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Extraction of the cellulose and the biometrics of the fibers of the pods of *Retamamonosperma* (L.). Boissgrowingin natural conditions in the Algerian Western Coast

Nadia Bouredja[1, 2], Zoheir Mehdadi[1], Mustapha Bouredja[1*]

[1]*Laboratory of Vegetable Biodiversity: Preservation and Valuation, Faculty of Science, DjillaliLiabès University, SidiBelAbbès , Algeria*

[2]*University of the Sciences and the Technology of Oran-Mohamed-Boudiaf-faculty SNV, Oran, Algeria*

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Abstract

The kind *Retama* are shrubby legumes, possessing at the same time pharmacological and ecological interests. In Algeria, three specie belonging to the kind *Retama*are indicated .Among these Legumes, *Retamamonosperma* is the most spread in the countries of the Mediterranean Basin where she occupies of vast spread in the Algerian coast. Our study is a contribution to the study of the biochemical valuation of *Retamamonosperma*.***The*** extraction of the cellulose, gave better efficiencies in cellulose (52, 66 %).The fibers of the pods of Retamamonosperma present an average length of 0, 53 mm and can be thus classified among plants with average fibers. All the obtained results open numerous perspectives of research regarding biochemical valuation of this vegetable resource.

* **Corresponding Author:** Mustapha Bouredja ✉bouredjanadia2007@yahoo.fr

Introduction

The kind *Retama* belonging to the family of Legumes, it is endemic of the Mediterranean Basin, Distributed in the various bioclimatic floors, of the wet in the dry. He characterizes the dune ecosystems, the scrublands and the desert (Allen and Allen, 1981).

In Algeria, three specie belonging to the kind *Retama*are indicated: *Retamamonosperma*Boiss. , *Retamaretam*Webb.and*Retamasphaerocarpa*L. (Quézel and Santa, 1962; Boulila*and al.*, 2009).R*etamamonosperma*, Object of our study, contains produced which can be exploited in medicine, as alkaloids (El-Shazly*and al.*, 1996), Flavonoids (Akkal *and al.*, 2010).

Cellulose probably is the most abundant organic compound in the world which mostly produced by plants. The cellulose establishes the base of a new long-lasting economy this polymer has versatile uses in many industries such as veterinary foods, wood and paper, fibers and clothes, cosmetic and pharmaceutical industries.

Among the strong diversity of the existing botanical species, *Retamamonosperma* is available in compatible quantities with applications of industrial scale, allowing a good exploitation.

The objective of this study it is the extraction of cellulose and fibers of pods of *Retamamonosperma* which is and natural polymer, main thing establishing vegetables produced in the walls of their cells.it finds numerous applications as raw material, in particular in the industry paper-maker and Pharmaceutical.

Materials and method

Characterization of the parietal polysaccharides and the biometrics of fibers

Biological material

The samples which were the object of this study are pods of Retama*Monosperma* taken by feet growing in the natural conditions of Ain El Türk, wilaya of Oran. Algeria.

Methods of studies

Determination of the moisture content

The taken pods are access weighed to determine the weight of the fresh material (Fw), Cut then displayed over a metallic plate and dried in a steam room in a temperature of 50 °C during 72 hours then weighed again To determine the weight of the dry material (Dw). Several made weighings every 24 hours to verify the stability of the Dw after 72 hours of drying.

Preparation of the vegetable powder

The dry material is reduced powder by grinding by using a crusher with type RETCH's knives, provided with a filter with stitches.

Preparation of parietal residue

The vegetable wall is obtained by the use of the organic solvents which allow the elimination of lipids and tannins. The used protocol is the one of Harche*and al.*(1991).

50 g of vegetable powder are introduced into mixture methanol-chloroform (1V-1V) and put under continuous agitation during a night under basket. This operation is twice repeated, after filtration on painting to be sieved, the residue is put in the methanol under agitation during two hours to eliminate the tracks of chloroform. The residue so obtained is then rinsed with the distilled water, then in the acetone and put in the steam room in 60°C.

Delignification of the parietal residue

In theory the procedure of the delignification should eliminate totally lignins without modification of polysaccharides. However, no method is totally satisfactory.

For the délignification of the wall, the pods of *Retamamonosperma* , we chose the method of Gabrielli*and al.*(2000). Which uses the soda diluted in the ethanol. 5g of parietal residue are placed in 100 ml of NaOH In 1 % in the ethanol 70% under agitation during 2 hours in 80 °C. The residue is rinsed 4 - 5 times by the distilled water then dried in the steam room in 60°C ,24 hours .

Extraction of the cellulose

There are several protocols of extraction using each a known extractant. In our case, we used 3g of parietal residue are introduced into a containing 100ml of NaOH in 4% and put under agitation during a night. This operation is renewed. After filtration on painting to be sieved, the residue is washed with the distilled water then with the acetone, then dried in the steam room in 60°C during a night and weighed. It represents the cellulosic fraction.

Biometrics of fibers

Dissociation and coloring

Fragments taken by the pods of *Retamamonosperma*are placed in tubes containing an acetic acid mixture and of hydrogen peroxide. They are put in the steam room then shaken strongly with the aim of favoring the separation of cells. It should be noted that the acetic acid has for role to dissolve the pectic cement existing in the average small strip. After settling, the filtrat is colored by the Safranine which colors elements lignified in red. A suspension of cells is observed in the photonique microscope.

Measure of the fibers

Fibers are examined in the photonique microscope to study their morphology and estimate their length. Shots on these fibers were made by means of the photomicroscope. The average length of 30 fibers is estimated by means of an eye micrometer.

Results and discussion

The moisture content of pods

The moisture content contained in the pods of *RetamaMonosperma* is given in the table1.

Table 1. Moisture content contained in the pods of *Retamamonosperma*, expressed in gram and in percentage.

Fw (gr)	Dw (gr)	Mc (%)
95,60	92,00	3,76

FW: freshly weight DW: dry weight MC: moisture content.

MC%= [(PFW-PDW) /PFW] ×100

Efficiency in raw wall of pods

The content in raw wall of the pods of *Retamamonosperma* extracted by the protocol is indicated in the table 2.

Table 2. Efficiency on the raw wall of pods (gr/50gr of dry material in percentage).

Quantity expressed their g/50 g	(%)
28,49 ± 0,38	56,98 ± 3,8

Efficiency in cellulose

The quantities of cellulose of the pods of *Retamamonosperma* are represented in the table3.

Biometrics of fibers

On the table 4 are represented the lengthes of 30 fibers of the pods of *Retamamonosperma*.

Table 3. Quantities of cellulose (expressed their g/3g of parietal residue in percentage).

	Quantity expressed their g / 3g	(%)
Cellulose	1,58 ± 0,009	52,66 ± 0,9

The biometric study shows that the length of the fibers of the pods of *Retamamonosperma* varies between 0, 30mm and 1,1mm. The average length is 0, 53 mm.

The fibers of the pods of *Retamamonosperma* present heterogeneous forms to disentangled, rounded off, forked, disentangled, rounded off, turned off extremities, in bevel certainwalls of which present numerous punctuations.Theseobserations are noted also certain works as those of Saadaoui (2008)in the almonds of Celtisaustralis, *Elaeagnusaugustifolia*, and *Zizyphus lotus*.

The variation of the moisture contents can be attributed to the internal factors: the period of the maturation and the factors external as the period of sunshine and the temperature.The average content in raw wall is 56, 98 %. This content in wall varies from a species to another one. Indeed, and as an example, values lower than that noted to our species, characterize the rackets of *Opuntiaficusindica*L. (47 %) (Chaa, 2002), pods of *Acaciaarabica* (42, 6 %) of Adrar and Tamanrasset (40,74 %) (Tissouras,2004).Besides, high contents were found at some of the other species belonging to the family of Poacae as *Lygeumspartum* (82.2%) (Zerhouni, 1996).

Table 4. Lengthes (in mm) fibers of the pods of *Retamamonosperma***.**

Number	Lenght
1	0,70
2	1,10
3	0,45
4	0,35
5	0,70
6	0,42
7	0,65
8	0,35
9	0,34
10	0,40
11	0,70
12	0,32
13	0,47
14	0,80
15	0,40
16	0,40
17	0,50
18	0,40
19	0,60
20	0,45
21	0,35
22	0,45
23	0,50
24	0,35
25	0,30
26	0,45
27	0,80
28	0,90
29	0,85
30	0 ,60
$\bar{X}$	0,53

The obtained results also show the ascendancy of the cellulose in the pods of *Retamamonosperma* with a 52, 66 % rate. This reflects the interest of this resource as plant potential mattering in the industrial domain.This rate is comparable to that registered in the pods of Locust tree *arabica* evolving in Adrar with an average value of 53, 27%, Upper to that of the same species pushing to Tamanrasset (49, 2 %) (Tissouras, 2004)And in the average contents in cellulose of foliar tissues of the alfa which varies between 45.60 %and 49.17 % (Mehdadi*and al.*,2008).

More low contents were noted at other species as rachis and leaves of *Phoenix dactylifera*with rates 44 % and 33 % respectively (Bendahou *and al.,* 2007).

During the stage of delignification, we notice a bleaching of the substratum caused by the extraction or the degradation of lignins. This discoloration looked for among others in the industry paper-maker is explained by the presence of acids hexènuroniques which contribute partially to the color of this substratum (Shatalov and Pereira, 2009). This proves the good choice of protocol of delignification used in the experimental part.

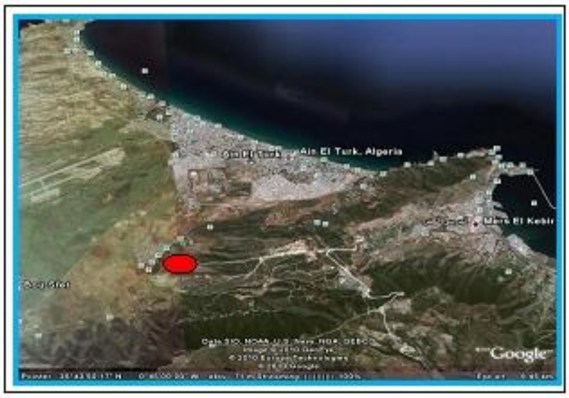

Fig.1. Site of taking of samples.

The solvents of extraction of the cellulose the most used are the alkaline solutions (soda, potassium hydroxide, lime, or still carbonate of potassium, formiate of sodium and ammonia). However, if we except the potassium hydroxide and the soda, the other bases react effectively only when they are used in great quantities during relatively long times (Barbat , 2009).

The soda is the base most frequently used for the treatment of the ligno-cellulosic products .It increases the absorption capacity of water, causes the inflation of the cellulosic fibers (Joseleau, 1980). This justifies the choice of the protocol of extraction adopted in our experiment.

The fibers of the pods of *Retamamonosperma* can be classified among plants with fibers average as it is the case of *Lygeumspartum* the length of fibers of which varies from 0,7 to 2,42 mm (Megdad, 1988) , *Phoenix dactylifera*between 0,1mm in 1,5mm, *Ammophilaaremaria*between 0,12 mm a 0,98 mmand*Stipabarbata*between 0,15 mm a 0,65 mm (Bounouara, 1987),*Stipatenacissima*between 0,49 mm a 1,6 mm (Nasri, 1989) .

The fibers of the pods of*Retamamonosperma are* shorter than those some wheat, the rye and some rice the length of which oscillates between 1,2 mm and 1,5 mm (Youcef, 1991) ; Of *Pinushalepensis*whose length varies from 2 mm to 4 mm (Martin, 1970) and of *Tetraclinisarticulata* fibers of which present an average length of 1,25 mm (Kacem , 1991) .

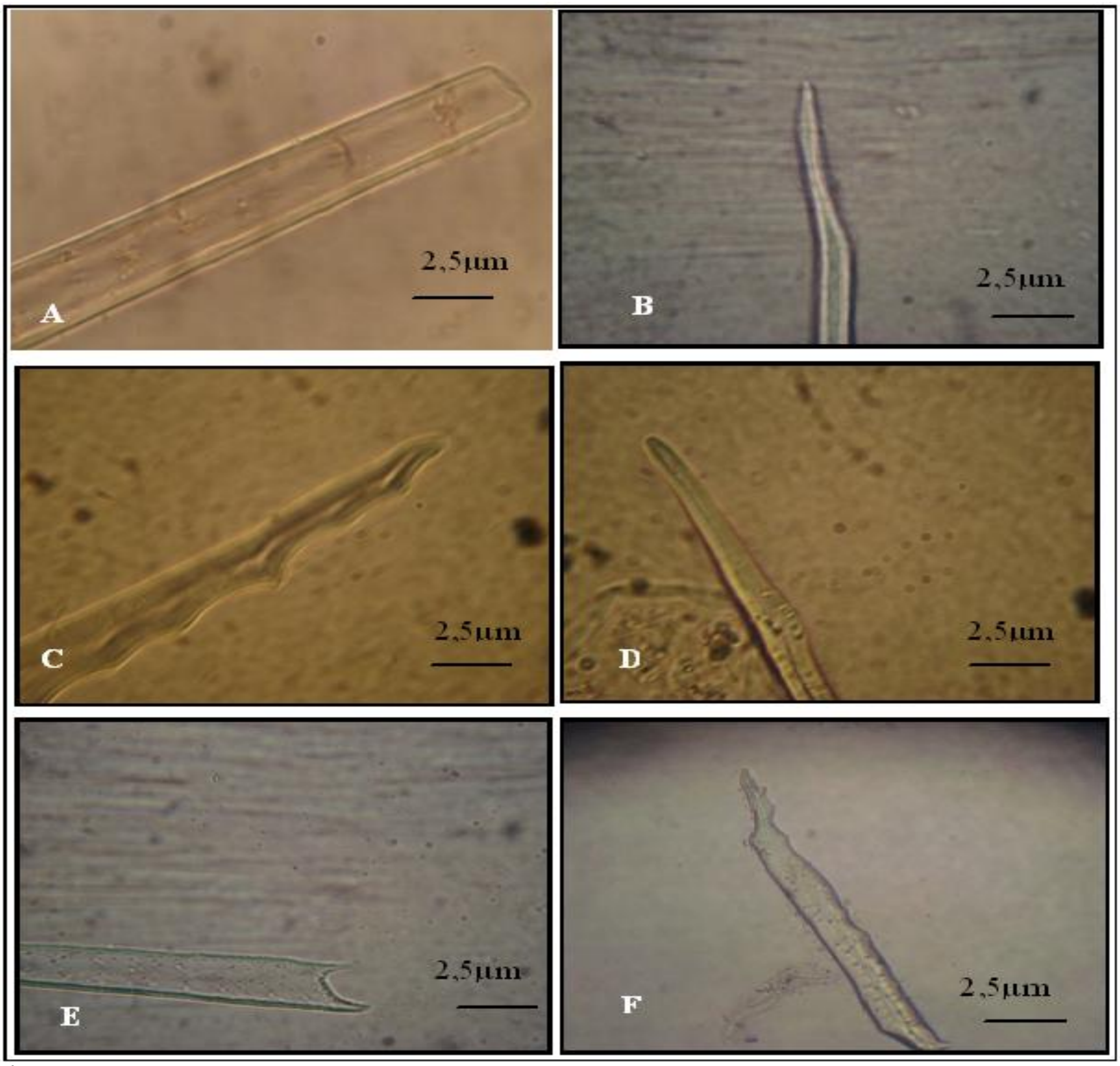

Fig. 1. Morphology of the fibers of pods of *Retamamonosperma.*

A : Detail of a fiber with truncated extremity (GR ×160)

B : Fiber with disentangled extremity (GR ×160)

C : Fiber with extremity disentangled with toothed wall (GR ×160)

D : Fiber with rounded off extremity (GR ×160)

E : Fiber with extremity forked with presence of the punctuations (GR ×160)

F : Fiber with extremity in bevel with the presence of the punctuations and with wall is toothed (GR ×160).

The parietal fibers of the pods of *Retamamonosperma* can be valued in various domains (food-processing, pharmaceutical, industrial and medical).

The food fibers are recognized for their beneficial effects on the human health. There is no official AJR (recommended daily contribution) for the consumption of food fibers, however a value of at least 25g a day is held as recommendation. The ANC (recommended nutritional contributions) are given for the French population, by age bracket in g/day (that is 25 in the 30g / day for the adults and in the daytime for a child of 10ans for example). Nowadays, the contribution in parietal carbohydrates is 15 in 22g a day, what is insufficient. 50% of this consumption results from cereal products, 32% of vegetables, 16% of fruits and 3% of dried vegetables (Mirande, 2009).

The insoluble fibers, as the cellulose, would settle the intestinal function (increase of the excretion of substratum) so that the transit time is about 48 hours (Borel*and al.*, 1990).

By following a regime supplemented in insoluble fibers, a loss of weight from 2 to 3, 2% was observed in the 4 weeks and from 2,9 to 4,9 % in the 8 weeks (Anderson and Pasupuleti, 2008) And by following a diet enriched in viscous soluble fibers, the people suffering from a type I diabetes or II can thus limit the grips of medicinal insulin (Anderson *and al.*, 2009)..

Conclusion

The obtained results also allowed the enormous potentialities which receives this essence. Indeed, *Retamamonosperma,* which by the quantity of the cellulose and the quality of its fibers will find scopes as diverse as the craft activities, the food of the cattle and the industry paper-maker. Indeed, these by-products can be valued in the field of the biotechnology and be the object of functional that is promising food of health.

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