

Zeitschrift: Boissiera : mémoires de botanique systématique
Herausgeber: Conservatoire et Jardin Botaniques de la Ville de Genève
Band: 24 (1975-1976)
Heft: 1

Artikel: Chemotaxonomic aspects of the gum exudates from some subspecies of *Acacia tortilis*
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DOI: <https://doi.org/10.5169/seals-895520>

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Chemotaxonomic aspects of the gum exudates from some sub-species of *Acacia tortilis*

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SUMMARY

Chemical analysis of specimens of their gum exudates indicate that *Acacia tortilis* subsp. *raddiana* is more similar to subsp. *spirocarpa* than to subsp. *heteracantha*.

RÉSUMÉ

L'analyse chimique des exsudations gommeuses des sous-espèces d'*Acacia tortilis* mène à la conclusion que la sous-espèce *raddiana* est plus proche de la sous-espèce *spirocarpa* que de la sous-espèce *heteracantha*.

Acacia tortilis is a widespread species, complicated genetically, and apparently divisible into a number of distinguishable geographical races. Brennan considers that 4 subspecies can be distinguished, viz.:

- Acacia tortilis* (Forsk.) Hayne
 - subsp. *tortilis*
 - subsp. *spirocarpa* (Hochst. ex A. Rich.) Brennan
 - subsp. *heteracantha* (Burch.) Brennan
 - subsp. *raddiana* (Savi) Brennan
 - var. *raddiana*
 - var. *pubescens* A. Chev.

There is considerable interest for several reasons in *Acacia tortilis* subsp. *spirocarpa* which is a big, flat-topped savannah tree, often photographed as a back-ground to animals in game-parks and reserves, and whose pods are valued as a source of forage. Unfortunately, the regeneration of this subspecies could be threatened because its seeds appear to be particularly susceptible (>90 per cent infestation is common) to attack by *Bruchidus* beetles (see Lamprey & al., 1974).

Although some distinguishing factors are claimed by others, such as the geographical range, glabrous pods, purplish-coloured bark on young twigs, and habit (subsp. *raddiana* is a much larger tree than subsp. *tortilis*, but is not large compared with subsp. *spirocarpa*), these distinguishing characters are not really very great;

Brenan considers *raddiana* to be a recognisable *subspecies*, but not a good *species*. It is of some significance that Fahn (1959), who regarded *A. tortilis* and *A. raddiana* as distinct species, found that a close similarity existed in their wood structures, the only main distinguishing feature being the broader concentric bands of aliform-confluent wood parenchyma in *A. raddiana*.

Chemical analysis of the gum exudates from some 60 different taxa of *Acacia* has been carried out by Anderson & al. (1973) in recent years. It is now reasonably well established that the particular chemical combination of analytical parameters of the gum from a particular species differ sufficiently from those of other species to make the chemical analysis of gum exudates a very sensitive test for distinguishing between taxa in which clear-cut decisions are difficult to reach from the consideration of botanical features alone. (For a review, see Anderson & Dea, 1969.)

Accordingly, when good gum specimens from *A. tortilis* subsp. *heteracantha*, subsp. *spirocarpa*, and subsp. *raddiana* var. *pubescens* were obtained, their chemical composition was investigated to ascertain whether significant differences could be discerned at the subspecies level. The gum from *A. tortilis* subsp. *spirocarpa* was collected by Mr. A. G. Seif-el-Din, Gum Research Officer, El Obeid, Republic of the Sudan, at 13°45'N, 30°20'E in March 1964. The gum from subsp. *raddiana* var. *pubescens* (specimen I) was collected by Mr. Seif-el-Din at 13°45'N, 30°20'E in April 1973, and specimen II was obtained by Mr. Seif-el-Din in March 1970 from a tree at Um Badir, N. Kordofan (vouchers authenticated by Mr. J. P. M. Brenan). Gum from subsp. *heteracantha* was obtained as follows: specimen I at Salisbury, Rhodesia, on February 28, 1971 (Kelly 479 in SRGH); specimens II and III at Botswana, near Rakops, Rhodesia (24°30'E, 21°4'S) in May 1971 (Pope 426 & 427 in SRGH).

The analytical data obtained for the 6 specimens are shown in Table 1. When all the analytical parameters are taken into account, there is little doubt that the

	<i>Acacia</i> <i>tortilis</i> subsp. <i>spirocarpa</i>	<i>Acacia</i> <i>tortilis</i> subsp. <i>raddiana</i>	<i>Acacia</i> <i>tortilis</i> subsp. <i>raddiana</i> var. <i>pubescens</i>	<i>Acacia tortilis</i> subsp. <i>heteracantha</i>		
		I	II	I	II	III
Moisture (%)	9.9	10.3	9.6	9.9	11.8	10.7
Ash (%)	1.6	1.9	1.3	1.5	2.0	1.7
Nitrogen (%)	0.46	0.96	1.22	1.51	1.49	1.51
Hence protein (%) (N × 6.25)	2.9	6.0	7.6	9.4	9.3	9.4
Methoxyl (%)	0.58	0.61	0.66	0.96	0.97	1.06
[α] _D , in water, degrees	+74	+88	+87	+97	+79	+87
[α] _D , in 7M urea, degrees	+78	+93	+92	+99	+82	+91
Intrinsic viscosity (ml/g ⁻¹)	9.8	9.3	11.2	22.5	16.9	19.4
Molecular weight (MW × 10 ⁴)	25	50	51	210	220	140
Equivalent weight	1590	2040	1940	2440	1730	2100
Hence uronic anhydride (%)	11.1	8.6	9.1	7.2	10.1	8.7
<i>Sugar composition after hydrolysis:</i>						
4-O-Methylgluronic acid	3.5	3.7	4.0	5.8	5.8	6.4
Glucuronic acid	7.6	4.9	5.1	1.4	4.3	2.3
Galactose	39	36	37	21	24	24
Arabinose	43	49	46	68	62	64
Rhamnose	7	6	8	4	3	3

Table 1. — Analytical data for purified gum polysaccharides from *Acacia tortilis* subspecies.

three subspecies examined each give a gum exudate that is analytically distinguishable from all other *Acacia* exudates examined to date.

The overall impression is that subsp. *raddiana* var. *pubescens* is intermediate between subsp. *spirocarpa* and subsp. *heteracantha*, but on the basis of their closely similar viscosities, molecular weight, methoxyl and rhamnose contents, and arabinose to galactose ratio, subsp. *raddiana* appears to be closer chemically to subsp. *spirocarpa* than to subsp. *heteracantha*, in spite of its morphological relationship with the latter subspecies. Subsp. *raddiana* is certainly not an entirely distinct species, on the basis of this chemical evidence.

Some of the analytical data for subsp. *heteracantha* indicate that it is somewhat variable. Anyone able to secure gum specimens, backed by the customary reference vouchers, of any of the subspecies (particularly subsp. *tortilis*) and varieties (particularly var. *raddiana*) of subsp. *raddiana* can be of great service by sending such specimens to either of the authors of this short paper. In the broader context, gum exudates from any plant source are always sought for chemical analysis.

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