African Dryland Alliance for Pesticidal-Plant Technologies

ADAPPT

2 years of experiences of the project: results achieved

ACP S&T Brussels 28th October 2011.

Professor Philip C Stevenson

ADAPPT

A network for optimising & promoting indigenous botanical knowledge for food security and poverty alleviation in Africa

Overall objectives

- strengthen S & T capacity of African programmes to exploit pesticidal plants
- Optimise use of pesticidal plants for poor farmers.
- establish a research network: scientists to farmers.
- develop platform for marketable products

UNIVERSITY of GREENWICH | Natural Resources Institute

Constraints of synthetic pesticides – in Africa

Toxicity

Cost

Environmental impacts

- adulterated products
- pesticide resistance

UNIVERSITY of GREENWICH | Natural Resources Institute

Farmers have to use something

Pesticidal plants

Unprocessed materials requiring rudimentary preparation
Highly suited to small scale farmers Isman, 2008 *Ann Rev Entomol*.

- Low cost
- Sustainable
- Low toxicity & persistence
- Can’t be adulterated

Outputs address ACP S&T objectives

- Output 1
  - African pesticidal plant network established
- Output 2
  - Capacity building through applied research
- Output 3
  - Ensuring sustainable use of target species
- Output 4
  - Production & marketing policy developed.
- Output 5
  - Communication & dissemination platform

OBJECTIVES of ACP S&T 1

Strengthen S&T capacity of ACP countries to support research, development and innovation in ACP region

- *institutional, administrative & policy.*
- *academic research & technology.*
- *business & civil society.*

Output 2

Capacity building through applied research

Output 3

Sustainable use of target species
(propagation, livelihoods & conservation)

Output 4

Production & marketing policies developed

Natural Resources Institute

OBJECTIVES of ACP S&T 2

Promote interdisciplinary approaches to sustainable development along 3 axes:

- *Co-ordination & networking in applied research.*
- *Instruments for collaborative research.*
- *Management of research activities and reinforcement of research.*

Output 1

African pesticidal plant network established

Output 5

Communication & dissemination platform (research papers, www, conference)

Natural Resources Institute

Output 1 Pan-African pesticidal plant research network established

- Inception meeting - Pretoria, South Africa Jan 2010
- Targets, action plans and network strategies

Zimbabwe

Zambia

Malawi

South Africa

Tanzania

Ghana

Pan-African

Kenya

United Kingdom

ADAPPT Networking

7 Country networks
30+individuals/country

1
2
1
2

Country leaders

Kenya | Malawi | RSA | Zambia | Tanzania | Ghana | Zim

ADAPPT & Project Leader

External advisory board

Primary links

Secondary links

Output 1 Pan-African pesticidal plant research network established

- National meetings held in 7 African countries
  - Identify issues and feed info to ADAPPT network
    - Training priorities
    - Knowledge about local plant species
    - Complementary skills identified
    - New partnerships made
    - Technical limitations identified.

UNIVERSITY of GREENWICH | Natural Resources Institute

Output 1 Pan-African pesticidal plant research network established

- New partnerships e.g.,

1. Sokoine University (Tanzania)
   Mzuzu University (Malawi)
   NRI UK new pesticidal plants & residues on stored grain.

2. Copper Belt University (Zambia)
   RBG, Kew (UK) chemistry of non-timber woods for pest control

3. Egerton University (Kenya)
   ICIPE (Kenya)
   University of British Columbia (Canada) on essential oils in pest control

UNIVERSITY of GREENWICH | Natural Resources Institute

Output 1 Pan-African pesticidal plant research network established

- Networking (and communication)
  - Symposium on economically useful plants, Zambia *June 2010* – 150 delegates
    - 4 presentations by ADPPT network
  - African Crop Science Soc. conference , Mozambique, *Oct 11* – 500 delegates
    - Pesticidal Plant workshop hosted by ADAPPT - 50 participants
    - 8 presentations + 3 posters by ADAPPT partners
    - Identified and discussed key areas for research
      - Optimisation
      - Commercialisation
      - Conservation

Output 2 Capacity building & training and knowledge exchange

- Training of post graduate students
- Evaluation and analysis of pesticidal plant materials.
  - 1 MSc (Uni of Greenwich) student passed & returned to Ghana as University lecturer
  - 2 PhD students (Uni of Greenwich)
  - MSc students research at University of Zimbabwe, University of Zambia and Mzuzu University (Malawi).

MSc research at University of Zambia

UNIVERSITY of GREENWICH | Natural Resources Institute

Output 2 Capacity building & training and knowledge exchange

- Training of post grads in micro-propagation - 14 participants
  - 3 day laboratory course - Zambia, Jan 2011.

Output 2 Capacity building & training and knowledge exchange

- Training for - 40+ participants in Zambia, Jan 2011.
  - Scientific writing
  - Biological evaluation of plant materials
  - Preparation of proposals for funding
    - 5 proposals written among network partners

    McKnight Foundation, ●

    DelPHE (British Council) ●

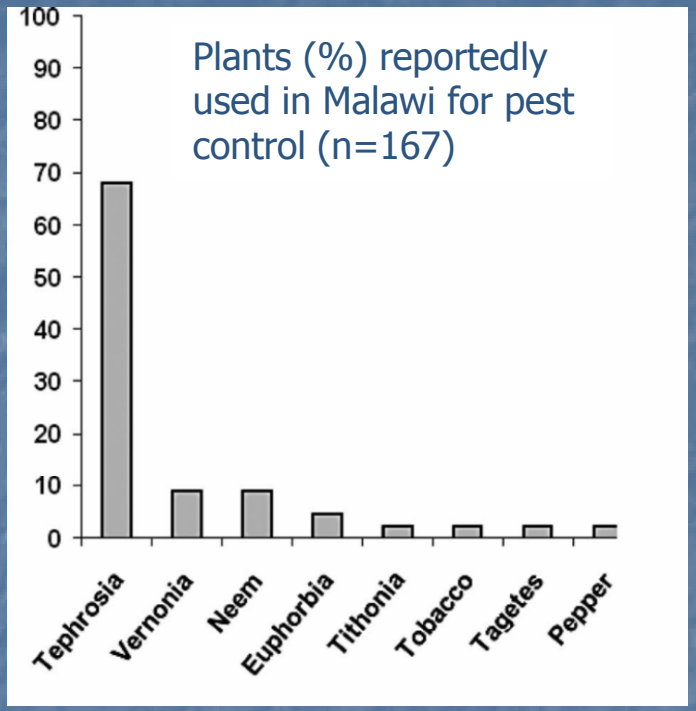
    CIFSR (Canadian Intl Food Security Res. Fund) ●

    PAEPARD (European Partnership in Agric Res and Dev) ●

    CSEF (Civil Society Environment Fund) ●

- Training to be repeated
  - Tanzania (Dec 2011)
  - Ghana (Jan-Jun2012).

Chemical analysis & biological evaluation of *Tephrosia vogelii* to control bruchid beetles in cowpea – applied research training

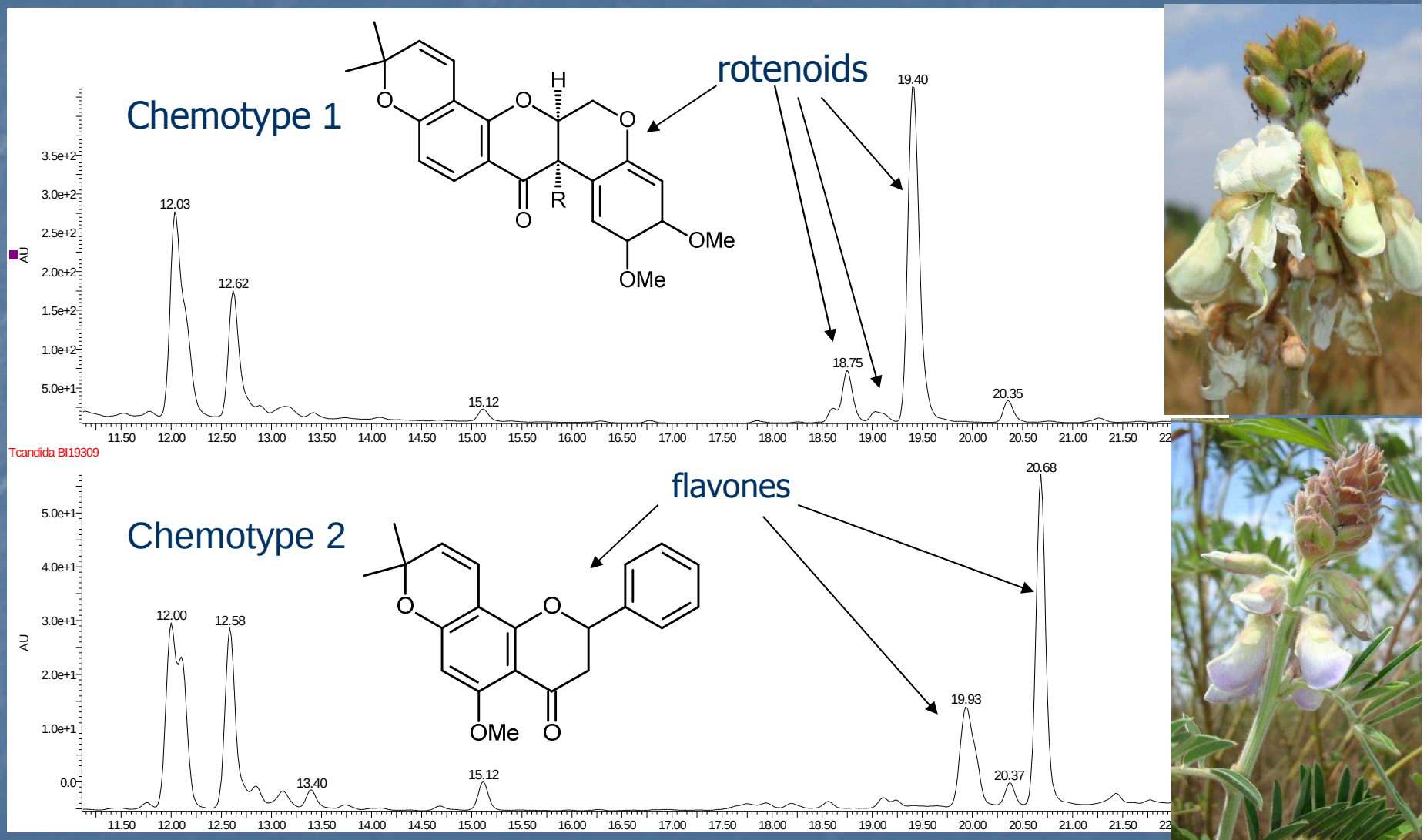


Tephrosia vogelii

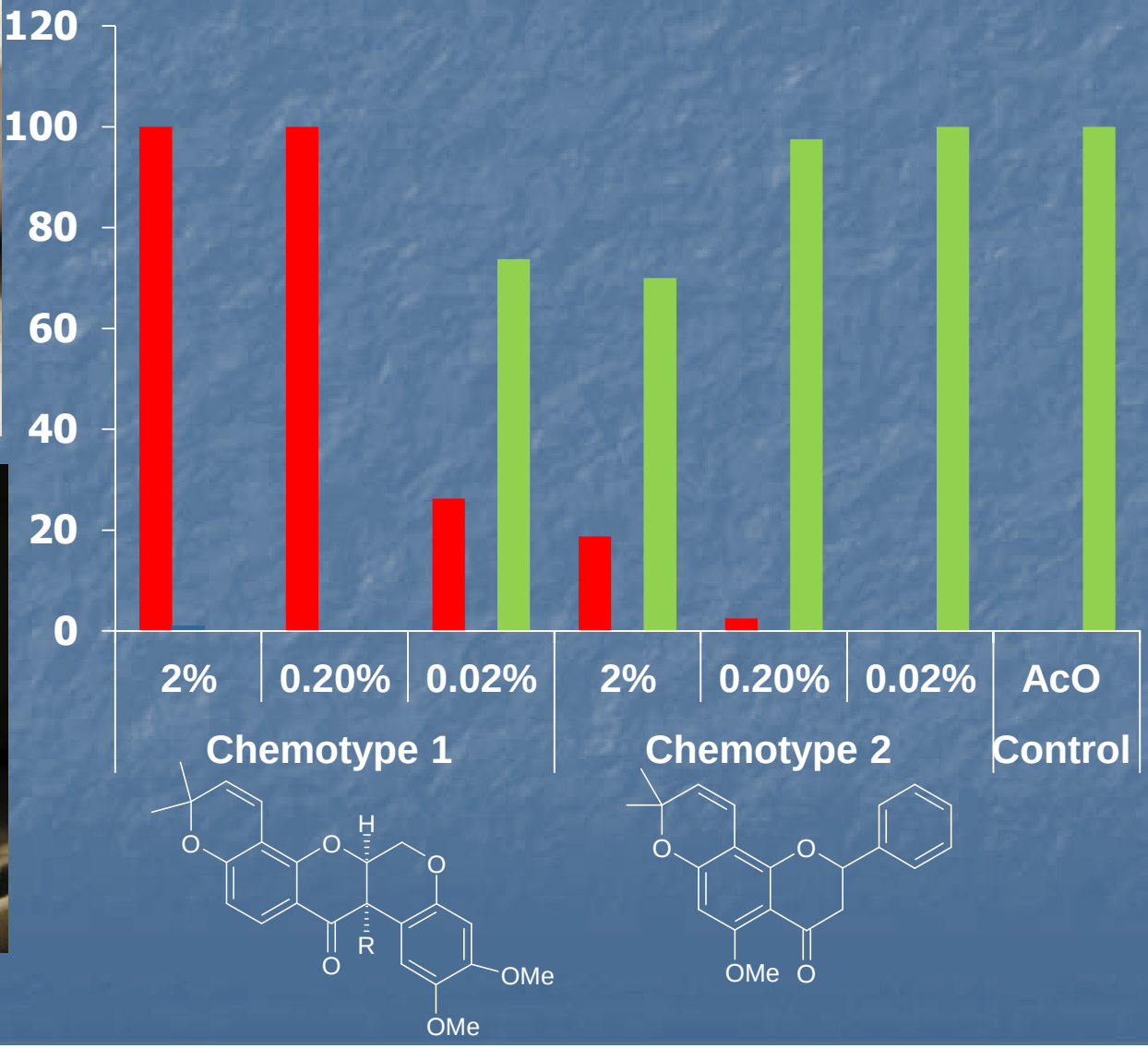
Kamanula et al. 2011 *Intl. J Pest Manage*
Nyirenda et al. 2011 *Afr. J Agr Res.*

- Validate activity
- Which chemicals active?
- Determine variations in efficacy/chemistry
- Optimise application

Chemical analysis of *T. vogelii* revealed 2 chemotypes



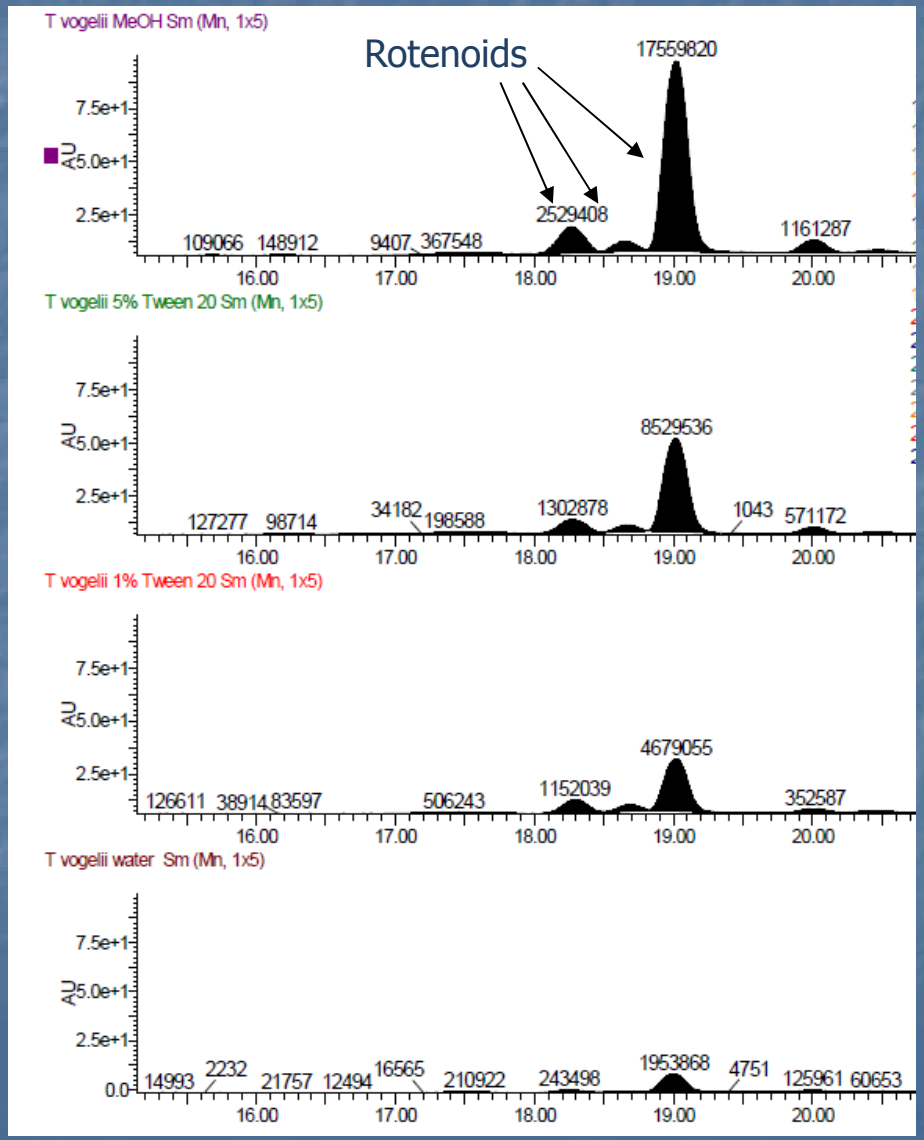
Mortality (%) of bruchids on cowpea treated with *T. vogelii* chemotypes 1 & 2 (after 48h)



Typical extraction of *T. vogelii* for field use

For field use - plants extracted in water
& applied with a knap sack sprayer.
But active rotenoids are not soluble in water

Extraction of rotenoids from *T. vogelii* for field use is improved with liquid soap



Methanol extract

5% Soap

1% Soap

Water
(Farmers extract)

Simple improved technology
Muslin bag extraction with liquid soap

+

Plant material + soap in muslin sac hung in sprayer.
Optimises extraction prevents nozzle clogging.

Field trials

Storage trials

Malawi
Tanzania
Zambia

Output 3 Sustainable production of pesticidal plants

Thokozani et al., 2011 *Afr. J. Biotech*

Some plants scarce & need cultivating but may have

- Low germination
- Slow seedling growth.
- Rapid loss of viability

- Propagation criteria developed for *Bobgunnia madagascariensis*

- Harvesting protocols for plant species
  - SAFIRE handbook published on ADAPPT site www.nri.org/adappt

UNIVERSITY of GREENWICH | Natural Resources Institute

Output 3 Sustainable production of pesticidal plants

High CO_2 atmosphere optimises growth

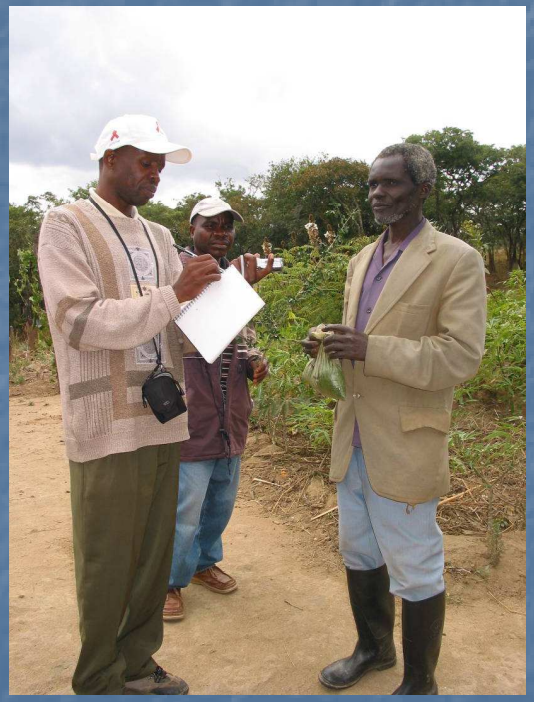
If plantlets in vermiculite can produce roots can be planted out directly for transfer to farmers

Microprop of *Securidaca longepedunculata* Zulu et al. 2011 *Afr J. Biotech*.

UNIVERSITY of GREENWICH | Natural Resources Institute

Output 4 Production and marketing of pesticidal plants

- Policy recommendations via desk study – looking at
  - Best practices & case studies
  - Farmer production
  - Marketing networks
  - Marketing hurdles
  - Bio-safety issues
  - Product Registration.



UNIVERSITY of GREENWICH | Natural Resources Institute

Output 4 Production and marketing of pesticidal plants

Outcomes (so far)

- variation in efficacy problematic –
  quality control needed before up-scaling
- opportunity for wide-scale promotion as commercial products for SMEs
- selling of PPs can not be formalised without changes to regulatory hurdles

UNIVERSITY of GREENWICH | Natural Resources Institute

Output 4 Production and marketing of pesticidal plants

- Way forward
  - framework exists to enable production of PPs
  - registration not complicated - but providing data and information is expensive
  - raw material supply remains a challenge
  - investment in development, promotion and awareness raising needed

UNIVERSITY of GREENWICH | Natural Resources Institute

Output 5 Communication & dissemination platform for pesticidal plant knowledge

- Papers published in international journals
- Attendance of scientific symposia
- International conference planned for Year 3
  - Proceedings to be published in a special issue of *Crop Protection & Bipesticides Internl.*
- ADAPPT network website www.nri.org/adappt
  - Information bulletins
  - policy briefs
  - plant database

UNIVERSITY of GREENWICH | Natural Resources Institute

African Dryland Alliance for Pesticidal Plant Technologies:

A network for optimising and promoting the use of indigenous botanical knowledge for food security and poverty alleviation in Africa

ADAPPT
African Dryland Alliance for Pesticidal Plant Technologies

Home
What's New?
Pesticidal Plants
Objectives
Activities
Our Advisors
Plants Database
Partners
Publications
Links
Contact Us
Using this Site
Secure area

What is ADAPPT?

ADAPPT is a project supported by a European Union grant through the ACP Science and Technology Programme to establish a network of scientists and agricultural technicians, from NGOs, agricultural institutes, ministries and universities from Ghana, Kenya, Malawi, Namibia, South Africa, Tanzania, Zambia, Zimbabwe and the United Kingdom with a focus on pesticidal plants* as environmentally benign and safer alternatives to synthetic pesticides. The specific partners are listed on the Partners page of this website. ADAPPT will:

1. Establish an intra-African network with linkages to international networks,
2. Build capacity to assess research needs to facilitate the formulation and implementation of research policies associated with pesticidal plants and to prepare and submit project proposals for new funding opportunities, and
3. Enhance the research capacity and incentive of the network partners and so increase the quality and impact of research results and disseminated outputs.

This action will address Millennium Development Goals 1, 7 and 8 by targeting poverty eradication at the small-scale farming level, building and enhancing strong scientific and technological capacity in agriculture, chemistry, biodiversity conservation, and plant physiology. This will support research, development and innovation in the ACP region, and enable the identification and formulation of activities or policies that are critical to sustainable development related to habitat conservation, pesticide regulations, indigenous knowledge and implementing the UN Convention on Biological Diversity.

The list below is a subset of pesticidal plants that have been the subject of research of ADAPPT partners. Further details about each plant can be found by clicking on the highlighted Latin names of the plant species listed.

Tephrosia vogelii

Azadiracta indica

Securidaca longepedunculata

Euphorbia tirucalli

Tithonia diversifolia

Vernonia amygdalina

Melia azedarach

Dolichos kilimandscharicus

Solanum panduriforme

Tagetes minuta

Robqunnia madagascariensis

Tephrosia vogelii (Vogel's Tephrosia)
Leguminosae

General

Tephrosia vogelii fact sheet (ICRAF)

ADAPPT fact sheet - under revision

T. vogelii is probably introduced and not native anywhere in Africa. It is widespread in tropical Africa from Sierra Leone and Ethiopia southwards to Angola, the Flora Zambesiaca area and the Comoro Islands; also from Assam to Indonesia. The species has been extensively cultivated and found near cultivated land for use as a fish poison and is clearly introduced in many of its present localities so that the extent of its native area is now obscured. It is a shrubby plant used as a fallow plant to improve soil fertility and to reduce erosion, particularly in higher areas. A related species, *T. candida* is widespread in parts of Asia, e.g. in Vietnam where it is used as a green manure and cover crop. Tephrosia spp. may grow as rapidly as 2-3 metres in 7 months. *T. vogelii*, after 5 months of growth, produces about 27-50 tonnes of green material per hectare. This is equivalent to about 110 kg of nitrogen. Plants can be planted as a hedgerow at a distance of 1 metre. Leaves of *T. vogelii* contain at least 4 insecticidal compounds collectively known as rotenoids. It has been reported that the mature leaves of *T. vogelii* contain 80-90% rotenoids. In other Tephrosia species, flavonoid compounds are found and these are also known to have profound effects on insect development and behaviour. The highest concentration of the active compounds are found in the leaves.

It is a shrub 1–3(4) m high, usually much branched and bushy. Stems brown tomentose with long flexuous hairs intermixed among shorter and denser spreading hairs. Leaves with (6)8–13(15) pairs of leaflets; petiole 9–28 mm long, petiole and rachis together (9)11–22(27) cm long, tomentose like the stem; leaflets 2.5–5.5(7.5) × (0.6)0.9–1.7(2.3) cm, elliptic-oblong to oblanceolate, rounded to cuneate at the base, rounded to emarginate at the apex, slightly mucronate, the upper surface rather thinly appressed-pubescent, the lower surface densely appressed-pubescent; stipules 11–20 × 2.5–4.5 mm, narrowly triangular or sometimes markedly falcate, soon falling. Flowers in dense heads up to 10(20 in fruit) cm, or the lowermost sometimes somewhat remote; bracts up to 16 × 13 mm, broadly ovate-acuminate to suborbicular-acuminate, brown or greyish tomentose, conspicuous at bud stage but soon falling as flowers open; pedicels 14–26 mm long, brown tomentose. Calyx 14–20(24) mm long, brown or greyish tomentose; upper and lateral teeth about twice as long as the tube, oblong, ± truncate at the apex, the lower tooth about 1.5 times as long as the lateral, strongly grooved and upwardly curved distally into a keel-like shape. Petals white, rarely the standard purple; standard 24–30(34) mm long, truncate to strongly cordate at the base, the wings and keel petals somewhat shorter. Upper stamen loosely attached to, and easily detachable from, the adjacent stamens about the middle of the filament. Ovary tomentose; style pubescent. Pods 9–14.5 × 1.3–1.7 cm, light brown lanate-tomentose. Seeds numerous (more than 15), 6–8 × 4–4.5 × 2–2.5 mm, black, smooth, with a well developed white U-shaped aril c.2 mm long.

Plant parts with insect-controlling properties
leaves, roots

Mode of action
Antifeedant, insecticidal, acaricidal, ovicidal, fish poison
Contact and stomach poison

Target organisms
a range of field pests and for general stored product protection

Preparation and application
Take fresh leaves of *Tephrosia vogelii* and dry them. Grind the dried leaves into a powder. Mix 100 g of powder with 100 kg of maize to control maize weevils and the larger grain borer. In beans it can control bean bruchids. The control effect lasts about 3 months. After that time new Tephrosia powder has to be added.

Map of ISP locations accessing the ADAPPT website

Science News

Natural Pesticide Protects Cattle Against Ticks in Africa

ScienceDaily (Oct. 11, 2011) — Cattle are extremely vulnerable to ticks, mites and flies which can transmit blood parasites, cause irritating wounds and then infections. In order to control them farmers must dip their cattle in a pesticide. This is impractical and expensive for poor farmers with just a small number of livestock.

A solution may lie in the perennialplant, *Lippia javanica*, widely consumed to alleviate symptoms of fever is also used by some farmers to make a pesticide. The University of Greenwich team in collaboration with the University of Zimbabwe, pulped and soaked the Lippia leaves in water to produce an extract which could be sprayed on cattle. Varying concentrations were tried to discover the best application method and the level of protection provided by the plant extract.

Cattle in Southwest Ethiopia. (Credit: Steve Torr, University of Greenwich)

See Also:

Plants & Animals
- Agriculture and Food
- Seeds
- Endangered Plants
- Botany
- Spiders and Ticks
- Pests and Parasites

Reference
- Organic farming methods
- Sustainable

Just In:
Global Warming Is Rea

Social Networks

*Recommend this story and **Google +1**:*
Like 12 Tw

Other bookmarking and

Monitoring and Evaluation

- External Advisory Board
  - Prof. Murray Isman
    - Dean, University of British Columbia, Canada
  - Prof. Ahmed Hassanali
    - Professor of Chemistry, Kenyatta University, Kenya
  - Prof. Opender Koul
    - Director, Koul Foundation, India
- Statistical analysis and research methods
  - Dr. Stephen Young (University of Greenwich)

UNIVERSITY of GREENWICH | Natural Resources Institute

Monitoring and Evaluation

- Publications - peer review -
- Project target = 10 peer reviewed papers
- Current output
  - 8 papers on pesticidal plants
  - 6 more in prep

- Stevenson et al. 2011 *Tetrahedron Letters*, 51: 4727–4730.
- Kamanula et al., 2011 *International Journal of Pest Management*. 57: 41-49.
- Thokozani, 2011 *African Journal of Biotechnology* 10: 5959-5966.
- Madzimure et al., 2011 *Tropical Animal Health & Production*, 43: 481-489
- Nyirenda et al., 2011 *African Journal of Agricultural Research*, 6: 1525-1537.
- Sarasan et al. 2011. *Plant Cell Reports*, 30:1163–1172.
- Zulu et al., 2011, *African Journal of Biotechnology* 10: 5988-5992.
- Stevenson et al. (in press), *Biopesticides Intl*.

UNIVERSITY of GREENWICH | Natural Resources Institute


ACP S&T
Thank You
ADAPPT
African Dryland Alliance for Pesticidal Plant Technologies
UNIVERSITY of GREENWICH
Natural Resources Institute