

## Pharmacognostical examination of the roots and stems of *Rauwolfia mannii* Stapf

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In previous communications the occurrence, indigenous usage, anatomy and chromatographic investigation of *R. rosea* K. Schum. have been described (Khalil, Court & Stewart, 1967; Court, Khalil & Stewart, 1967). Brief reference was made to the closely related species *R. mannii* Stapf and it was apparent that a detailed investigation was necessary to establish any differences between the species.

*R. mannii* was described by Stapf in 1894 and recorded with *R. cardiocarpa* K. Schum., *R. preussii* K. Schum. and *R. rosea* in Supplement I of the Kew Index (1886-1895). *R. cardiocarpa* and *R. preussii* are now considered synonymous with *R. mannii* (Feuell, 1955; Bisset, 1958). Confusion over the separate identities of *R. mannii* and *R. rosea* is related to the original morphological basis of differentiation, which depends on variations in the form of branches and peduncles (Stapf in Thiselton-Dyer, 1904). Pichon (1947) grouped both species in the section *Afrovolfia* of his classification of the genus. Boutique & Monseur (1955) observed close similarity between *R. mannii* growing in the Eastern Congo and *R. rosea* from the Usambaras, Tanzania, although synonymy has not been established (Bisset, 1958). Whereas Poisson (1965) does record the species as synonymous, East African botanists and the Royal Botanic Gardens, Kew (private correspondence) accept the species as distinct.

The presence of reserpine (0.04%),  $\delta$ -yohimbine (ajmalicine), reserpiline, ajmaline and serpentine has been reported in the roots of *R. rosea* (Korzun, St. André & Ulshafer, 1957; Court & others, 1967) whilst reserpine, rescinnamine, reserpiline, ajmaline and serpentine have been observed in *R. mannii* (Court & others, 1967). Other authors (Kaiser & Popelak, 1959) claim serpentine and its isomer alstonine to be absent.

### *Habitat*

*R. mannii* is a shrub attaining a height of 1-3 m at altitudes up to 2,300 m in forest and scrubland in Southern Nigeria, Cameroun, Gabon, Ruanda-Urundi and the Congo (Thiselton-Dyer, 1904; Dubois, 1955). *R. preussii* was reported indigenous to Southern Nigeria and French Cameroun, but no authentic specimens are available.

### *Indigenous usage*

*R. mannii* is known in West Africa as Mbara and may be occasionally used as an arrow poison supplement (Lewin, 1923). The powdered bark may be applied to wounds (de Wildemann, 1939).

### *Plant material*

The material used in this investigation was:

*R. mannii* roots and stems, herbarium specimens from Nigeria, obtained by the Tropical Products Institute, London, 1964; *R. mannii* roots and stems collected in Yaounde, Cameroun, 1968; *R. rosea* roots and stems collected in Tanzania in 1962 and verified by the East African Herbarium, Nairobi, Kenya; *R. rosea* roots and stems collected in Lushoto, Tanzania in 1964 and verified by the East African Herbarium.

*Microscopical examination*

Measurements of cells in radial, tangential and longitudinal planes and of cell inclusions and cells isolated by maceration, were obtained as described for *R. rosea* (Khalil & others, 1967). Methods for the determination of vessel diameter index values and vessel element length were as described earlier (Court, 1967).

*Results and discussion*

The tissue arrangement and distribution in the axis of *R. mannii* is similar to that described for *R. rosea* (Khalil & others, 1967) although sclereid development is more pronounced in *R. mannii* and can be related to the greater height of this species.

Comparison of cell dimensions corresponding to those reported for *R. rosea* indicates fair agreement except for the root vessel measurements. For *R. mannii*, R = 21 to 30 to 42 to 63  $\mu\text{m}$  and T = 21 to 30 to 42 to 68  $\mu\text{m}$  and for *R. rosea*, R = 25 to 34 to 55 to 84  $\mu\text{m}$  and T = 21 to 29 to 50 to 67  $\mu\text{m}$  where R and T refer to measurements made in the radial and tangential planes respectively.

Quantitative microscopy confirmed that the root vessel diameters are smaller for *R. mannii*, although the vessel element lengths are similar (Table 1). The laborious technique of vessel diameter index differentiates the two species. For *R. mannii* the 60  $\mu\text{m}$  index is less than 10% and for *R. rosea* greater than 30%.

Stapf (1894) has recorded that young branches of *R. mannii* are quadrangular with more or less conspicuous decurrent raised lines; Schumann (Engler, 1895) describes

Table 1. *Vessel index determinations* (Vessel index = percentage of elements exceeding critical diameter) and vessel element length.

Species	Vessel index determinations				Number of specimens	
	Critical diameter			90 $\mu\text{m}$		
	30 $\mu\text{m}$	60 $\mu\text{m}$	90 $\mu\text{m}$			
<i>R. mannii</i> (Cameroun) ..	.. 94.7 $\pm$ 0.4	1.5 $\pm$ 0.4	0	10		
<i>R. mannii</i> (Nigeria) ..	.. 94.7 $\pm$ 0.3	5.9 $\pm$ 0.8	0	10		
<i>R. rosea</i> (Tanzania, 1962) ..	.. 99.8 $\pm$ 0.1	44.4 $\pm$ 2.3	2.4 $\pm$ 0.2	9		
<i>R. rosea</i> (Tanzania, 1964) ..	.. 99.8 $\pm$ 0.2	41.0 $\pm$ 2.5	2.2 $\pm$ 0.6	9		
(Arithmetic mean $\pm$ Standard error)						
Species	Vessel element length				Number of samples	Number of observations
	Range	Mean	Standard deviation			
<i>R. mannii</i> (Cameroun) ..	58-274-618-840 $\mu\text{m}$	446 $\mu\text{m}$	172 $\mu\text{m}$	6	900	
<i>R. mannii</i> (Nigeria) ..	116-341-661-971 $\mu\text{m}$	501 $\mu\text{m}$	160 $\mu\text{m}$	6	900	
<i>R. rosea</i> (Tanzania, 1962) ..	50-296-566-994 $\mu\text{m}$	421 $\mu\text{m}$	145 $\mu\text{m}$	6	300	
<i>R. rosea</i> (Tanzania, 1964) ..	85-355-709-1,022 $\mu\text{m}$	532 $\mu\text{m}$	177 $\mu\text{m}$	6	300	

the young branches of *R. rosea* as terete without decurrent lines. Examination of the available specimens confirms this differentiation.

Thin layer chromatographic examination of the specimens available using the methods described earlier (Court & others, 1967) again indicated the presence of rescinnamine in *R. mannii* but not *R. rosea*.

Khalil & others (1967) commented on the similarity between *R. rosea* and *R. volkensii* Stapf (now known to be *R. oreogiton* Mgf.) and *R. obscura* K. Schum. roots. These species exhibit small vessels and limited sclereid development and *R. mannii* must be considered in this group. The main features are compared in Table 2.

Table 2. *Comparison of the main features of four species of rauwolfia.*

Species	Normal height	Vessel diameter	Sclereid development	Reference
<i>R. mannii</i>	.. 2-3 m	R 21-30-42-59 $\mu\text{m}$ T 21-30-42-68 $\mu\text{m}$	Isolated or groups of up to 12	This work
<i>R. rosea</i>	.. 0.5-2 m	R 25-34-55-84 $\mu\text{m}$ T 21-29-50-67 $\mu\text{m}$	Isolated or small groups. Rare in roots below 1 cm diameter	Khalil & others, 1967
<i>R. obscura</i>	.. 1-1.5 m	R 52-56 $\mu\text{m}$ T 35-50 $\mu\text{m}$	Absent	Paris & Dillemann, 1956
<i>R. oreogiton</i>	.. 2 m	R 26-44-56-96 $\mu\text{m}$ T 26-37-48-78 $\mu\text{m}$	Isolated or small groups of up to 10. Rare except in specimens exceeding 4 cm diameter	Court, 1961

It is concluded that although similar in structure, the roots of *R. mannii* and *R. rosea* may be identified by careful investigation of sclereid development, vessel diameter index and by thin layer chromatography.

#### REFERENCES

- BISSET, N. G. (1958). *Ann. Bogor.*, **3**, Part 1, 233.  
 BOUTIQUE, R. & MONSEUR, X. (1955). *Bull. agric. Congo belge*, **46**, 271-280.  
 COURT, W. E. (1961). *J. Pharm. Pharmac.*, **13**, 422-434.  
 COURT, W. E. (1967). *Can. J. pharm. Sci.*, **2**, 68-71.  
 COURT, W. E., KHALIL, A. A. & STEWART, A. F. (1967). *Planta Med.*, **15**, 173-178.  
 DUBOIS, L. (1955). *Bull. agric. Congo Belge*, **46**, 567-595.  
 ENGLER, A. (1895). *Pflanzenw. Ost. Afr. C.*, 317.  
 FEUELL, A. J. (1955). *Colon. Pl. Anim. Prod.*, **5**, 1-33.  
 KAISER, F. & POPELAK, A. (1959). *Chem. Ber.*, **92**, 278-287.  
 KHALIL, A. A., COURT, W. E. & STEWART, A. F. (1967). *Planta Med.*, **15**, 104-117.  
 KORZUN, B. P., ST. ANDRÉ, A. F. & ULSHAFFER, P. R. (1957). *J. Am. pharm. Ass. (Sci. Edn.)*, **46**, 720-723.  
 LEWIN, L. (1923). *Die Pfeilgifte* (Leipzig: J. A. Barth), 259.  
 PARIS, R. & DILLEMANN, G. (1956). *Ann. pharm. fr.*, **14**, 505-518.  
 PICHON, M. (1947). *Bull. Soc. bot. Fr.*, **94**, 31-39.  
 POISSON, J. (1965). *Ibid.*, **112**, 162-174.  
 STAPF, O. (1894). *Kew Bull.*, 21.  
 THISELTON-DYER, W. T. (1904). *Flora of Tropical Africa* Vol. IV, i, 113-114. London: Lovell Reeve and Co., Ltd.  
 DE WILDEMAN, E. (1939). *Mém. Inst. r. colon. belge, Sect. Sci. nat. méd.*, **9**, 330.