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THE GUM EXUDATES FROM SOME *ACACIA* SUBSPECIES OF THE SERIES BOTRYOCEPHALAE*

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Abstract—Gum specimens from *A. deanei* subsp. *paucijuga* (two samples), *A. irrorata* subsp. *irrorata*, and *A. dealbata* subsp. *subalpina* have been analysed. There are minor differences between the two specimens from *A. deanei* subsp. *paucijuga*, but they, and the gum from *A. irrorata* subsp. *irrorata*, have analytical parameters that correspond well with those for species in the proposed Group A within the Botryocephalae. In contrast, the gum from *A. dealbata* subsp. *subalpina* conforms well with the analytical parameters established for *A. dealbata* gum, and the slight analytical differences lead to it being assigned with greater confidence to the proposed Group B. Now that the gum exudates from approximately 40% of the species within the Botryocephalae have been studied and shown to fall into two different types, it is hoped that the chemical data may be meaningful taxonomically.

INTRODUCTION

The Botryocephalae is a comparatively small group (*ca* 32 species) of bipinnate wattles. Some species are important for tannin production but not for commercial gum production because the gums are usually dark in colour, incompletely soluble in water and with an astringent taste. Nevertheless the gum chemistry of the Botryocephalae is interesting. Of the 32 known species, analytical data for 12 have been published [1]. Their analytical parameters showed a surprisingly wide range of values and it was proposed that this series may be characterized by the existence of at least two different structural types of gum exudate [1]. The differences in composition and properties of the gums, on the basis of which assignments of species were made to proposed Groups A and B, have been described [2]. Species in Group A differ greatly in composition from gums of the Phyllodineae, and some resemblances to gum exudates of species in the Gummiferae are apparent; species in Group B have gum exudates that are typical of the Phyllodineae. Thus there are interesting possibilities of using the gum exudates as taxonomic markers. This paper reports the analytical data obtained for the gums from three subspecies within the Botryocephalae. The data support the suggestion [2] that gums of the Botryocephalae can be assigned to one or other of two structural types.

RESULTS AND DISCUSSION

The analytical data obtained are shown in Table 1. The data for specimen B of gum from *A. deanei* subsp. *paucijuga* are compared with the data published previously [1] for sample A. The occurrence of seasonal and geographical variations is well established for *Acacia* gum exudates; the differences between samples A and B for *A. deanei* subsp. *paucijuga*, obtained from trees growing widely apart, are comparable to the differences already established, for example, for two specimens of gum from *A. parramattensis* trees growing in close proximity to each other [1]. Only by examining the gums from different, authenticated, trees of a particular species growing in different locations and seasons can the variation in analytical parameters be established. If specifications for definitive trade or legal purposes have to be established, they must be average values derived from the results established for different specimens from the various provenances available [3].

The gums from *A. deanei* subsp. *paucijuga* and from *A. irrorata* subsp. *irrorata* have analytical parameters that fall clearly within the ranges proposed [1] for the Botryocephalae Group A. They have low galactose/arabinose ratios and comparatively high values for all other parameters, e.g. % nitrogen, intrinsic viscosity, MW and % uronic acid, with rhamnose values > 4% and strongly negative specific rotations. In contrast, the gum from *A. dealbata* subsp. *subalpina*, which is a new subspecies identified recently by Dr. M. D. Tindale [personal communication], is a typical member of the proposed Group B in having a high ratio of galactose/arabinose (4:1), and comparatively low values for all the other parameters, e.g. % nitrogen, intrinsic viscosity, MW and % uronic acid and % rhamnose, with a specific rotation close to zero. Moreover, the data for this new subspecies of *A. dealbata* correspond well with those established [4] for seven specimens of *A. dealbata* gum collected from different locations in Africa and Australia: the differences between the data for *A. dealbata* and its subspecies *subalpina* are slight but strengthen the assignment of *A. dealbata* to the proposed Group B.

These studies therefore strengthen the suggestion [1] that Botryocephalae species give gums that can be assigned to one of at least two different structural types. Gum specimens from the remaining members of the Botryocephalae are requested for analysis to allow the proposal to be tested further.

*Part 64 of the series "Studies of Uronic Acid Materials".

Table 1. Analytical data for purified gum polysaccharides from some *Acacia* subspecies, series Botryocephalae

	A. deanei subsp. *paucijuga*		*A. irrorata* subsp. *irrorata*	*A. dealbata* subsp. *subalpina*
	Sample A	Sample B		
Moisture, %	6.6	11.5	4.7	7.4
Ash, %*	2.8	2.4	2.7	0.8
Nitrogen, %*	0.76	1.3	1.57	0.37
Hence protein, % (N × 6.25)*	4.8	8.1	9.8	2.3
Methoxyl, %†	0.41	0.75	0.4	0.5
$[\alpha]_D$ in water, (degrees)†	−70	−66	−49	−1
Intrinsic viscosity, [η], ml/gm*	20	13	14	5
Molecular weight, (MW × 10^5)*	10.3	3.6	3.6	0.9
Equivalent weight†	1175	1350	1070	2670
Hence uronic anhydride, %†‡	15	13	16.5	6.5
Sugar composition after hydrolysis				
4-O-Methylglucuronic acid§	2.5	4.5	2.5	3
Glucuronic acid	12.5	8.5	14	3.5
Galactose	30	38	44	71
Arabinose	43	43	30	18
Rhamnose	12	6	9	4

*Corrected for moisture content.
†Corrected for moisture and protein content.
‡If all acidity arises from uronic acids.
§If all methoxyl groups located in this acid.

EXPERIMENTAL

Origin of gum specimens. Gum from *A. deanei* (R. T. Bak.) Welch, Cooms and McGlynn subsp. *paucijuga* (F. Muell. ex N. A. Wakef.) Tindale: Sample A was collected by Mr. L. Pedley at Brisbane Botanic Gardens, Queensland, in September 1968; Sample B was collected by Mr E. Lassak (79–017) 22 km west of Gilgandra on road to Warren, NSW, on 23/2/1979. Gum from *A. irrorata* Sieber ex Spreng. subsp. *irrorata* was collected at Toonumbar State Forest, 23 km WSW of Kyogle, NSW, on 25/12/1979 by R. Coveny 10543 and P. Hind. Gum from *A. dealbata* Link subsp. *subalpina* Tindale MS was collected by Mr. R. D. Croll on 15/5/1980 and identified by Dr. M. D. Tindale, Royal Botanic Gardens, Sydney.

Preparation of samples for analysis. The samples were incompletely soluble in cold water but dissolved in 1% $NaBH_4$ [5] within 24 hr. After dialysis against tap water for 48 hr and against distilled water for 24 hr, the solns were filtered through Whatman No. 42 and No. 1 papers, and freeze dried.

Analytical methods. The standard analytical methods used have been described [6].

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