


Annex 8. SAPP Project – Dr Phil Stevenson

The SAPP Project
Southern African Pesticidal Plants



The SAPP Project

Optimising the use of
Southern African Pesticidal Plants


- Dr. Philip C Stevenson
- Natural Resources Institute, University of Greenwich,
- Chatham, Kent, UK. (Lead Institute).

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Partnership









- University of Zimbabwe.
- DARS, Mzuzu, Malawi.
- ICRAF, Malawi.
- Mzuzu University, Malawi
- SAFIRE, Zim & Zambia.
- Royal Botanic Gardens, Kew, UK

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The objectives of the ICART-CRARF initiative to:



1. *reduce the high level of rural poverty by making agriculture more competitive, to raise the poor farmers' income*
 - LIVELIHOODS
2. *offset the high rate of natural resource degradation, with focus on soil, water and biodiversity*
 - CONSERVATION
3. *develop effective rural policy options, institutional and farmer organisations to support the agricultural production systems and to link the farmers to the market*
 - POLICY

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Project Aims



- Optimise application, harvesting and H & S of pesticidal plants
 - Improving pest management

Livelihoods
- Database of knowledge about distribution, habitats & harvesting
 - Promote conservation across the region.


Conservation
- Cultivate & strengthen market potential
 - Private sector

Policy and Markets
- Capacity building in SADC
 - Training of SADC scientists and technicians
 - Exchange visits to UK & other SADC countries.


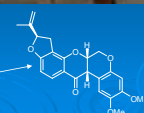
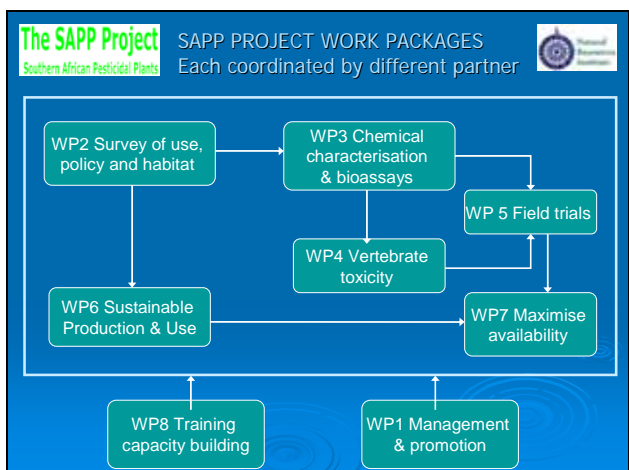
All 3

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Pesticidal plants



- Fruit, leaves, bark, root etc.
- Low cost
 - Harvesting and prep takes time
- Less harmful
 - People & environment
- Effectively reduce
 - Crop damage, stored product losses & livestock parasites
- Plants not perfect
 - Variable efficacy
 - Large quantities needed
 - Toxicity – e.g., rotenone

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Field Locations

- Malawi
 - Nchenachana
 - Champhira
- Zambia
 - Choma
 - Chipata
- Zimbabwe
 - Muzarabani
 - Nyanga

Caesalpinoid (Miombo) woodland zone

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Miombo woodland

- Caesalpinoid legume trees
 - *Brachystegia* spp. (Miombo)
 - *Colophospermum mopane*
 - *Baikiaea plurijuga*

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Surveys Of Use & Distribution

- Surveyed
 - pesticidal plant use
 - major pest problems

>500 farmers interviewed in 6 locations

Engaging with farmers and extension workers

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Surveys Of Use & Distribution

- ~100 plant species of known value
 - Priority species list
 - *Aloe ferox*
 - *Bobgunnia madagascariensis*
 - *Dolichos kilimandsharicus*
 - *Euphorbia* (spp.)
 - *Lippia javanica*
 - *Neorautanenia mitis*
 - *Solanum panduriforme*
 - *Securidaca longepedunculata*
 - *Strychnos spinosa*
 - *Tephrosia vogelii/candida*
 - *Vernonia* (spp.)
 - *Mucuna pruriens*
 - Non-indigenous species
 - *Tithonia diversifolia*,
 - *Azadirachta indica* – Neem,
 - *Tagetes minuta*
 - *Cymbopogon* spp.

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Surveys of Use Outcomes & Visibility

- Pesticidal plant information sheets (village posters?)
 - For farmers & extension workers
- Policy document on economic importance of pesticidal plants especially from Miombo woodlands
 - Conservation priorities & incentives
 - Small enterprise opportunities
- Database on distribution & optimised uses of plants
- Available Dec 2009 SAPP website www.nri.org/sapp

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THE SOUTHERN AFRICAN PESTICIDAL PLANTS PROJECT: Caesalpinoid Woodlands of Southern Africa: Optimising the Indigenous Use of Pesticidal Plants

<http://www.nri.org/sapp>

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Visibility - worldwide

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Farm trials & PRA

- > Validation of pesticidal plants
 - Farmer PRA of plants
 - Substantiate survey data
- > Promotion of concept
- > Engage with farmers
 - Facilitate adoption of optimised use
 - Provide information exchange forums
 - Enhance widespread knowledge base

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Target pests

- Spider Mites damage field crop
- Aphids also transmit disease
- Weevils damage stored grain
- Ticks spread disease

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Choma –Zambia

Nachibanga ward

1128 households (pop'n. 7584)

200 households adopting pesticidal plants under SAPP

PRA with 36 farmers at 5 sites
4 treatments
1 commercial pesticide
1 untreated

Plant material admix @ 2% w/w

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PRA of pesticidal plants

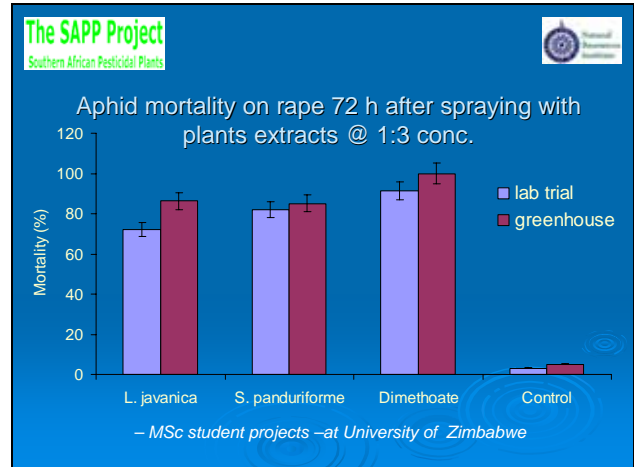
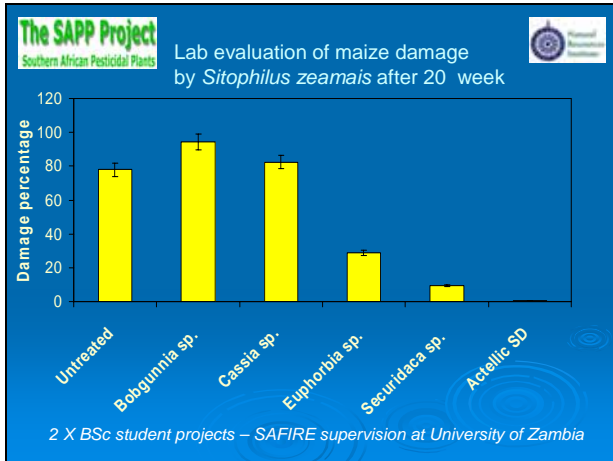
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Farmers ranking

Ranked according to effect.

1.	Actelic Superdust	(Commercial product)
2.	<i>Securidaca longepedunculata</i>	(Mupama)
3.	<i>Euphorbia</i> spp.	(Namanunga)
4.	Control	(Untreated)
5.	<i>Bobgunnia madagascariensis</i>	(Muyongolo) **
6.	<i>Cassia abbreviata</i>	(Mululuwe)

**Validation of plants is critical.

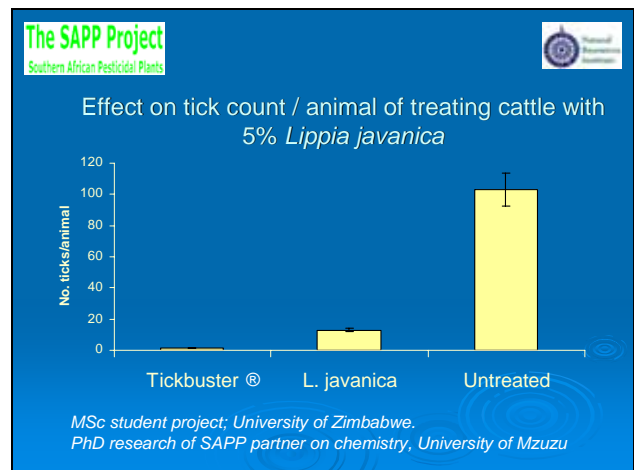


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Station trials - cattle

- Tickbuster®
 - effective control of ticks.
- Station trials show
 - Solanum panduriforme* (5%)
 - Strychnos spinosa* (10%)
 - effective alternatives.
- But potential toxicity to mammals/humans so ideally avoided

MSc student project; Uni of Zim



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Chemical Analysis & Bioassays

Tephrosia vogelii
most reported plant


- Validation needed
- Assumptions about occurrence of rotenone.
- Rotenone absent from *Tephrosia*
- Are tephrosin & deguelin active?
- What determines occurrence of rotenoids?

COC1=CC=C2C(=C1)OC(=O)C3=C(C=C2)OC(=O)C4=C(C=C3)OC(=O)C5=C(C=C4)OC(=O)C6=C(C=C5)OC(=O)C7=C(C=C6)OC(=O)C8=C(C=C7)OC(=O)C9=C(C=C8)OC(=O)C10=C(C=C9)OC(=O)C11=C(C=C10)OC(=O)C12=C(C=C11)OC(=O)C13=C(C=C12)OC(=O)C14=C(C=C13)OC(=O)C15=C(C=C14)OC(=O)C16=C(C=C15)OC(=O)C17=C(C=C16)OC(=O)C18=C(C=C17)OC(=O)C19=C(C=C18)OC(=O)C20=C(C=C19)OC(=O)C21=C(C=C20)OC(=O)C22=C(C=C21)OC(=O)C23=C(C=C22)OC(=O)C24=C(C=C23)OC(=O)C25=C(C=C24)OC(=O)C26=C(C=C25)OC(=O)C27=C(C=C26)OC(=O)C28=C(C=C27)OC(=O)C29=C(C=C28)OC(=O)C30=C(C=C29)OC(=O)C31=C(C=C30)OC(=O)C32=C(C=C31)OC(=O)C33=C(C=C32)OC(=O)C34=C(C=C33)OC(=O)C35=C(C=C34)OC(=O)C36=C(C=C35)OC(=O)C37=C(C=C36)OC(=O)C38=C(C=C37)OC(=O)C39=C(C=C38)OC(=O)C40=C(C=C39)OC(=O)C41=C(C=C40)OC(=O)C42=C(C=C41)OC(=O)C43=C(C=C42)OC(=O)C44=C(C=C43)OC(=O)C45=C(C=C44)OC(=O)C46=C(C=C45)OC(=O)C47=C(C=C46)OC(=O)C48=C(C=C47)OC(=O)C49=C(C=C48)OC(=O)C50=C(C=C49)OC(=O)C51=C(C=C50)OC(=O)C52=C(C=C51)OC(=O)C53=C(C=C52)OC(=O)C54=C(C=C53)OC(=O)C55=C(C=C54)OC(=O)C56=C(C=C55)OC(=O)C57=C(C=C56)OC(=O)C58=C(C=C57)OC(=O)C59=C(C=C58)OC(=O)C60=C(C=C59)OC(=O)C61=C(C=C60)OC(=O)C62=C(C=C61)OC(=O)C63=C(C=C62)OC(=O)C64=C(C=C63)OC(=O)C65=C(C=C64)OC(=O)C66=C(C=C65)OC(=O)C67=C(C=C66)OC(=O)C68=C(C=C67)OC(=O)C69=C(C=C68)OC(=O)C70=C(C=C69)OC(=O)C71=C(C=C70)OC(=O)C72=C(C=C71)OC(=O)C73=C(C=C72)OC(=O)C74=C(C=C73)OC(=O)C75=C(C=C74)OC(=O)C76=C(C=C75)OC(=O)C77=C(C=C76)OC(=O)C78=C(C=C77)OC(=O)C79=C(C=C78)OC(=O)C80=C(C=C79)OC(=O)C81=C(C=C80)OC(=O)C82=C(C=C81)OC(=O)C83=C(C=C82)OC(=O)C84=C(C=C83)OC(=O)C85=C(C=C84)OC(=O)C86=C(C=C85)OC(=O)C87=C(C=C86)OC(=O)C88=C(C=C87)OC(=O)C89=C(C=C88)OC(=O)C90=C(C=C89)OC(=O)C91=C(C=C90)OC(=O)C92=C(C=C91)OC(=O)C93=C(C=C92)OC(=O)C94=C(C=C93)OC(=O)C95=C(C=C94)OC(=O)C96=C(C=C95)OC(=O)C97=C(C=C96)OC(=O)C98=C(C=C97)OC(=O)C99=C(C=C98)OC(=O)C100=C(C=C99)OC(=O)C101=C(C=C100)OC(=O)C102=C(C=C101)OC(=O)C103=C(C=C102)OC(=O)C104=C(C=C103)OC(=O)C105=C(C=C104)OC(=O)C106=C(C=C105)OC(=O)C107=C(C=C106)OC(=O)C108=C(C=C107)OC(=O)C109=C(C=C108)OC(=O)C110=C(C=C109)OC(=O)C111=C(C=C110)OC(=O)C112=C(C=C111)OC(=O)C113=C(C=C112)OC(=O)C114=C(C=C113)OC(=O)C115=C(C=C114)OC(=O)C116=C(C=C115)OC(=O)C117=C(C=C116)OC(=O)C118=C(C=C117)OC(=O)C119=C(C=C118)OC(=O)C120=C(C=C119)OC(=O)C121=C(C=C120)OC(=O)C122=C(C=C121)OC(=O)C123=C(C=C122)OC(=O)C124=C(C=C123)OC(=O)C125=C(C=C124)OC(=O)C126=C(C=C125)OC(=O)C127=C(C=C126)OC(=O)C128=C(C=C127)OC(=O)C129=C(C=C128)OC(=O)C130=C(C=C129)OC(=O)C131=C(C=C130)OC(=O)C132=C(C=C131)OC(=O)C133=C(C=C132)OC(=O)C134=C(C=C133)OC(=O)C135=C(C=C134)OC(=O)C136=C(C=C135)OC(=O)C137=C(C=C136)OC(=O)C138=C(C=C137)OC(=O)C139=C(C=C138)OC(=O)C140=C(C=C139)OC(=O)C141=C(C=C140)OC(=O)C142=C(C=C141)OC(=O)C143=C(C=C142)OC(=O)C144=C(C=C143)OC(=O)C145=C(C=C144)OC(=O)C146=C(C=C145)OC(=O)C147=C(C=C146)OC(=O)C148=C(C=C147)OC(=O)C149=C(C=C148)OC(=O)C150=C(C=C149)OC(=O)C151=C(C=C150)OC(=O)C152=C(C=C151)OC(=O)C153=C(C=C152)OC(=O)C154=C(C=C153)OC(=O)C155=C(C=C154)OC(=O)C156=C(C=C155)OC(=O)C157=C(C=C156)OC(=O)C158=C(C=C157)OC(=O)C159=C(C=C158)OC(=O)C160=C(C=C159)OC(=O)C161=C(C=C160)OC(=O)C162=C(C=C161)OC(=O)C163=C(C=C162)OC(=O)C164=C(C=C163)OC(=O)C165=C(C=C164)OC(=O)C166=C(C=C165)OC(=O)C167=C(C=C166)OC(=O)C168=C(C=C167)OC(=O)C169=C(C=C168)OC(=O)C170=C(C=C169)OC(=O)C171=C(C=C170)OC(=O)C172=C(C=C171)OC(=O)C173=C(C=C172)OC(=O)C174=C(C=C173)OC(=O)C175=C(C=C174)OC(=O)C176=C(C=C175)OC(=O)C177=C(C=C176)OC(=O)C178=C(C=C177)OC(=O)C179=C(C=C178)OC(=O)C180=C(C=C179)OC(=O)C181=C(C=C180)OC(=O)C182=C(C=C181)OC(=O)C183=C(C=C182)OC(=O)C184=C(C=C183)OC(=O)C185=C(C=C184)OC(=O)C186=C(C=C185)OC(=O)C187=C(C=C186)OC(=O)C188=C(C=C187)OC(=O)C189=C(C=C188)OC(=O)C190=C(C=C189)OC(=O)C191=C(C=C190)OC(=O)C192=C(C=C191)OC(=O)C193=C(C=C192)OC(=O)C194=C(C=C193)OC(=O)C195=C(C=C194)OC(=O)C196=C(C=C195)OC(=O)C197=C(C=C196)OC(=O)C198=C(C=C197)OC(=O)C199=C(C=C198)OC(=O)C200=C(C=C199)OC(=O)C201=C(C=C200)OC(=O)C202=C(C=C201)OC(=O)C203=C(C=C202)OC(=O)C204=C(C=C203)OC(=O)C205=C(C=C204)OC(=O)C206=C(C=C205)OC(=O)C207=C(C=C206)OC(=O)C208=C(C=C207)OC(=O)C209=C(C=C208)OC(=O)C210=C(C=C209)OC(=O)C211=C(C=C210)OC(=O)C212=C(C=C211)OC(=O)C213=C(C=C212)OC(=O)C214=C(C=C213)OC(=O)C215=C(C=C214)OC(=O)C216=C(C=C215)OC(=O)C217=C(C=C216)OC(=O)C218=C(C=C217)OC(=O)C219=C(C=C218)OC(=O)C220=C(C=C219)OC(=O)C221=C(C=C220)OC(=O)C222=C(C=C221)OC(=O)C223=C(C=C222)OC(=O)C224=C(C=C223)OC(=O)C225=C(C=C224)OC(=O)C226=C(C=C225)OC(=O)C227=C(C=C226)OC(=O)C228=C(C=C227)OC(=O)C229=C(C=C228)OC(=O)C230=C(C=C229)OC(=O)C231=C(C=C230)OC(=O)C232=C(C=C231)OC(=O)C233=C(C=C232)OC(=O)C234=C(C=C233)OC(=O)C235=C(C=C234)OC(=O)C236=C(C=C235)OC(=O)C237=C(C=C236)OC(=O)C238=C(C=C237)OC(=O)C239=C(C=C238)OC(=O)C240=C(C=C239)OC(=O)C241=C(C=C240)OC(=O)C242=C(C=C241)OC(=O)C243=C(C=C242)OC(=O)C244=C(C=C243)OC(=O)C245=C(C=C244)OC(=O)C246=C(C=C245)OC(=O)C247=C(C=C246)OC(=O)C248=C(C=C247)OC(=O)C249=C(C=C248)OC(=O)C250=C(C=C249)OC(=O)C251=C(C=C250)OC(=O)C252=C(C=C251)OC(=O)C253=C(C=C252)OC(=O)C254=C(C=C253)OC(=O)C255=C(C=C254)OC(=O)C256=C(C=C255)OC(=O)C257=C(C=C256)OC(=O)C258=C(C=C257)OC(=O)C259=C(C=C258)OC(=O)C260=C(C=C259)OC(=O)C261=C(C=C260)OC(=O)C262=C(C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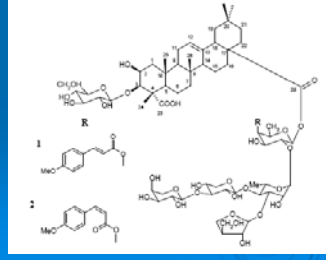
The SAPP Project
Southern African Pesticidal Plants

Securidaca longepedunculata

- Methylsalicylate
- Saponins



- Deterrent & toxic to pest
But volatile
- Short lived effect



- Saponins also active
- Occur in stem bark
- Can stem bark be used instead of root
 - sustainable

The SAPP Project
Southern African Pesticidal Plants

Water extracts saponins & is more efficient use of plant

Every grain coated – saponins act as surfactant

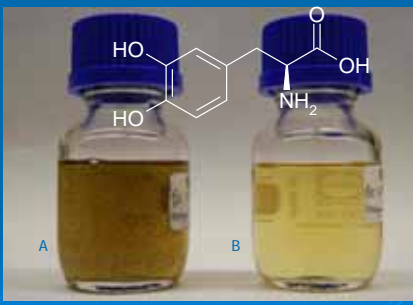
Submersion of grain during treatment & solarisation kills pre-storage infestation.



Extracting *Securidaca* and treating grain

The SAPP Project
Southern African Pesticidal Plants

Mucuna pruriens



L-dopa forms polymers.

So extract sprayed immediately

Or stored in vinegar

Mucuna pruriens seed coat extracted in 70% MeOH.

A = 70% MeOH B is 2% acetic acid in 70% MeOH.

The SAPP Project
Southern African Pesticidal Plants

Effect of plant species extracts on *Spodoptera littoralis*

Species or sample	Feeding Index	Devel effect %	Mortality 2 nd inst.	Mortality 4 th inst.
<i>S. longepedunculata</i> stembark	88.7(7.52)**	37*	55*	45*
<i>Dolichos kilimandscharicus</i>	-45.7(5.9)	83	40*	35*
<i>Solanum panduriforme</i>	-53.4(12.92)	88	50*	30*
<i>Entada rheedeei</i> pods	-45.2(9.38)	82	50*	45*
<i>Euphorbia tirucali</i>	-64.7(11.48)	77	55*	40*
Neem seed kernel MeOH	100(0.0)**	18**	100**	75**
Neem seed kernel Decon 90	85.8(5.81)**	19**	100**	75**
Neem seed kernel Water	-30(32.61)	21**	15	0
Decon 90	-18.5(12.71)	96	0	0
Control		100	0	0

** P < 0.01 * P < 0.05

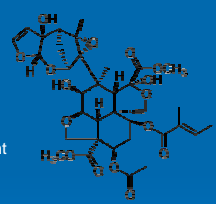
All extracts tested at 0.1g/ml

Encourages use of surfactant

The SAPP Project
Southern African Pesticidal Plants

Azadirachta indica -
Proven efficacy but not used widely


- Plant location limits availability.
- Active compounds - terpenoids
 - Azadirachtin, Nimbin & Salanin
 - Deterrent & toxic
- Occurrence of active components inconsistent
 - Low levels or absent from leaf.
 - Neem seed kernel better source.
 - Azadirachtin highly labile and light sensitive.
 - Stability optimised by leaving in plant form.
- Azadirachtin extracts into water but not Nimbin or Salanin
 - implications for farmer use
 - Extraction with surfactant



The SAPP Project
Southern African Pesticidal Plants

Safety & Toxicity of pesticidal plants

- *Strychnos spinosa*
 - High mortality in mice at >25%
- *Solanum panduriforme*
 - known toxicity (Poison apple)
 - data being collated
- *Lippia javanica*
 - less toxic than *S. spinosa*
 - Used as herbal tea
- Need to determine toxicity
 - at concentrations < 25% w/v
 - topical application



– MSc student projects – at University of Zimbabwe, Harare.

The SAPP Project
Southern African Pesticidal Plants

Sustainable production & propagation

Securidaca longepedunculata

Effective but not abundant

Promoting use exacerbates problems of over-harvesting

Poor germination (<50% after 1 month).

Seedling growth slow.




The SAPP Project
Southern African Pesticidal Plants

Sustainable production & propagation

S. longepedunculata seeds sterilised and cultured on MS media (Murashige & Skoog, 1962)

Treatment time (mins)	Germination (%)
30	90
45	73
60	67



MSc project – Zambian at University of Bangor, Wales & RBG, Kew, UK.

The SAPP Project
Southern African Pesticidal Plants

Sustainable production & propagation




Providing microprop plantlets to farmers requires appropriate transfer technology

Potential exists for small enterprises

The SAPP Project
Southern African Pesticidal Plants

Training and Capacity Building

- Training target exceeded.
- 2 University of Greenwich, UK registered PhDs
- 12 MSc and 8 BSc students
- University of Zimbabwe, University of Mzuzu, University of Zambia and ICRAF MSc students, dissertations and other components of their degrees
 - Biological assays,
 - Toxicological studies
 - Plant micropropagation
- >8 Field and lab technicians
 - Field trials
 - Farmer surveys
 - Data evaluation
 - Insects & mites bioassays



BSc students at UNZA evaluating insect infestation from field samples.

The SAPP Project
Southern African Pesticidal Plants

Publicity



Interview for Malawi National Radio on SAPP project

Agricultural show, Rhumphi, Malawi



SAPP project leader, and Honourable Deputy Agriculture Minister, Mr Binton Kuntsaira, Malawi

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Southern African Pesticidal Plants

Thanks

- Farmers
- All the technical staff
- University of Zambia
- EU & SADC Funding & support

