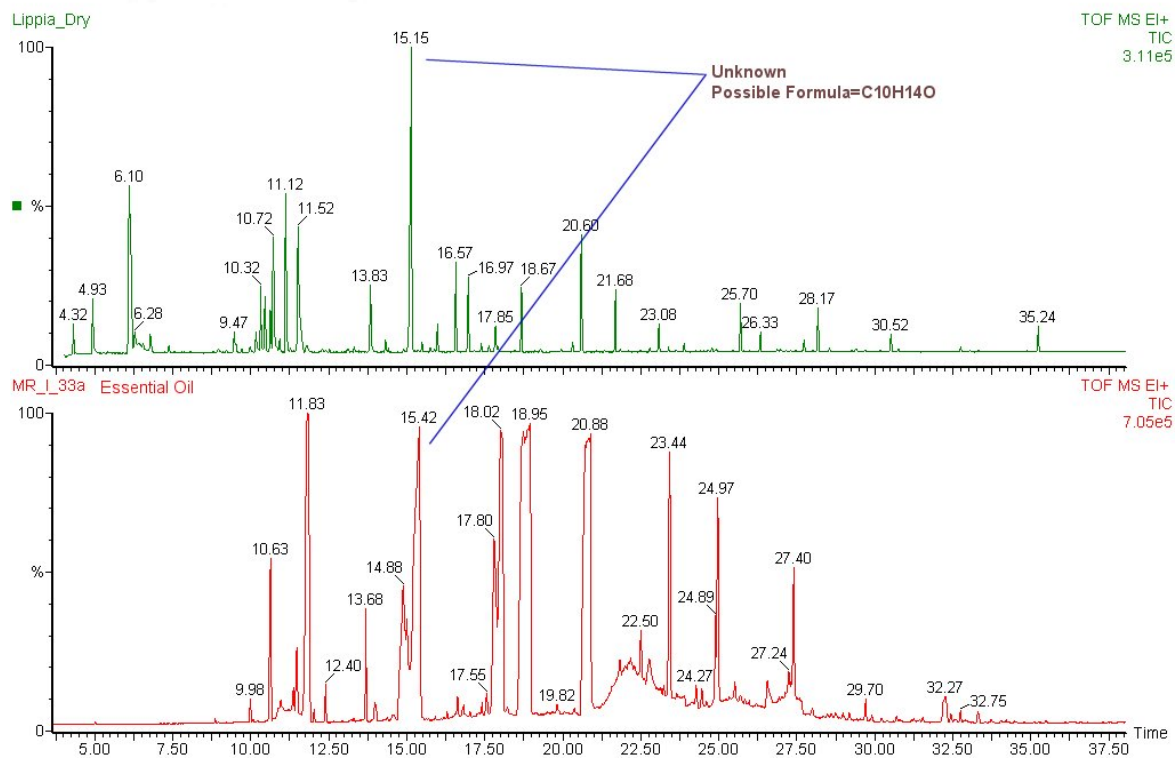
# BP1: Chemical analysis

- Scientific research focused on the volatile components of the plant
- Led to the preparation of an essential produced by steam distillation
- Chemical profile of the essential oil determined using GC MS
- Active ingredients were isolated, identified
- Studies in undisturbed ecosystem revealed existence of various intra-species chemotypes (2002)
- Mosquito repellent was patented

# BP1: Techniques for trapping volatiles



# BP1: GC profiles



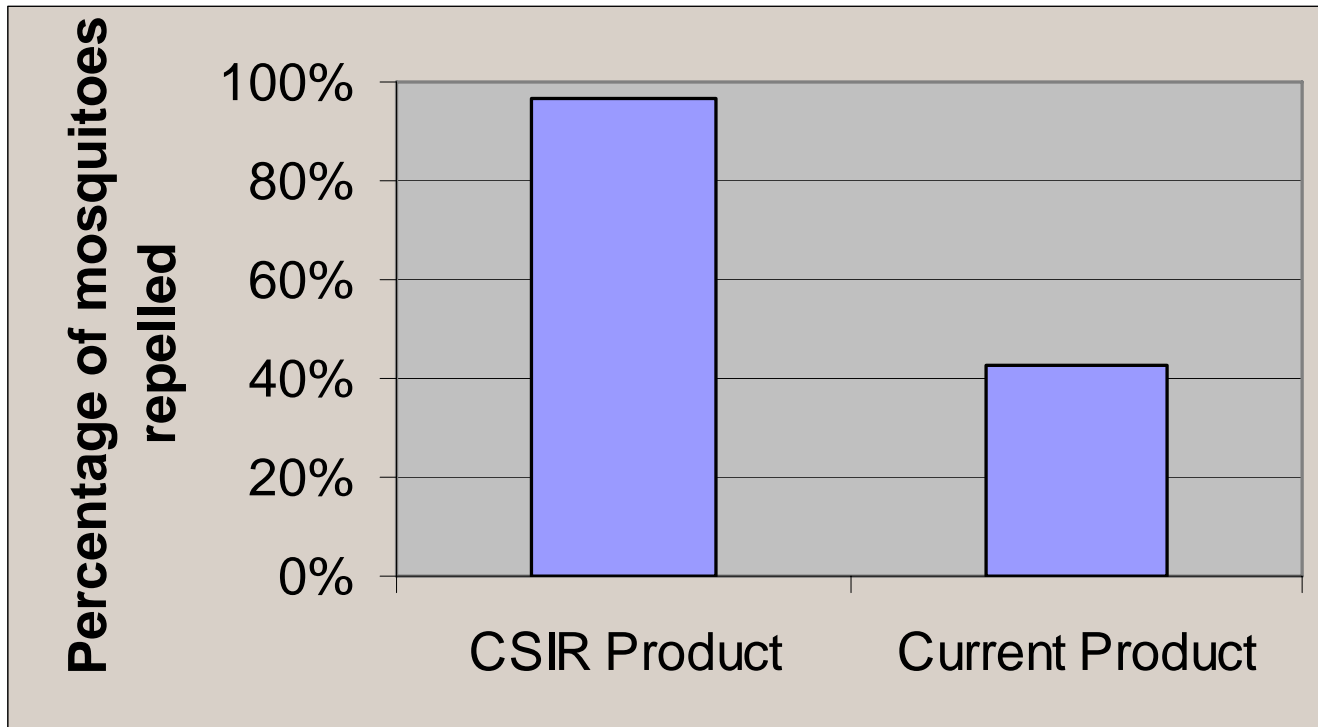
# BP1: Biological assaying

- Essential oil and active ingredients tested for efficacy in biological assays
- Tests done at the SABS
- Olfactometer used to determine efficacy of the samples to repel mosquitoes - suitable assay for volatile compounds
- Formulated the essential oil into a candle form
- Early toxicology completed

# BP1: Olfactometer tests



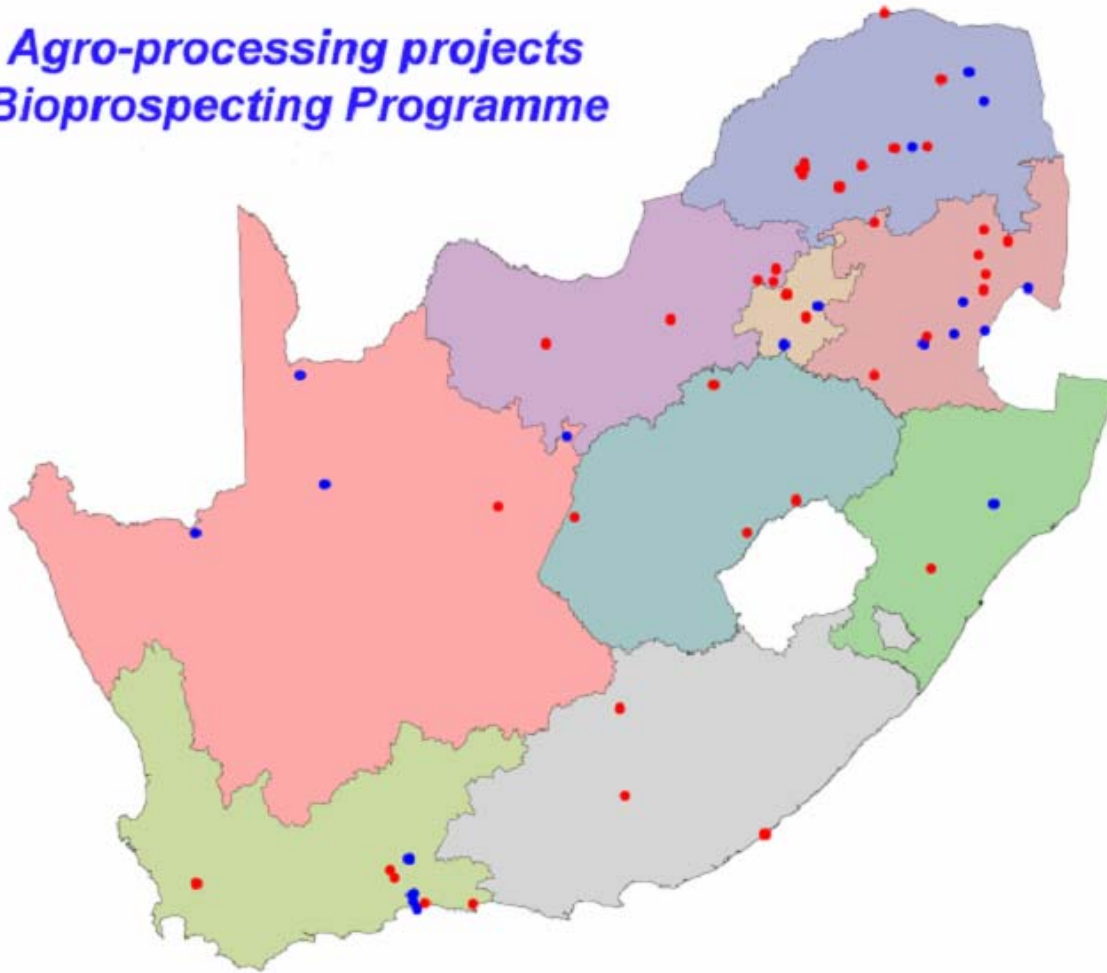
# SABS comparison of candles containing BP1 vs. citronella oil



# BP1: novel mosquito repellent

- Dossier on the product was completed and submitted for registration
- CSIR owned company viz. Ulwazi Botanicals is being set up for the marketing and sale of the mosquito repellent
- Recommended for registration of use under Act 36, Department of Agriculture as a mosquito repellent
- BP1 forms the basis of community-owned businesses being established in South Africa viz. Limpopo, Mpumalanga, Eastern and Western Cape Provinces

**Agro-processing projects  
Bioprospecting Programme**





# Good Farming Practice- Giyani, Limpopo Province



- Technology transfer to community farmers
- Funded by DST Poverty Alleviation



# Good Farming Practice- Giyani, Limpopo Province



- 30Ha scale

# Good Farming Practice- Giyani, Limpopo Province



# Plant harvesting- Giyani, Limpopo Province



# Plant processing- Giyani, Limpopo Province



Before and after  
distillation





# Essential oil distillation factory on Community farm- Giyani, Limpopo Province









## Collection of essential oil in separator



# Community owned mosquito repellent candle making factory





# BP1: Highlights

- Demonstration of successful value addition to indigenous knowledge on use of a medicinal plant and biodiversity through scientific research
- Benefits to owners of indigenous knowledge through a benefit sharing agreement
  - Monetary benefits to be paid into a trust - beneficiaries are traditional healers
- Non monetary benefits through community owned agroprocessing businesses
  - Transfer of technology- new skills
  - Poverty reduction through creation of new jobs

# Other therapeutic areas being investigated

- Cancer
- HIV
- Opportunistic infections
- Wound healing
- Malaria
- TB
- Asthma and allergies
- Inflammation
- Arthritis
- Erectile dysfunction

# Medicinal plant processing

- CSIR Clinical Supplies Unit (CSU)
- Compliant with Good Manufacturing Practice
- Approvable by Medical Control Council and USA regulatory authorities (FDA)
- **Bridge gap between research laboratory and clinical trials**
- **Manufacture of dosage forms of Traditional medicines in compliance GMP - ensure quality and reproducibility**



# CSIR Clinical Supplies Unit





# CSIR Clinical Supplies Unit



- Minister of Health and Director-General of WHO during national launch of National Reference Centre for African Traditional Medicines at CSIR



Thank you for your attention

