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Internodule Variation of *Anogeissus leiocarpus* Gum

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Abstract: Eighteen nodules of *Anogeissus Leiocarpus* gum were collected randomly from different trees from two different locations (Abojebiha and Elfula) in Sudan. The nodules were analyzed for twelve analytical parameters (moisture%, ash%, nitrogen%, protein%, pH, refractive index, specific rotation, relative viscosity, equivalent weight, uranic acid%, reducing sugars% and tannin %). Analysis of variance showed significant differences ($P \leq 0.05$) for all parameters studied in each of Abojebiha and Elfula nodules except for the refractive index value which was found to be constant (1.334) in both locations. In addition UV absorption spectra of all nodules gave λ max (247, 258, 265, 270, 274, 277, 280 and 283).

Key words: *Anogeissus leiocarpus*, gum, nodules, analytical parameters

INTRODUCTION

Anogeissus leiocarpus provides gum exudates, which is yellow or light brown in color. The gum is characterized by gaining economic importance in certain applications. This paper presents physico-chemical data obtained on examination of 18 separate gum nodules regarding internodule variations.

Definition of the family: *Combretaceae* is a family of twenty genera and six hundred species tropical and subtropical trees and shrubs. Generally *combretaceae* was known as rich sources of tannin. Genera include *Terminalis*, *Combretum*, *Quisqualis*, *Myrobolans* and *Anogeissus* (Hans, 1990). Some gums from *combretaceae* are being increasingly utilized commercially for example *ghatti* gum and *leiocarpus* gum.

Nomenclature: *Anogeissus leiocarpus* (DC) Guill, Perr .A. Schimper Hochst ex and Dalz.
Arabic: Sahab (Elamin, 1990)

General distribution: *Anogeissus leiocarpus* tree is widely distributed in Africa between isoheight of about 200mm and the rain forest, from Senegal to Sudan and Ethiopia, in the south to Zaire (Hans, 1990).

In Sudan *Anogeissus leiocarpus* tree is widespread in Kassala Province, Darfur province, Bahr El Gazal province and Upper Nile province. It is absent from the east bank of the Nile except for small area within 20km of Juba. In Yambio district it occurs in gallery forest. Specimen from dried areas tend to have smaller leaves and more hairy flowers (Elamin, 1990).

Uses of *Anogeissus leiocarpus*: The wood is used mainly in the round for transmission and building poles,

fences posts, forked poles and as beam of local building construction. It is also used for firewood and charcoal. The leaves and barks contain tannin materials recognized by Sudan tanning industry (Elamin, 1990). In northern Nigeria and Burkina Faso the ashes are used for preparation of goatskin. Hans (1990) reported that in Mali all parts of *Anogeissus leiocarpus* tree are used as medicine mixed with other plants in traditional system. Also *Anogeissus leiocarpus* gum was used as food additives mixed with gum Arabic or as a substitute for it.

MATERIALS AND METHODS

Eighteen nodules of *Anogeissus Leiocarpus* (twelve nodules from Abojebiha and six nodules from Elfula) were collected randomly from the natural exudates nodules of different trees.

The gum nodules were dried at room temperature (about 30°C) then cleaned by hand, ground, sieved through sieve No. 16 and kept in labeled plastic containers for analysis.

Analytical methods: Moisture%, ash%, pH, viscosity and specific rotation were determined according to FAO (1990a,b) papers No. 44 and 49. Nitrogen was determined by a semi-micro kjeldal methods (AOAC, 1984) and the protein content was determined by multiplying nitrogen percent by the factor 6.6 (Anderson, 1986). Equivalent weight was determined according to methods reported in the Encyclopedia of Chemical Technology (1966). Qualitative estimation of tannin was carried out using the methods of Price *et al.* (1978). Reducing sugars were determined according to Robert and White (1987) and maximum absorption spectra of 1 % gum solution were determined by using a PERKIN - EIMER LAMBDA 2 UV/VIS SDPECROMETER.

Table 1a: Analytical data of twelve *Anogeissus leiocarpus* gum nodules collected as natural exudates from Abojebiha (season 1994-1995)

| Sample | Moisture % | Ash % | Nitrogen % | Protein % | pH | RI |
|-----------|--------------------|-------------------|-------------------|--------------------|------------------|--------------------|
| AN1 | 10.2 ^a | 5.5 ^a | 0.58 ^h | 3.83 ^{ef} | 3.9 ^e | 1.334 ^a |
| AN2 | 10.0 ^{ab} | 4.7 ^{bc} | 1.09 ^b | 7.19 ^{bc} | 4.4 ^b | 1.334 ^a |
| AN3 | 10.3 ^a | 3.3 ^g | 1.09 ^b | 7.19 ^{bc} | 4.4 ^b | 1.334 ^a |
| AN4 | 9.5 ^{ab} | 3.9 ^{ef} | 0.70 ^g | 4.62 ^{de} | 4.2 ^c | 1.334 ^a |
| AN5 | 9.0 ^b | 4.7 ^{bc} | 1.03 ^c | 6.79 ^{bc} | 4.4 ^b | 1.334 ^a |
| AN6 | 10.0 ^{ab} | 4.7 ^{bc} | 0.82 ^e | 5.41 ^d | 4.1 ^d | 1.334 ^a |
| AN7 | 10.5 ^a | 4.8 ^b | 0.96 ^d | 6.34 ^{bc} | 4.1 ^d | 1.334 ^a |
| AN8 | 10.5 ^a | 4.8 ^b | 1.11 ^b | 7.33 ^b | 4.6 ^a | 1.334 ^a |
| AN9 | 8.9 ^b | 4.4 ^{cd} | 0.54 ⁱ | 3.56 ^f | 4.1 ^d | 1.334 ^a |
| AN10 | 8.8 ^b | 4.1 ^d | 0.54 ⁱ | 3.56 ^f | 3.7 ^f | 1.334 ^a |
| AN11 | 8.5 ^b | 4.1 ^d | 0.78 ^f | 5.15 ^d | 3.7 ^f | 1.334 ^a |
| AN12 | 9.0 ^b | 3.6 ^g | 1.65 ^a | 10.89 ^a | 4.1 ^d | 1.334 ^a |
| Mean | 9.6 | 4.38 | 0.907 | 5.989 | 4.5 | 1.334 ^a |
| S.E \pm | 0.25 | 0.128 | 0.012 | 0.296 | 0.005 | 0 |

AN = Abojebiha nodules. RI = Refractive Index. Each value in the table is a mean of three replicates. No significant differences among values sharing the same letter (P>0.05)

Table 1b: Analytical data of twelve *Anogeissus leiocarpus* gum nodules collected as natural exudates from Abojebiha (season 1994 - 1995)

| Sample | Specific rotation { α } _D | Relative viscosity T-T ₀ /T ₀ | Equivalent weight | Uronic acid % | Reducing sugar % | Tannin % |
|-----------|---|---|----------------------|-------------------|-------------------|--------------------|
| AN1 | -16.0 ^g | 1.60 ^e | 1367.7 ^e | 14.1 ^a | 0.45 ^e | 0.98 ^a |
| AN2 | -39.0 ^{bc} | 1.11 ^d | 1495.2 ^{ab} | 12.9 ^a | 0.56 ^a | 1.08 ^a |
| AN3 | -59.2 ^{ab} | 2.45 ^b | 1495.0 ^{ab} | 13.4 ^b | 0.50 ^b | 0.87 ^a |
| AN4 | -23.6 ^{de} | 2.31 ^b | 1452.9 ^c | 13.5 ^b | 0.56 ^a | 0.87 ^a |
| AN5 | -19.0 ^{ef} | 2.24 ^b | 1432.9 ^{cd} | 13.5 ^b | 0.31 ^f | 0.84 ^a |
| AN6 | -8.9 ^{gh} | 1.45 ^c | 1442.5 ^c | 12.9 ^a | 0.33 ^e | 0.65 ^b |
| AN7 | -15.3 ^{fg} | 0.73 ^e | 1500.0 ^a | 13.5 ^b | 0.33 ^e | 0.32 ^c |
| AN8 | -9.0 ^{gh} | 2.82 ^a | 1433.6 ^{cd} | 13.1 ^c | 0.44 ^d | 0.54 ^b |
| AN9 | -24.7 ^{de} | 1.46 ^c | 1475.7 ^b | 14.3 ^a | 0.44 ^d | 0.58 ^b |
| AN10 | -40.5 ^{bc} | 1.38 ^c | 1355.5 ^e | 13.0 ^c | 0.31 ^f | 0.86 ^a |
| AN11 | -31.0 ^{cd} | 1.45 ^c | 1490.0 ^{ab} | 13.0 ^c | 0.44 ^d | 0.43 ^{bc} |
| AN12 | -31.7 ^{cd} | 1.35 ^{cd} | 1428.5 ^d | 13.6 ^b | 0.44 ^d | 0.54 ^{bc} |
| Mean | -26.49 | 1.69 | 1447.4 | 12.23 | 0.425 | 0.713 |
| S.A \pm | 0.36 | 0.081 | 6.908 | 0.138 | 0.003 | 0.081 |

AN = Abojebiha nodules. Each value in the table is a mean of three replicates. No significant differences among values sharing the same letter (P>0.05)

Statistical analysis: Each sample was analyzed in triplicate and data was assessed by analysis of variance (ANOVA) (Snedecor and Cochran, 1987) and by Duncan's multiple rang test with probability $P \leq 0.05$ (Duncan, 1955).

RESULTS AND DISCUSSION

Analytical data of Abojebiha nodules are given in Tables 1a and b. Table 1a shows that moisture content of twelve nodules ranges from 3.8.5% to 10.5%, the ash content is in the range of 3.3% - 5.5%, nitrogen content ranges from 0.54% to 1.65%, the protein content ranges between 3.56% and 10.89%, pH values content ranges from 3.7 to 4.6 and the refractive index is found to be constant in all nodules having the value 1.334. Table 1b shows that twelve nodules of *Anogeissus Leiocarpus* have negative values of specific rotation ranging from -8.9° to 59.2°. Relative viscosity ranged between 0.73 and 2.82, equivalent weight ranges from 1355.5 to 1500.0,

uronic acid content ranges from 12.9% to 14.3%, reducing sugar content ranges between 0.31% and 0.56%, tannin content ranges from 0.32% to 1.08%. Analysis of variance of each parameter showed significant differences ($P \leq 0.05$) in both tables in respect of all parameters examined except for the refractive index values, which were found to be constant for all nodules examined.

Analytical data of Elfula nodules are given in Tables 2a and b. Table 2a shows that the values of moisture content ranges between 7.0% and 8.9%, ash content ranges from 2.1 to 2.6%, nitrogen content ranges from 0.63% to 1.15%, protein content ranges from 4.15% to 7.59%, pH values range between 4.0 and 4.3 and refractive index is constant in all nodules having the same value 1.334.

Table 1b indicates that the specific rotation of six nodules ranges from 32.2° to -42.9°, the relative viscosity ranges between 1.64 and 1.99, equivalent weight

Table 2a: Analytical data of six *Anogeissus leiocarpus* gum nodules collected as natural exudates from Efula (season 1994-1995)

| Sample | Moisture % | Ash % | Nitrogen % | Protein % | pH | RI |
|--------|------------------|------------------|-------------------|--------------------|------------------|--------------------|
| EN1 | 7.2 ^c | 2.2 ^b | 1.15 ^a | 7.59 ^a | 4.0 ^d | 1.334 ^a |
| EN2 | 8.3 ^c | 2.3 ^a | 0.63 ^b | 4.15 ^b | 4.3 ^a | 1.334 ^a |
| EN3 | 7.0 ^c | 2.1 ^b | 0.96 ^a | 6.33 ^{ab} | 4.3 ^a | 1.334 ^a |
| EN4 | 8.6 ^b | 2.6 ^a | 0.94 ^a | 6.20 ^{ab} | 4.3 ^a | 1.334 ^a |
| EN5 | 8.9 ^a | 2.3 ^a | 0.67 ^b | 4.42 ^b | 4.2 ^b | 1.334 ^a |
| EN6 | 8.9 ^a | 2.3 ^a | 0.90 ^a | 5.94 ^b | 4.1 ^c | 1.334 ^a |
| Mean | 8.15 | 2.3 | 0.875 | 5.77 | 4.2 | 1.334 ^a |
| S.E ± | 0.326 | 0.113 | 0.099 | 0.655 | 0.019 | 0 |

EN = Efula nodules. RI = Refractive index. Each value in the table is a mean of three replicates. No significant differences among values sharing the same letter (P> 0.05)

Table 2b: Analytical data of six *Anogeissus leiocarpus* gum nodules collected as natural exudates from Efula (season 1994-1995)

| Sample | Specific rotation {α} _D | Relative viscosity T-T ₀ /T ₀ | Equivalent weight | Uronic acid % | Reducing sugar % | Tannin % |
|--------|------------------------------------|---|---------------------|--------------------|--------------------|-------------------|
| EN1 | -36.5 ^{0e} | 1.74 ^c | 1137.4 ^b | 17.1 ^a | 0.37 ^c | 1.02 ^b |
| EN2 | -38.1 ^{0c} | 1.70 ^c | 1209.9 ^b | 15.0 ^b | 0.44 ^b | 1.13 ^b |
| EN3 | -37.8 ^{0d} | 1.64 ^d | 1723.5 ^a | 12.9 ^{0d} | 0.54 ^a | 0.77 ^b |
| EN4 | -32.2 ^{0f} | 1.86 ^b | 1492.4 ^a | 11.5 ^d | 0.34 ^c | 1.74 ^a |
| EN5 | -42.9 ^{0a} | 1.93 ^a | 1542.2 ^a | 12.1 ^{cd} | 0.50 ^{ab} | 1.61 ^a |
| EN6 | -50.1 ^{0b} | 1.99 ^a | 1471.3 ^a | 13.2 ^c | 0.55 ^a | 1.62 ^a |
| Mean | -37.9 ⁰ | 1.81 | 1433 | 13.6 | 0.45 | 1.31 |
| SE± | 0.06 | 0.02 | 133.525 | 0.479 | 0.005 | 0.117 |

EN = Efula nodules. Each value in the table is a mean of three replicates. No significant differences among values sharing the same letter (P> 0.05).

ranges from 1137.6 to 1723.3, uronic acid content ranges from 11.5 to 17.1%, reducing sugar power ranges from 0.34 to 0.54% and the tannin content ranges from 0.77 to 1.74%. Analysis of variance showed significant differences (P<0.05) for all parameters studied in Efula nodules except for the refractive index value which is found to be constant in each of both locations having the value 1.334.

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