

SHORT REPORTS

THE HYDROXYPROLINE CONTENT OF GUM EXUDATES FROM SEVERAL PLANT GENERA*

D. M. W. ANDERSON, J. F. HOWLETT† and C. G. A. McNAB

Chemistry Department, The University, Edinburgh EH9 3JJ, U.K.; †Food Science Division, Ministry of Agriculture, Fisheries and Food, Horseferry Road, London SW1P 2AE, U.K.

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Key Word Index *Albizia*; *Moringa*; *Grevillea*; *Azadirachta*; *Aralia*; *Lannea*; *Entada*; *Leucaena*; gum exudates; amino acids.

Abstract—Amino acid compositions are presented for the proteinaceous components of the gum exudates from *Albizia glaberrima*, *A. sericecephala* and *A. anthelmintica*; *Aralia elata*; *Azadirachta indica*; *Entada africana*; *Grevillea robusta*; *Lannea humilis* and *L. schimperi*; and *Moringa oleifera*. The gums from four of these genera (*Albizia*, *Azadirachta*, *Grevillea* and *Moringa*) contain low proportions, and the others contain high proportions, of hydroxyproline. High proportions of hydroxyproline were found previously in gum exudates from genera within the Leguminosae (*Acacia*, *Astragalus* and *Prosopis*), to which must now be added *Entada* and *Leucaena*. In contrast, however, *Albizia* spp. (Leguminosae) have low proportions of hydroxyproline, whereas the non-leguminous genera *Aralia* and *Lannea* have high proportions of hydroxyproline.

INTRODUCTION

Recent publications have shown that the gum exudates from some Combretaceae [1] and *Sterculia* spp. [2] contain low proportions of hydroxyproline, whereas the leguminous genera *Acacia* [3], *Astragalus* [4] and *Prosopis* [5] give gum exudates whose proteinaceous components contain high proportions of hydroxyproline. The opportunity has therefore been taken to examine the gum exudates from eight other plant genera, including three from the Leguminosae, to test whether generalizations useful for chemotaxonomic purposes might be involved.

RESULTS

Table 1 shows the data available for gum exudates found to have low proportions of hydroxyproline, i.e. from *Albizia glaberrima*, *A. sericecephala* and *A. anthelmintica*, *Azadirachta indica* (two specimens), *Grevillea robusta* and *Moringa oleifera*. Table 2 shows the data for species giving high proportions of hydroxyproline, i.e. *Aralia elata*, *Entada africana*, *Leucaena leucocephala*, *Lannea humilis* and *L. schimperi*.

DISCUSSION

Recent studies have indicated that species of some non-leguminous genera give gum exudates containing low proportions of hydroxyproline, e.g. *Sterculia* [2] and *Combretum* [1], whereas species of genera belonging to the Leguminosae, e.g. *Acacia* [3], *Astragalus* [4] and *Prosopis* [5], give gum exudates containing high proportions of hydroxyproline. Table 1 shows that species of a further four genera give gum exudates containing low proportions of hydroxyproline; one of these genera is *Albizia* Durazz., a large and complicated pantropical leguminous genus which is closely allied to, and often mistaken for, *Acacia* and vice versa [6]. The difference between the amino acid compositions of the *Albizia* spp. studied here and those from *Acacia* [3] and *Prosopis* spp. [5] is particularly striking. Apart from the gums from *Moringa oleifera* and *Albizia glaberrima*, which contain the largest proportions of proline reported to date, the exudates from the other species shown in Table 1 all have aspartic acid as their main proteinaceous component; this is also a feature of the gum exudates from *Sterculia* spp. [2] and from the Combretaceae [1].

The results from the *Albizia* spp. studied therefore indicate that it cannot be presumed that all genera within the Leguminosae give gum exudates containing high proportions of hydroxyproline, although Table 2 shows that this is indeed the case for the gums from a further two leguminous species belonging to the genera *Entada* and *Leucaena*, which have been shown [7, 8] to be similar to gum arabic [*Acacia senegal* (L.) Willd.] [9] in terms of

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Table 1. Amino acid compositions of the proteinaceous components (residues per 1000 residues) of gum exudates containing low proportions of hydroxyproline

	<i>Albizia</i>			<i>Azadirachta indica</i>		<i>Grevillea</i>	<i>Moringa</i>
	<i>glaberrima</i>	<i>sericocephala</i>	<i>anthelmintica</i>	(Ceylon)	(India)	<i>robusta</i>	<i>oleifera</i>
% N	0.47	0.35	2.8	5.0	5.6	0.20	0.15
Alanine	85	75	46	63	63	64	90
Arginine	28	17	29	24	14	16	31
Aspartic acid	108	144	141	155	154	166	76
Cystine	17	14	13	8	9	37	2
Glutamic acid	53	68	69	73	73	58	88
Glycine	81	75	75	66	65	122	68
Histidine	29	28	58	45	45	48	30
Hydroxyproline	40	22	17	10	17	28	68
Isoleucine	32	43	50	54	54	29	54
Leucine	47	65	77	83	83	20	71
Lysine	47	82	47	39	39	95	51
Methionine	3	9	7	0	0	2	7
Phenylalanine	18	35	27	50	53	34	30
Proline	198	92	73	63	63	27	84
Serine	66	64	87	82	83	65	80
Threonine	60	64	69	69	69	60	68
Tyrosine	24	29	34	27	28	55	18
Valine	63	75	80	89	90	76	84

Table 2. Amino acid compositions of the proteinaceous components (residues per 1000 residues) of gum exudates containing high proportions of hydroxyproline

	<i>Aralia</i>	<i>Entada</i>	<i>Leucaena</i>	<i>Lannea</i>	
	<i>elata</i>	<i>africana</i>	<i>leucocephala</i>	<i>humilis</i>	<i>schimperi</i>
% N	0.42	1.59	0.35	0.29	0.27
Alanine	50	67	59	39	25
Arginine	5	4	11	5	5
Aspartic acid	59	77	64	45	15
Cystine	1	1	1	0	0
Glutamic acid	39	48	30	35	17
Glycine	34	31	29	26	17
Histidine	19	25	37	17	10
Hydroxyproline	339	330	306	415	462
Isoleucine	29	17	27	20	9
Leucine	42	48	38	57	66
Lysine	24	24	34	15	4
Methionine	1	0	0	0	0
Phenylalanine	15	26	10	12	7
Proline	58	62	74	81	61
Serine	184	117	164	110	158
Threonine	48	66	43	82	112
Tyrosine	19	25	31	18	19
Valine	35	32	40	25	17

their composition and physico-chemical properties. Although the behaviour of the *Albizia* spp. differs therefore from other members of the Leguminosae, Table 2 also shows that gums containing high proportions of hydroxyproline are produced by species of genera, e.g. *Aralia*, *Lannea*, that do not belong to the Leguminosae. Indeed, *Lannea schimperi* gum contains the highest proportion of hydroxyproline reported to date, exceeding the value (425 residues per 1000 residues) quoted [5] for

Prosopis velutina. Table 2 does extend, however, the previous indication [3-5] that gums with high proportions of hydroxyproline also contain major amounts of serine. For *Lannea schimperi* gum, hydroxyproline and serine together account for 62% of the amino acids present. This gum may therefore provide a useful model for studies of the structural role [10] played by proteinaceous components containing high proportions of serine and hydroxyproline.

EXPERIMENTAL

Origin of gum specimens. Details have been given for the origins of the gum specimens from *Albizia* spp. [11], *Azadirachta indica* [12], *Grevillea robusta* [13], *Entada africana* [7], *Leucaena leucocephala* [8] and *Lannea* spp. [14]. The gum from *Aralia elata* was collected from pruning wounds to a bush growing in the Royal Botanic Garden, Edinburgh. The gum from *Moringa oleifera* Lam. was provided by Dr. I. B. Deb, Regional Botanist, Southern Circle, Coimbatore, India.

Amino acid analyses. Full details of the hydrolysis (6 M HCl) procedure and of the amino acid analyser used have been given elsewhere [2, 5, 10].

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