

Introduction to Herbaria



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The Herbarium

- A collection of dried plants
- A store of reference material
- A means of identification
- An arbiter of correct names
- A comprehensive data-bank

“The essential working tool for systematics”

Role of the Herbarium

- Identification
- Taxonomic research
- Data repatriation (including databasing)
- IUCN Conservation ratings
- Voucher specimens
 - Ecological
 - DNA sequencing
 - Phytochemical

Fieldwork and the Herbarium

- Field Identifications difficult
 - Tropical habitats very diverse
 - Family or genus level
 - Floras often not available (tropics especially)
 - Floras bulky
- Ecological fieldwork:
 - Plots, often sterile vouchers, shorter-term
- Taxonomic fieldwork:
 - General collecting, fertile material, long-term

Herbaria around the world

- General or international herbaria
- National and regional
 - E.g., Forest Research Institute Malaysia (FRIM)
Forest Herbarium, Sarawak (SAR)
Forest Research Centre, Sabah (SAN)
- University herbaria
- Local botanists = local contacts
- Index Herbariorum



Herbaria from around the world



Specimen

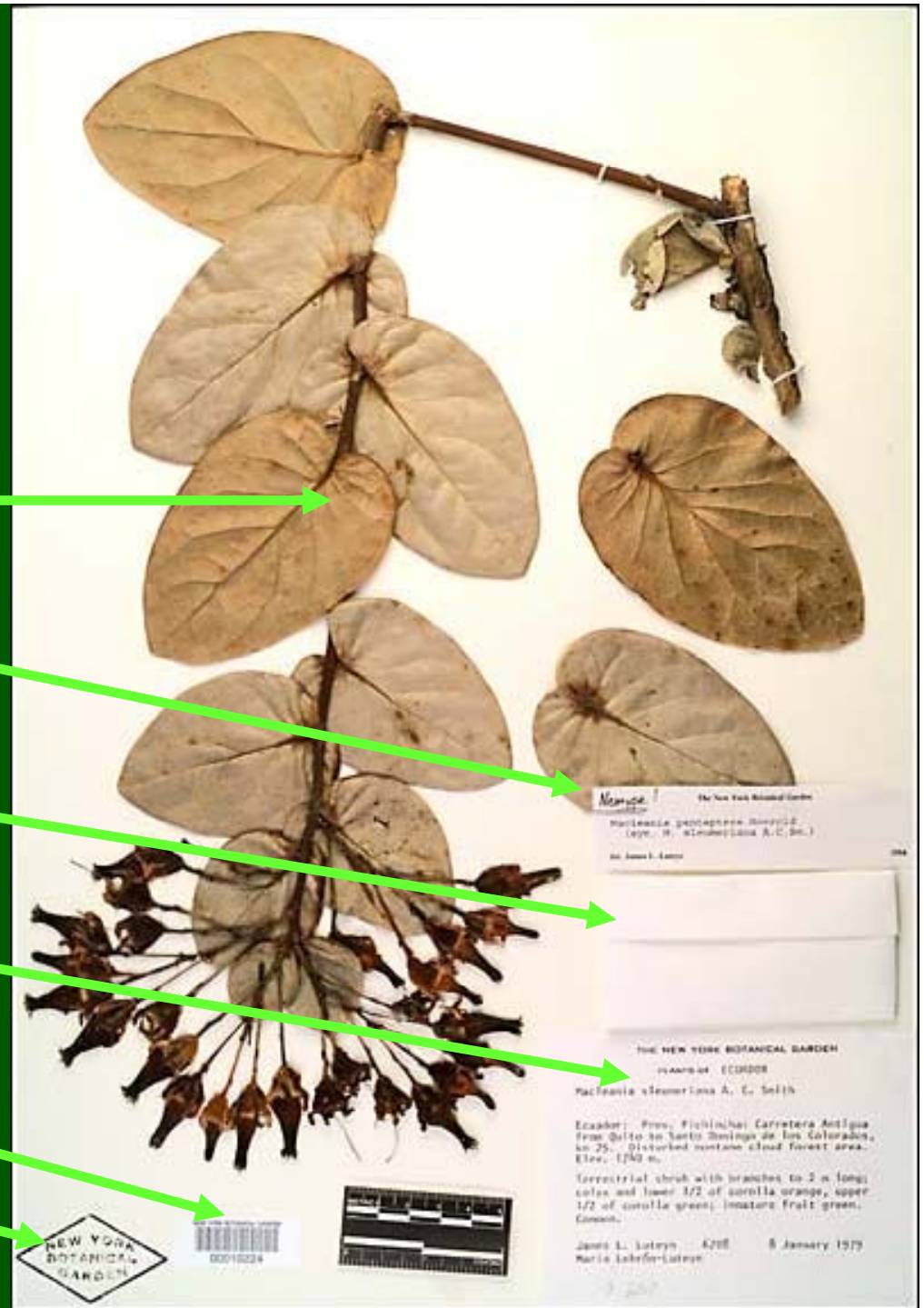
Determinavit slip

Loose parts

Label

Barcode

Herbarium stamp



The Kew Herbarium

- Approx. 5 million specimens
- Comprehensive collections from all regions



Wing C - 1857



Wing A - 1903

The Kew herbarium contd.

- Specimen arrangement
 - Phylogenetic according to Bentham and Hooker (1880)
 - Re-arrangement with the new wing
 - Mabberley's Plant Book (new edition)
- Staff 'arrangement'
 - Regional teams
 - Systematic teams

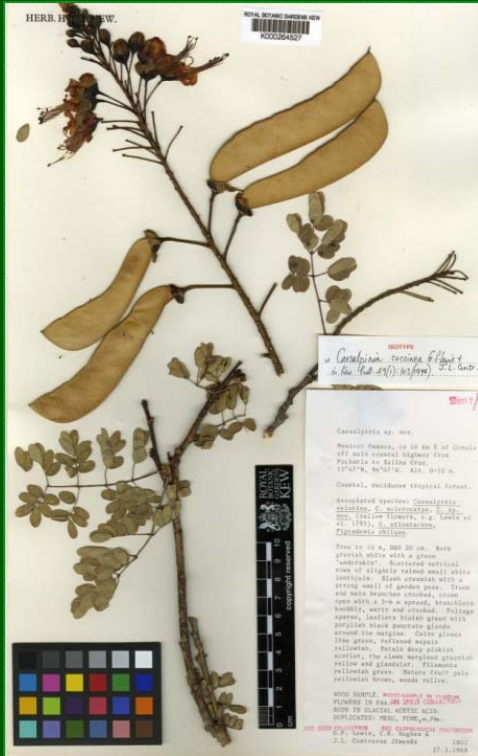
Regional Teams

- South-East Asia and Pacific
 - Drylands Africa
 - Africa Wet tropics
 - South America
 - Temperate
-
- Name all material except systematic families
 - Sorts, identification, field guides, and research

Systematic Teams

- Malpighiales (Euphorbs)
 - Myrtaceae (Eucalypts etc.)
 - Labiatae/Lamiaceae (Mints)
 - Rubiaceae (Coffee)
 - Leguminosae (Peas and beans)
 - Monocots
-
- Monographic and phylogenetic research

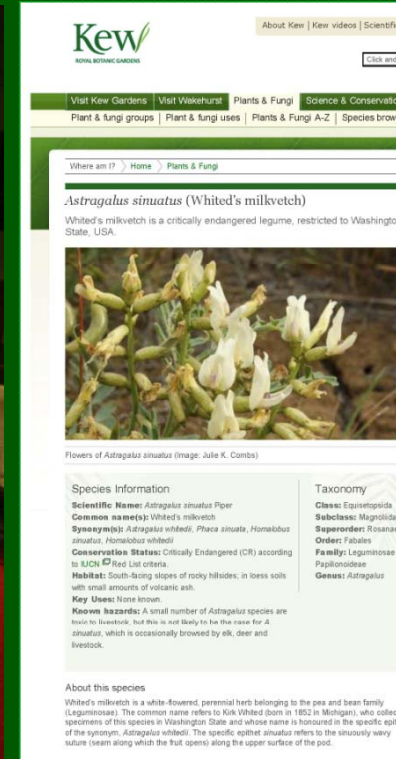
Digitisation progress



Data repatriation of 4000 specimens from Mexico and Central America



Nearly 50,000 legume specimens on-line



32 legume “species pages”



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Phytochemistry 63 (2003) 41–46

PHYTOCHEMISTRY

www.elsevier.com/locate/phytochem

Insect antifeedant furanocoumarins from *Tetradium daniellii*

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Received 13 September 2002; received in revised form 10 December 2002



3.2. Plant material

Fruits of *Tetradium daniellii* (Benn.) T.G. Hartley were collected from plants growing at the Royal Botanic Gardens, Kew (Acc. no. 1977-6618). A small fragment of fruit of *T. daniellii* from a herbarium specimen (Forrest 14772) collected in Yunnan, China in September 1917 was also used for extraction and HPLC analysis.

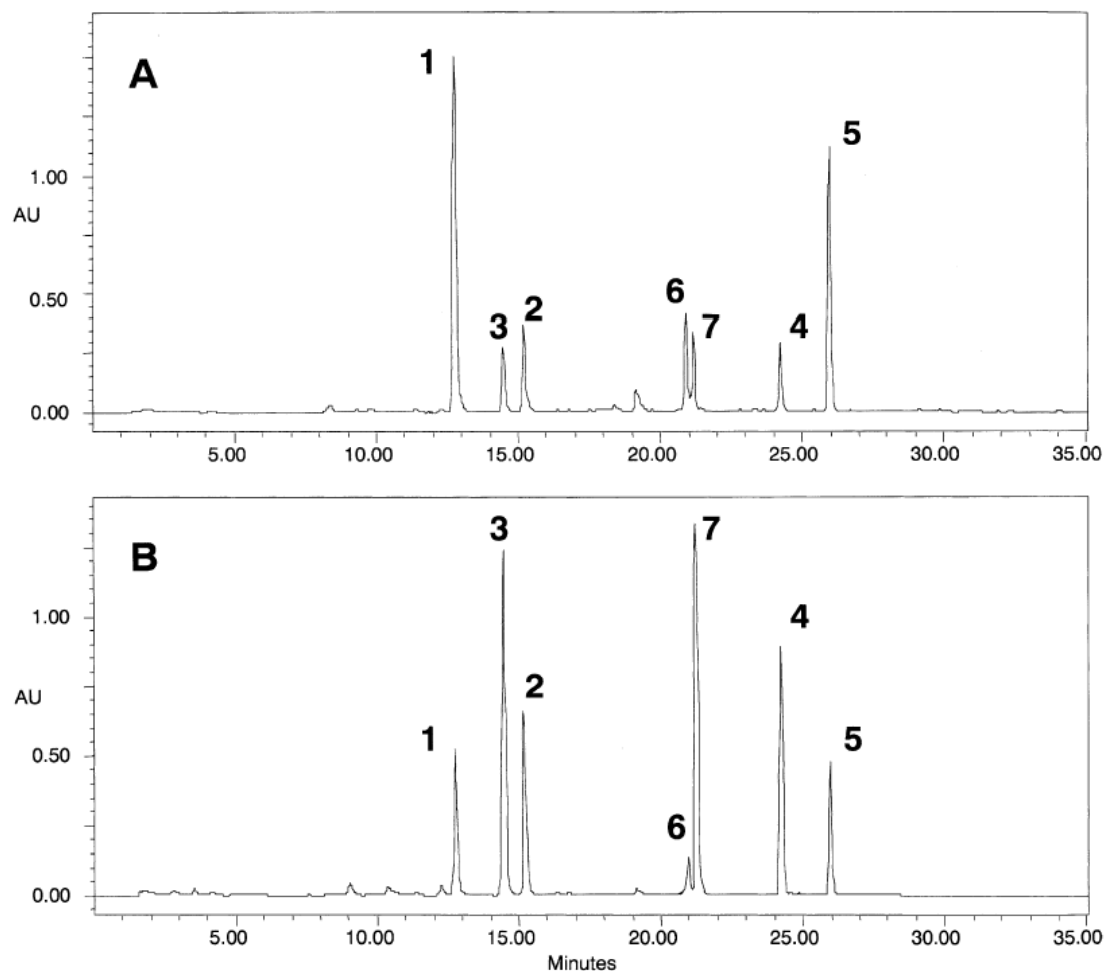
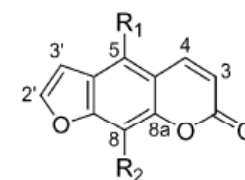


Fig. 2. HPLC profile of furanocoumarins from fruits of *Tetradium daniellii*: (a) living material, (b) herbarium specimen.



	R ₁	R ₂
1	H	OCH ₃
2	OCH ₃	H
3	OCH ₃	OCH ₃
4	H	
5		H
6		H
7		H

Fig. 1. Structures of furanocoumarins 1–7 isolated from fruits of *Tetradium daniellii*.



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Journal of Stored Products Research 43 (2007) 79–86

Journal of
**STORED
PRODUCTS
RESEARCH**

www.elsevier.com/locate/jspr

Comparative study of field and laboratory evaluations of the ethnobotanical *Cassia sophera* L. (Leguminosae) for bioactivity against the storage pests *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae) and *Sitophilus oryzae* (L.) (Coleoptera: Curculionidae)

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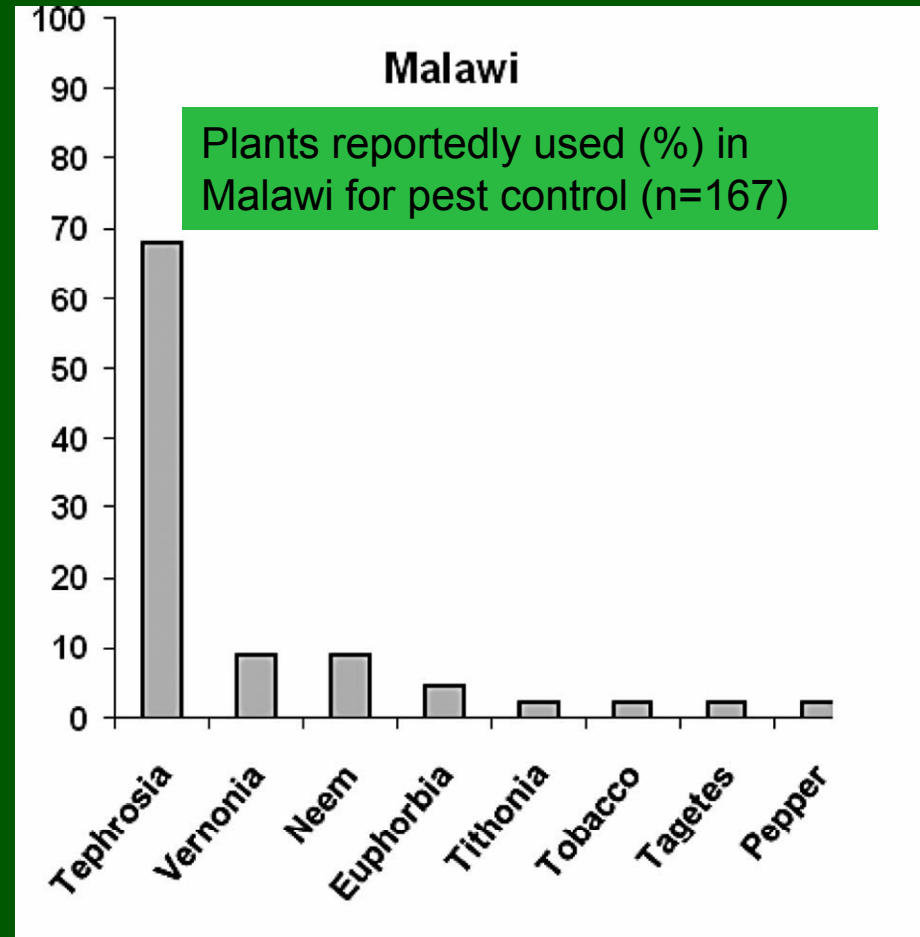
^bJodrell Laboratory, Royal Botanic Gardens, Kew, Surrey TW9 3DS, UK

Accepted 17 November 2005





Tephrosia vogelii



Some farmers report no activity from *Tephrosia*

Callosobruchus maculatus

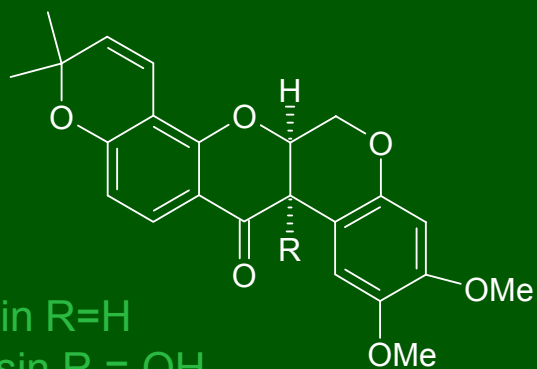


Oviposition by fecund bruchid beetles on cowpea seeds treated with powdered plant @1% w/v after 48 h.

Mean number of eggs



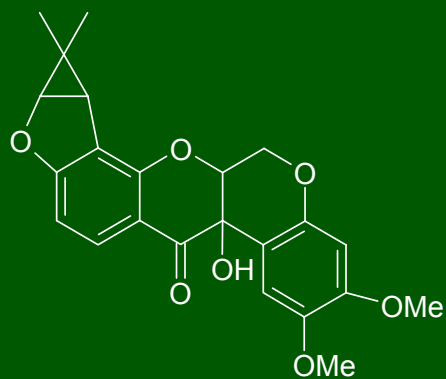
Rotenoids from *Tephrosia vogelii* leaves



Deguelin R=H
Tephrosin R = OH



Rotenone R=H
12 α -hydroxyrotenone R = OH



Sarclobine



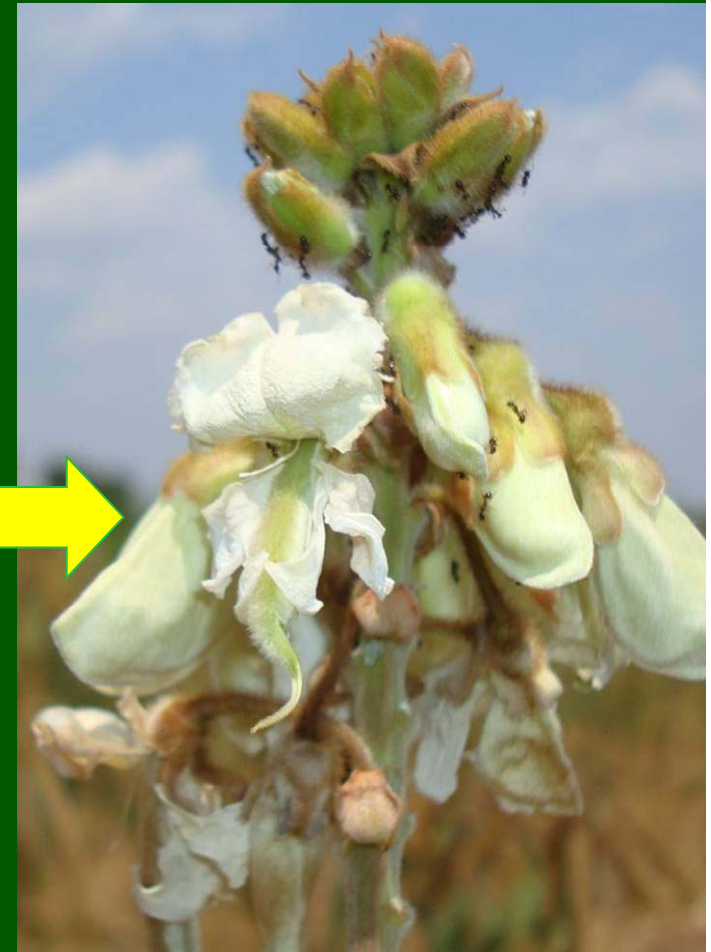
Toxicarol

Is *T. candida* effective?



Tephrosia vogelii.
Controls bruchids

Tephrosia candida
Promoted for soil improvement (N₂ fixing & green mulch) and (assumed) pest control properties.



(growing at an International Agroforestry Centre)

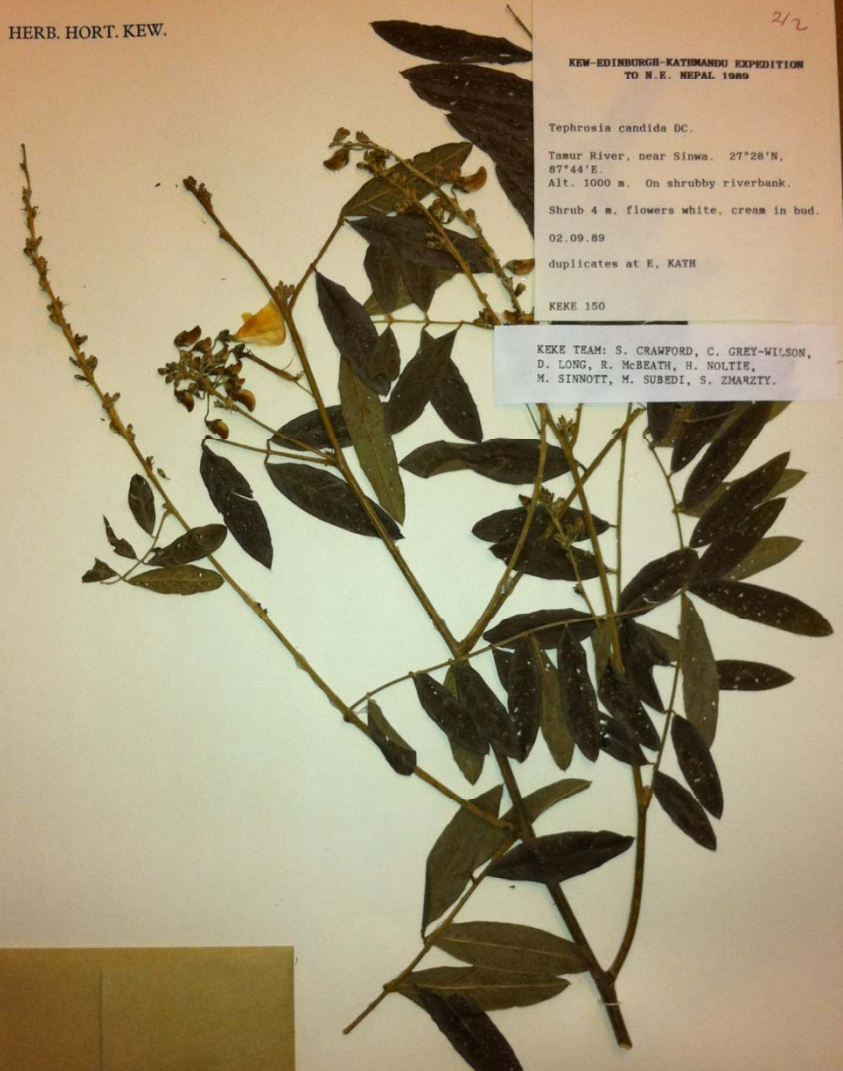
HERB. HORT. KEW.



NATIONAL HERBARIUM OF MALAWI
Tephrosia vogelii *Hod. f.*
 Family *Fabionaceae*
 Malawi S. Reg. Zomba Dist.
 Loc. Mpits Tobacco Estate, Inhandu
 Grid Ref. Alt.
 Hab. Evergreen forest edge
 Descr. Shrub up to about 2m. high.
 Leaves hairy on the lower surface.
 Pods also hairy.
 Coll. J.L. Balaka & W. Nachamba
 No. 1205
 Date 15/6/85
 Div. 8140/3M/2.84 48

Herb. Univ. Malawi
 No. 1205

HERB. HORT. KEW.



212
 KEW-EDINBURGH-KATHMANDU EXPEDITION
 TO N.E. NEPAL 1989
 Tephrosia candida DC.
 Tamur River, near Sinwa. 27°28'N,
 87°44'E.
 Alt. 1000 m. On shrubby riverbank.
 Shrub 4 m. flowers white, cream in bud.
 02.09.89
 duplicates at E, KATH
 KEKE 150

KEKE TEAM: S. CRAWFORD, C. GREY-WILSON,
 D. LONG, R. McBEATH, H. NOLLIE,
 M. SINNOTT, M. SUBEDI, S. ZHARTY.



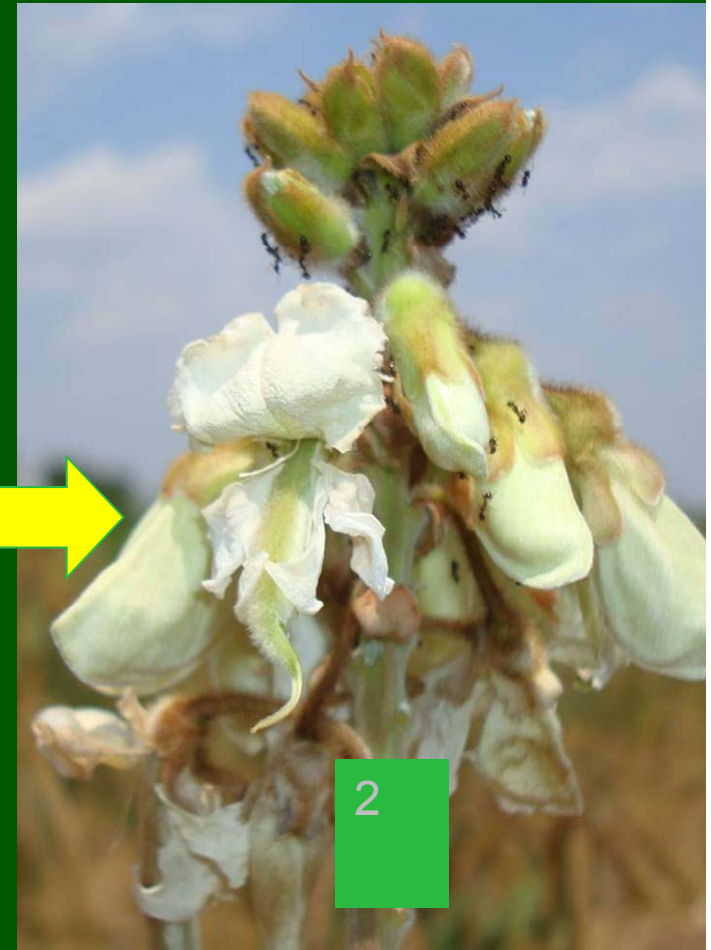
Oh – its actually *T. vogelii*



Tephrosia vogelii.
Controls bruchids

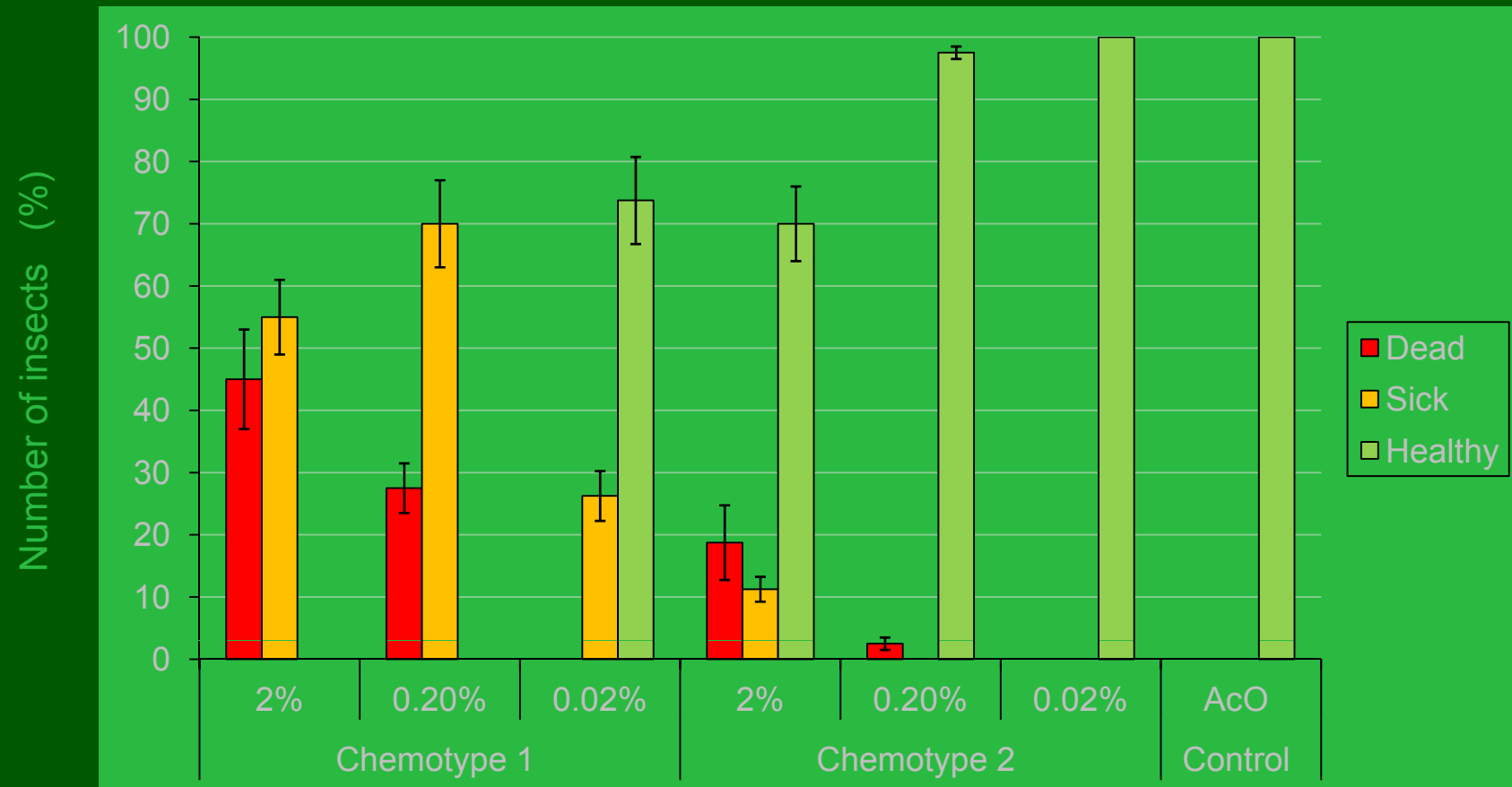
~~*Tephrosia candida*~~

Promoted for soil improvement (N₂ fixing & green mulch) and (assumed) pest control properties.



Plastid *Ltrn* region, ITS nuclear DNA sequences & morphology indicate both to be *T. vogelii*

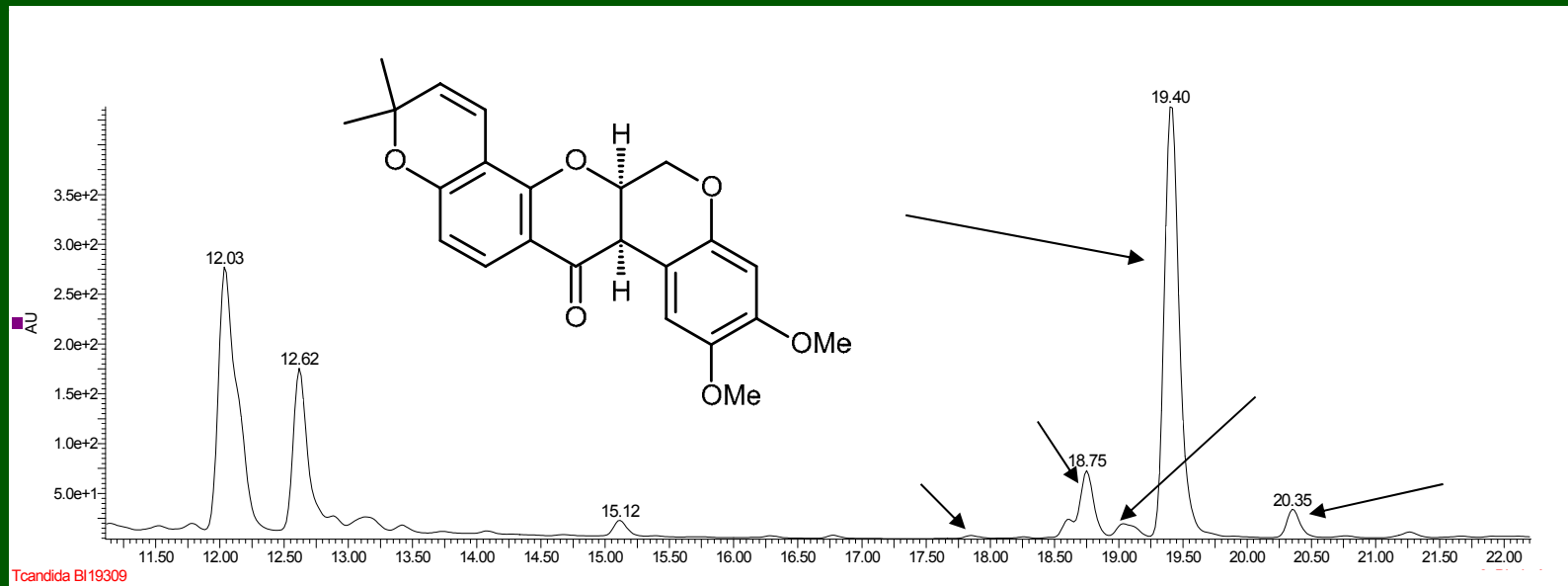
Effect on *C. maculatus* of cowpea treated with acetone extracts of *T. vogelii* chemotypes after 48 h.



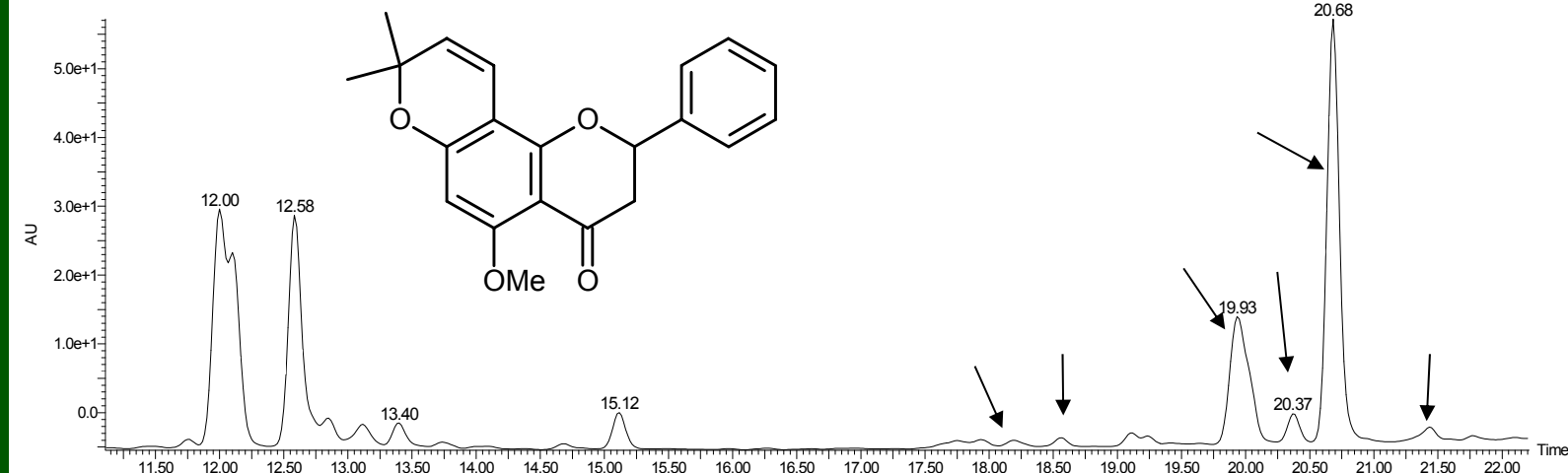
Sick insects are alive but paralysed

LC-MS chromatograms of *T. vogelii* chemotypes 1 & 2

1

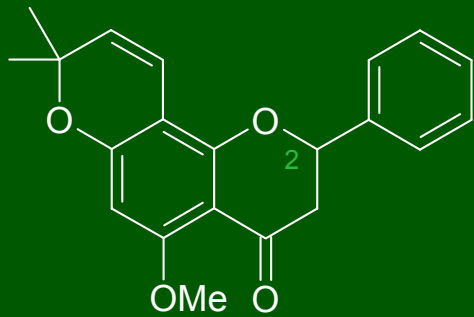


2



Compound IDs based on 700MHz NMR and Orbitrap HR-EI MS

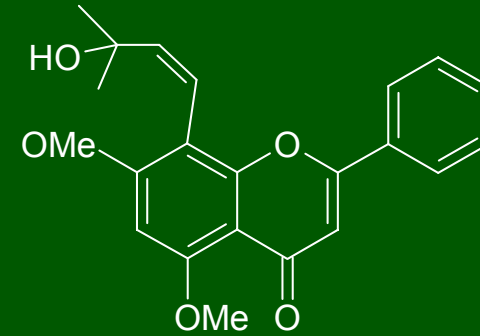
Flavanones and flavones from *T. vogelii* chemotype 2 (inactive)



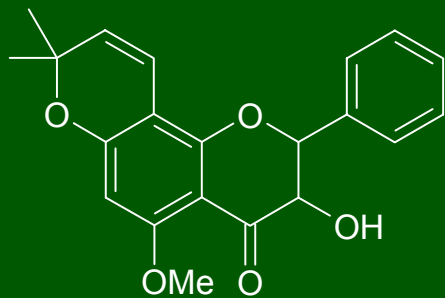
Obovatin 5-methylether



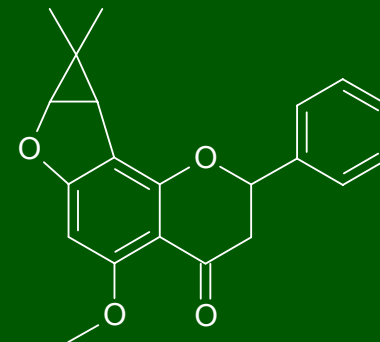
Deguelin R=H
Tephrosin R = OH



Z-tephrostachin



Yukovanol 5-methylether *



Tephrovogelone *

*two of 6 new
flavonoid aglycones



Mildbraediendron excelsum

Herbarium sheet:

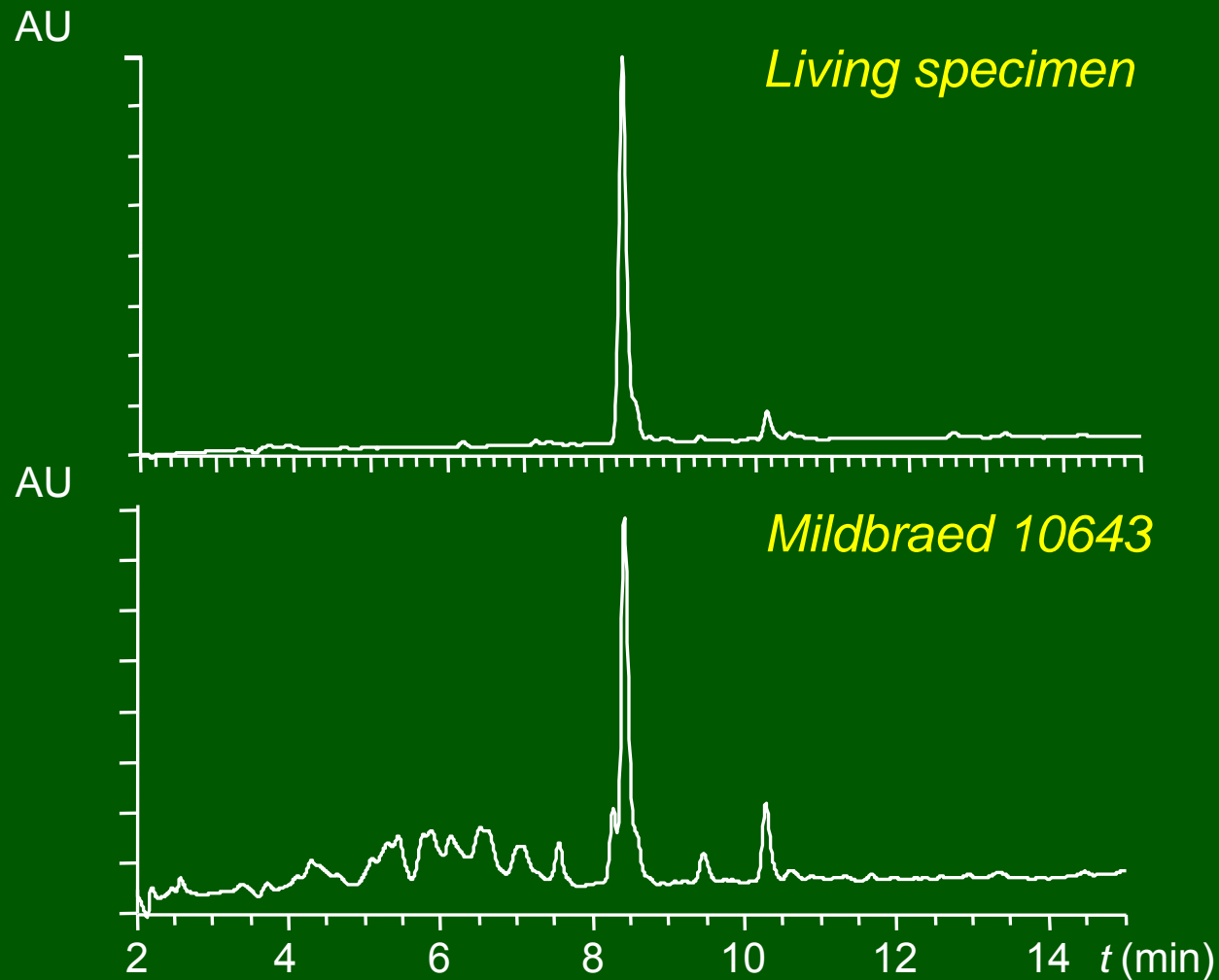
Specimen collected by Johannes Mildbraed in 1928

Living specimen:

Grown from seed collected in 1996, Mt. Kupe, Cameroon



LC-UV Analysis of *Mildbraediodendron excelsum*

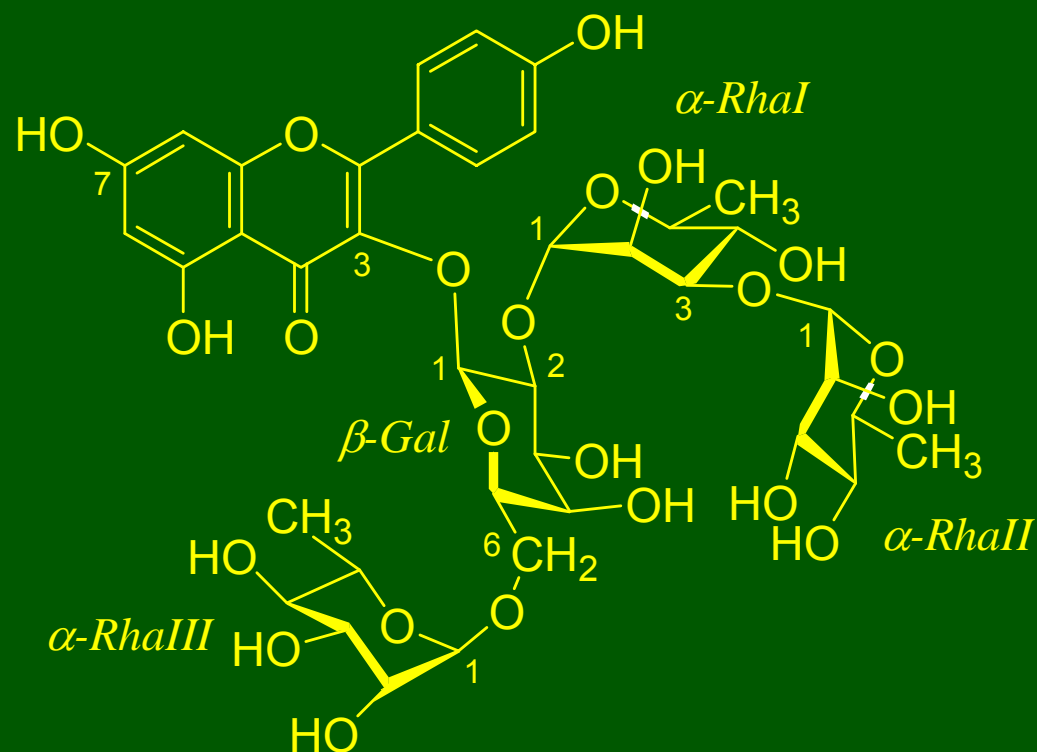


LC chromatogram (total scan PDA)



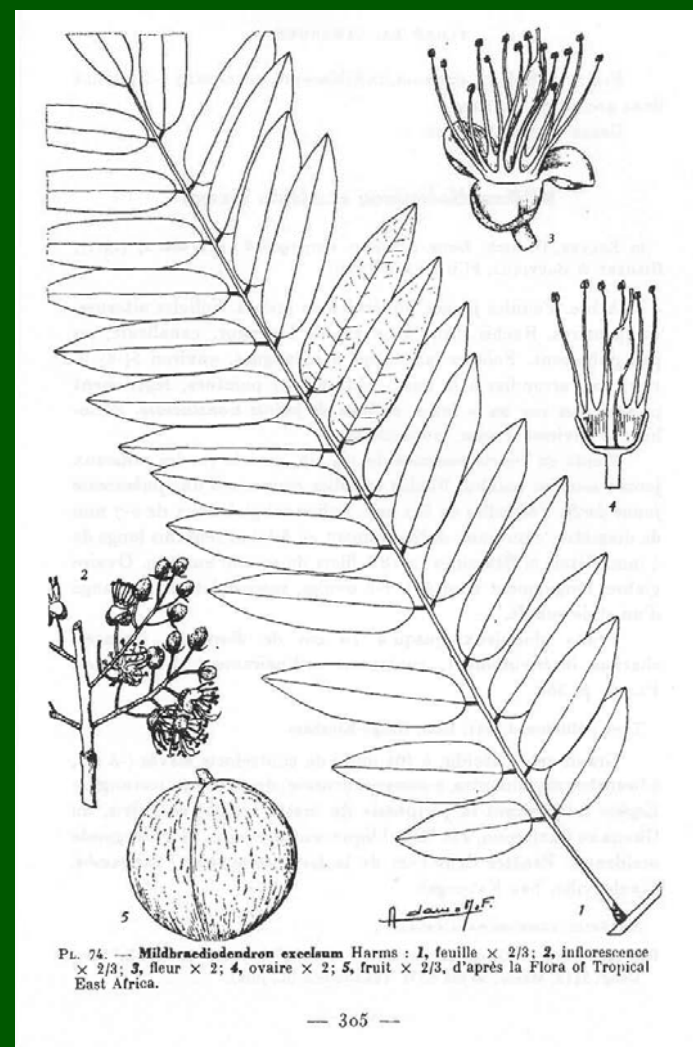
ANALYTES: 50% aq. MeOH
extracts of leaflet material

MILDBRAEDIN: a flavonol tetraglycoside from *Mildbraediodendron excelsum*

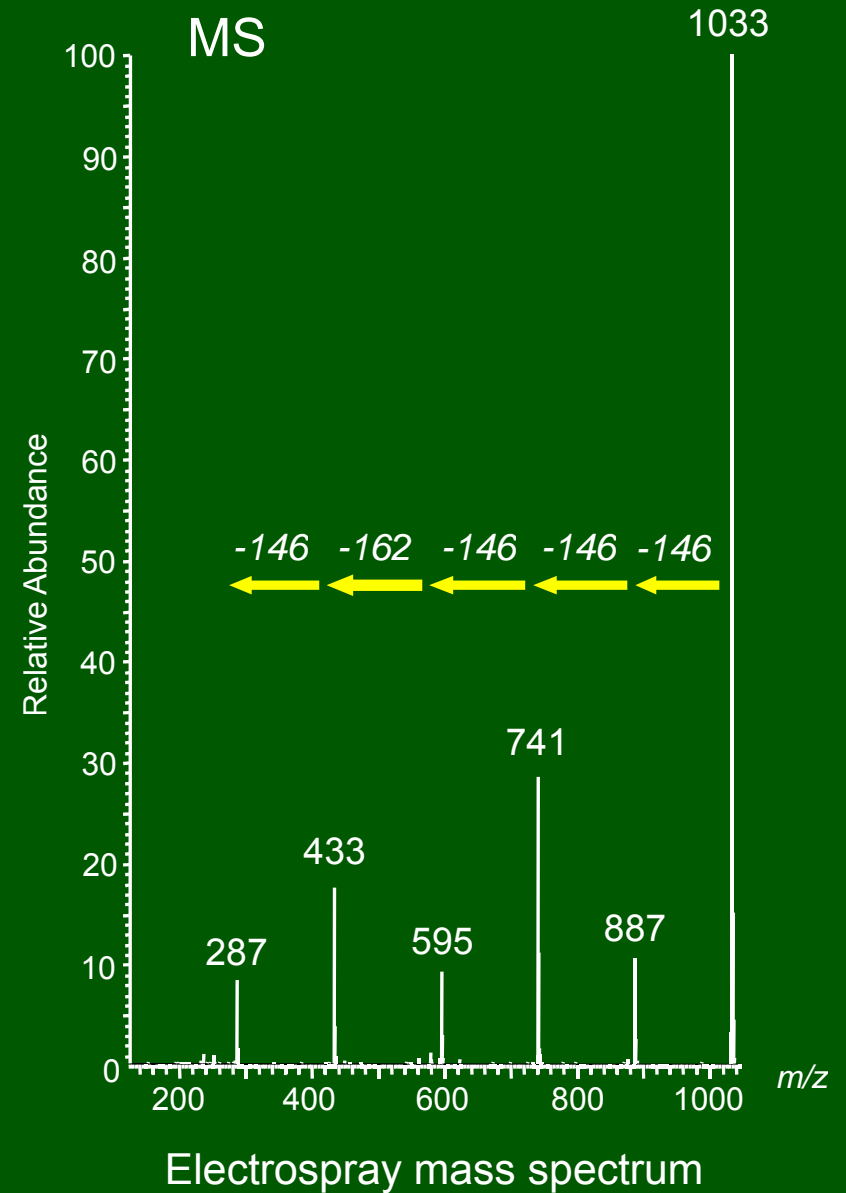
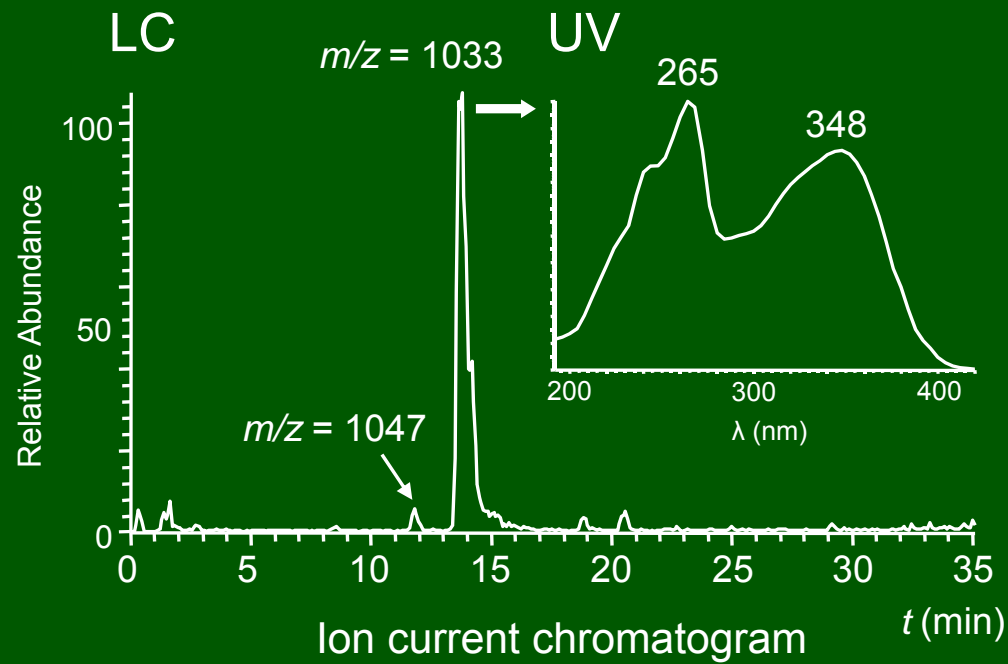


- Main phenolic component of:
- (1) Herbarium leaf fragment (1928)
 - (2) Living specimen

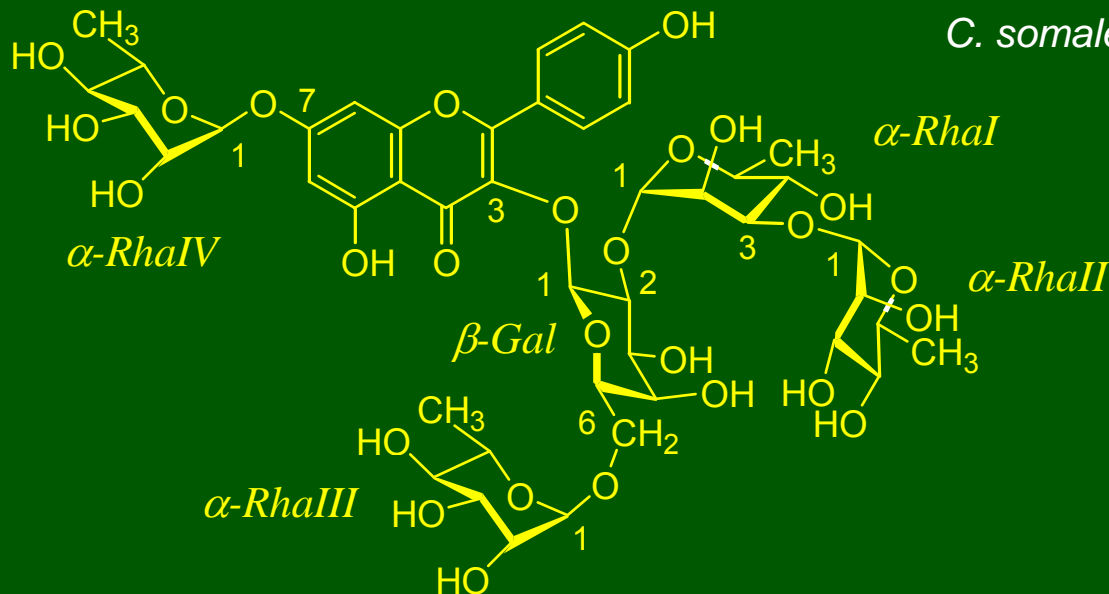
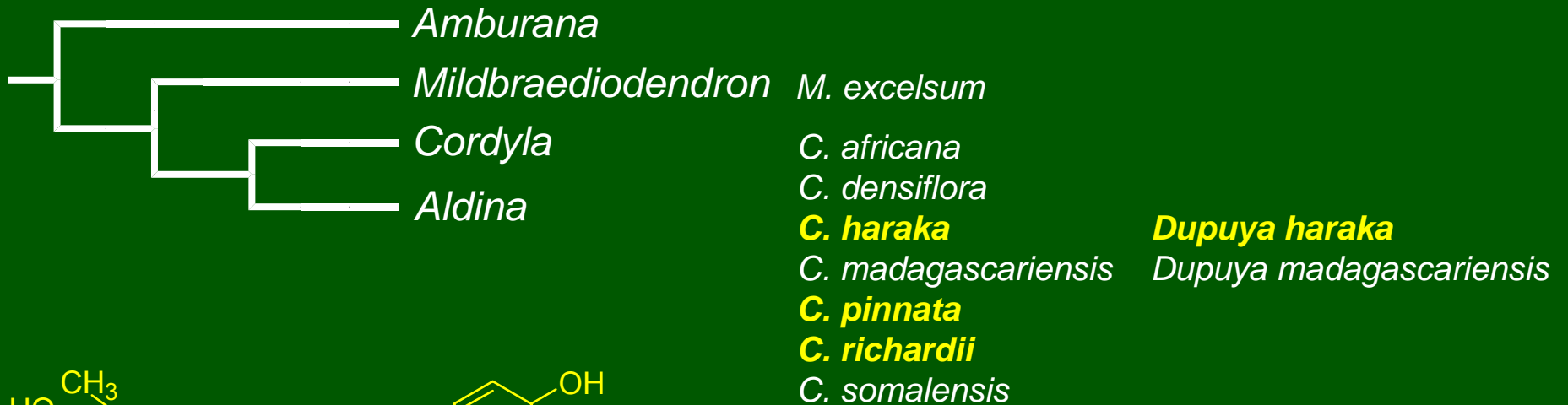
Veitch et al. (2005) *Tetrahedron Lett.* 46, 8595



Flavonol pentaglycosides of *Cordyla haraka*



Distribution of flavonol pentaglycosides in *Cordyla* s.l.



CONCLUSIONS:

C. haraka allied with
C. pinnata & *C. richardii*

No support for transfer of
C. haraka to *Dupuya*

R = OH, Cordylasin B
R = H, Cordylasin A

Veitch, Kite & Lewis (2008) *Phytochemistry* 69, 2329