THE ORGANS OF THE DATE PALM: AN ECOLOGICALLY CLEAN RAW MATERIAL FOR HUMAN USE IN THE ALGERIAN SAHARA

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ABSTRACT

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The region of Ouargla, located in the south-east of Algeria, is one of the main date-producing areas. Date palm is a source for and various products. It produces, every year, dates that are, traditionally, considered as a basic food for the local community as well as a commercial product. This phoenicicole biomass is also used for different purposes (building, heating, fodder, cooking, agriculture, therapy and cosmetics). This study aims to value the products of oasis land, through date palms products, and to endeavor to highlight the economic importance of these products and their uses in order to consider strategies for developing this patrimony. Nine sites are retained for investigation. They represent localities which are notorious for having kept, so far, knowledge and know-how in the use of dates as well as other organs of the date palm, and where these products are likely integrated in the socio-economic life of their populations. The aim is to determine the raw material of production, the uses of the date palm organs, dates' fields of usage and the importance of the products derived from the phoenicicol mass in the commercial environment. We noticed that the organs of the date palm, which are considered as a raw material, are available in a considerable tonnage. An important range of sub-products is derived from the date palm. It is used in basket-making (utensils, cabinetmaking, and garden-work material) and as a livestock aliment with high economic revenue. Besides, these organs (palms, spines, petiole, seeds, sap, pollen…) are used in making medicinal and cosmetic products. All in all, these products are biological and start making their place in modern trade, which might give a new dynamic to the local and national economy.

Keywords: **Ouargla, date palm, products and sub-products, economic value,-land products.**

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INTRODUCTION

The date palm is the mainstay of the oasis ecosystem. For a long time, it has possessed a profound originality in the social and economic life of the oasis (Bouammar & Bekhti, 2011). In the Algerian Sahara, the date palm is a source of very diverse products; dates and various organs are used as building materials, energy production, fodder, for culinary, therapeutic, cosmetic and handicraft purposes (Ould El Hadj et al., 2001). The products obtained are organic, natural, without synthetic additives. Local products from the entire phoenicultural mass are included in the range of local products. Today, local products play an important role in sustainable territorial development. These products protect the environment by using raw materials that comply with standards, ensure stable employment and improve the social level of the local population. Similarly, they are the focus of the concerns and expectations of many consumers, especially those seeking authenticity, originality and food safety (Omari & Elkandoussi, 2012). Algeria has a large and very varied territory, particularly in terms of agriculture, and high quality local products are harvested in different rural areas. Ouargla is one of Algeria's oases, which, due to its strategic geographical location, has experienced a succession of civilizations that have had a marked influence, not only in human but also in environmental terms, making this region a great reservoir of plant genetic resources. Indeed, in Ouargla, the area occupied by date palm corresponds to 9.198,2 ha, with a total number of 1.048.103 palm trees, including 837.766 related palms, associating 298.453 date palms of Deglet Nour, 405.453 Ghars, 1970 Degla Beida and 131.890 palms of different other cultivars respectively (Agricultural Services Branch [ASB], 2017).

Our study is based on the valorization of the products of the date palm (products of Oasis terroirs) and their economic importance in Ouargla, known for its knowledge and local know-how. The approach followed to carry out the present study is as follows:

MATERIAL AND METHODS

Presentation of the study area

The study was conducted in Ouargla region (south eastern Algeria), distant 800 km from Algiers. It occupies the center of an endorheic basin called "basin of Ouargla" which is situated in the bed of Oued M'ya, it stretches from the ruins of Sedrata and Gara Krima south to Hassi El Khefif north and is limited by:

- Sebkhet Safioune; North
- Ergs Touil and Arifdji; to the East
- Dunes of Sedrata; South
- East side of the M'zab Ridge; to the West.

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Ouargla is one of the largest oases of the Algerian Sahara. In terms of date palm numbers, it is the second growing area for this species after Biskra region (Office of the Commissioner for the Development of Agriculture in the Saharan Regions [CDARS], 2016).

METHODOLOGY

The work is a survey of farmers and craftsmen (weavers). The approach followed is that described by Guerradi et al. (2005). It is based on successive steps, which can be summarized as follows:

Context Analysis

This first step of the methodology aims to pose the problem in a systemic approach.

Delimitation of the relevant system

This step makes it possible to distinguish the elements of the problem for which an in-depth analysis is necessary. Thus, the study focused on the components of the system likely to bring interesting information. On this basis, we have adopted a reasoned sampling for craftsmen and salespeople. Reasoned sampling consists of a pre-selection of all its elements in a targeted manner, with regard to the relevance of these elements to the objective of the work (Abidate et al., 1999). In addition, random sampling was adopted for farmers, since they have common criteria.

Data collection

The data collection was carried out according to the following successive stages:

The exploration was carried out mainly through the various local structures specialized in activities related to the date palm. It is the Directorate of Agricultural Services [DSA] (2017), the Directorate of Culture, the Directorate of Planning and Budget Monitoring [DPSB] (2012), the Office of the CDARS (2016), the Chamber of Agriculture, the Subdivisions of Agriculture and the House of Crafts. In addition, the heads of mosques and well managers, as well as herbalists, sellers of handicrafts, sellers of the organs of the date palm. These key-informants are instrumental in the selection of study areas and the target population.

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Interviews with farmers

Visits and interviews with 200 farmers have clarified the origin of the raw material used in the processes of manufacturing and processing, namely cultivars giving the best organs (palms, fibrillum "lif", regimes (date palm bunches), petioles "horns" .. etc.).

Interviews with craftsmen

The meeting with the craftsmen (120 people) took place in their own homes. The interview allowed collecting the maximum information about working methods, the choice of raw material, its uses and treatments performed until the finished articles. Generally, it is women who master the basketry activity, they represent 107 people (89% of the respondents in the region). Men also master this artisanal activity, but they represent only 13 people (11% of respondents).

Seller Interviews

These sellers, ten in numbers, are a source of information on the origin of the date palm products and by-products requested on the market, as well as the sales situation. Indeed, the economic component through the revenues and the promotion of the byproducts elaborated are obtained and clarified by the interviews conducted with herbalists known by their seniority, experience and quality of their sold products. They mainly aim to sound out their opinions on the use of different articles by users.

RESULTS AND DISCUSSION

Characterization of raw material

The raw material consists of different organs of cultivars retained either, cultivar Ghars and Dokkar (male palm). Genetic diversity of cultivars whose choice is linked to a complex set of socio-economic factors (food and economic needs of the family), influenced in turn by the oasis environment, predominance of the variety Ghars (61 %) followed respectively by Deglet Nour (17 %) and the other less represented cultivars (22%) such as Tifiziwine, Takarmoste, Tanslit, Itim, Dkoulete, and others.

Importance of date palm organs

The organs of the date palm are available in large quantities. An estimate of their average biomass is made in the field according to the nature of organs from a palm tree (Table 1).

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Table 1. Nature of organs from a palm tree.

Date palm organs	Average per palm tree
Dry palms	22
Plans	11
Petioles (Cornefs)	9 to 25
Lif (fibrillum) g / palm tree	300 to 2000

The Estimation of the number and tonnage of date palm organs

The quantities of these organs depend on the (plant) characteristics of the cultivars, the growing conditions and the age of the palms.

These parameters are estimated by the application of the method cited by Chehma et al. (2000); Ibrahim et al. (2004).

The estimate of biomass reveals the importance of the quantities of palm organs (dry palms, diets, petioles and fibrillum) available for recovery and processing (Table 2).

Table 2. **Number and tonnage of date palm organs in the region of Ouargla.**

Organs	Number at Regional level	Regional tonnage (Tons/year)
Dry leaves of the date palm	25.556.454	26.580
Diets	12.778.227	7.667
Petioles	19.748.169	4.503
Fibrillum	-	1336

Number of dry palms

Based on the fact that:
- A date palm leaflet weighs an average of 5 g;
- A leave of the date palm has on average of 180 leaflets;
- A productive date palm of 12 to 40 years old, irrigated and moderately maintained gives an average of 22 palms a year;

We can estimate that the number of dry palms for the total of palms by the following formula:

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Number of dry leaves of the date palm =Number of palms × Number of leaves of the date palm per palm

Tonnage of dry leaves of the date palm

The tonnage of leaves torn off annually can be estimated by the following formula:
Leaves of the date palm =

$$\frac{\text{Number of palms} \times \text{nombre of leaves given/ year /palm} \times \text{weight of leave}}{1000}$$

Number of schemes

According to the rough estimate of the land, the palm gives an average of 11 diets per companion. Table1 and Table 2 summarize the estimates made.

Tonnage of schemes of date palm

The following formula provides the tonnage of schemes:

$$\frac{\text{Number of productive palm trees} \times \text{number of schemes / year /palm} \times \text{weight of a scheme}}{1000}$$

According to our field estimate, we found that a regime weighs an average of 0.6 kg.

By multiplying this result by the number of palm trees in the region of Ouargla; results from Table1 and Table 2.

$$\frac{\text{Number of productive palm trees} \times \text{number of petiole given/ year /palm} \times \text{weight of a petiole}}{1000}$$

Number and Tonnage of petioles

The field study resulted in a number of 9 to 25 horns per palm tree; we admit 17 horns per palm tree and per year, as an average. For tonnage, a petiole weighs on average 228 g. The following formula provides the tonnage of petioles (Table 1 and Table 2).

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Tonnage of fibrillum

Depending on the cultivars of the palm tree, the field study shows that the average value of fibrillum is 1, 15 kg / year / palm (Table 1 and Table 2).

By multiplying the previous data by the number of palms in the region of Ouargla; the results are shown in the tables below.

Parts that can be consumed by animals (dry flippers and schemes)

In the region of Ouargla, like many other Saharan regions, dry palms and diets are widely used as livestock feed. Following this importance, many well-known studies proposed to show their forage qualities to consider a better valuation.

Date pedicels

According to CHEHMA and *al*. (2000), the estimate is as follows:
A spikelet (pedicel) carries on average 35 dates, a date weighs on average 7 g. So a pedicel carries 7 x 35 = 245 g;
- A pedicel weighs on average 4,5 g;
- A pedicel of 4.5 g, carries 245g of dates.
The weight of the pedicels compared to a kg of dates is:
1000 g x 4, 5 / 245 = 18, 36 g = 0, 01836 kg.
• knowing that date production in the region is estimated at 462.807qx (Agricultural Services Branch, 2017), we can estimate the tonnage of date pedicels as follows:

Tons of pedicels = Total date production x the weight of the pedicels in relation to one kg of dates 462.807x 100 x 0, 01836 kg = 8.193.714qx, That is to say 819.371, 4 tons of pedicels.

Leaflets

According to CHEHMA and *al*. (2000):
* A dry leaflet weighs on average 5 g;
* The leaves of the date palm has an average of 180 leaflets;
* A date palm averages 22 dry leaves per year;
- At the level of the region
* There are 814.978 productive palm trees to the level of the region (Agricultural Services Branch, 2017);
5 x 180 = 900 g; that is 0, 9 kg / Palm
0, 9 x 22 = 19, 8 kg / palm tree / year

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19.8 x 814.978 = 16.136.564,4 kg, this gives 161.365.644 tons of consumable material by the animals.

Chehma et al. (2000) estimated annual tonnages of dry palms and date pedicels estimated at 135.000 tones and 5.000 tones, respectively. The present study indicates a remarkable increase in the tonnage of dry palms (26.580 tons) and pedicels (819.371.4 tons) resulting from the increase in the number of palms in the region of Ouargla.

Uses and profitability of date palm organs

Heating wood

Considerable profits can offset the expenses of farmers or phoeniculturists and participate in the development of date palm organs. In Egypt, the use of palm for making different types of wood can provide a profit of EGP 146 million (Egyptian Guinea) (Ibrahim et al., 2004) which corresponds to 14.522.682.78 Euros (€) or 1.651.990.000 Algerian Dinars (DA). In fact, 32% of the date palm organs remain scarcely valued, and 25% of petioles (cornefs) and dry palms are used for heating (Figure 1) thus forming an excellent firewood. This importance comes from the presence of cellulose, hemicelluloses and lignin. Indeed, lignin provides more energy (calorific value = 26,63 (MJ / kg), than cellulose and hemicelluloses (calorific value = 17,46 MJ / kg), because it contains more carbon. According to several authors, (Mccourt et al., 1996) and (Sarlos etal., 2003): the petioles, spines and date palm stipe give a dense wood (wood burns more or less long, thus releasing more or less heat), it is dry, and also natural (clean and without risk); these are the desired characteristics for a good firewood.

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Figure 1. Organs of unexploited date.

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The richness of the date palm organs in cellulose (84,85% at the spine and 28,40% in the pinnae) and lignin (12,20% at the spine and 26,90% for the pinnae), favors a modernization of carpentry based on these organs (Ibrahim et al., 2004)]. Although, the lignocellulosic biomass of trees and herbs contains 40 to 60% cellulose, 20 to 40% hemicelluloses and 10-25% lignin (Jean, 2010).

In addition, recent research shows the importance of palm organs as a raw material for the manufacturing of compressed wood and plywood (Kandeel & al., 1988).

In general, the Algerian phoenicultural regions and in particular the region of Ouargla, do not have any wood processing technology and its derivatives in the cabinetmaking.

Dry palms and pedicels can be classified as coarse lignocellulosic foods. However, through the biotechnological process of biomass processing, dates and crop residues can provide 9% vegetable protein for livestock feed (Chehma et al., 2000; Zitouni, 2009). All the same, this cellulose richness can favor a large paper and textile production industry.

Therefore, the valuation of these tonnages can lead to a real promotion of date organs in the region of Ouargla.

Artisanal use

The organs of the date palm are saved as a raw material of high value for the artisans of the region. Indeed, all date cultivars provide this material, with the exception of a few other cultivars well known for their stiffness and elasticity, which are widely used in basketry, including the Ghars cultivar (Figure 2). The Dockkar (male palm), Itim, Hamraya, Ali-or-Rachid and Tanslit or Tamsrit are also widely used in basketry (Table 3).

Table 3. Cultivars used in the preparation of the different articles and the importance of these articles according to the localities.

Items	Used Cultivar	Used Organ
Hats	Ghars and Dockkar	Heart and Middle Crown leaflets
Hand Fans	Ghars	Heart and Middle Crown leaflets
Baskets (two baskets tied on the back of the donkey to carry herbs and dates), Adel (large basket), Couffins.	Ghars, Dockkar, Itim, Tanslit	Adult leaflets and fibrillum

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Items	Used Cultivar	Used Organ
Small baskets for dates	Ghars, Dockkar	Middle crown leaflet and fibrillum
small bowl of water	Ghars, Dockkar	Heart leafletand floral stalk
couscous steamers, plats, couscoussiers covers	Ghars	Heart leaflet and floral stalk
Round rugs	Ghars	Protective leaflet of the palm heart and fibrillum
Container with lid for preserving dry meat	Ghars, Dockkar, Itim	Protective leaflet of the palm heart and fibrillum
Rectangular carpets	Ghars	leaflets of adult palmes and fibrillum
sort of basket without handles for the transport of sand in the gardens	Ghars	Adults leaflets or fibrillum
Anses	Ghars,Rejets, Dockkar and Itim	Fibrillum
Beds	Dockkar, Tanslit and Tifiziwin	Rachis of palms and fibrillum
Ropes	Ghars, rejets, Itim and Dockkar	Fibrillum
Broom	All cultivars	Floral stalk
Bird traps	Ghars, Dockkar and rejets	Rachis, leaflets and floral stalk
Doors, roof	Tifiziwin, Ghars, Dockkar and Tanslit.	Trunk
Windbreak	All cultivars	Trunk and dry palms

For the manufacture of handicrafts based on the green palms, especially from the palms of the core, the collection is carried out according to a distinct chronology; one to two palms / tree / year, and from the palms of the middle crown, it is from 3 to 5 palms / tree / year. These can vary depending on the age and condition of the date palm.

Whereas, for Dokkar (male palm), which is considered the second preferred cultivar for artisans, 4 to 5 palms / year are taken from the heart and middle crown respectively.

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Figure 2. Leaflets of the heart of palm *Ghars.*

It should be noted that even the pinnae of adult flippers can be used for making carpets and baskets of any size. These are mainly intended for agricultural work in the palm grove. Palms are taken in the order of 2 to 5 palms per palm tree per year.

Another source of this raw material is the young plants from seeds of date palm, for rigidity and elasticity spine. This is confirmed by the fellahs of all the studied localities (Figure 3).

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Figure 3. Seeds of date seeds (source of pinnats for basketry).

The fibrillum (Figure 4) and petioles of the date palm (Figure 5), in addition to rope and carpentry, can be used as thermal insulation in construction and in cooling instruments. Indeed, the thermal insulating power is ensured by cellulose. According to Jean (2001), this material has the characteristic of being able to absorb water vapor and thus makes it possible to regulate humidity. Its acoustic absorption is excellent. Cellulose insulators are ecological

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used for the insulation of floors, roofs, light partitions and wood frame walls. It is necessary not to choose an insulator solely on the basis of its thermal, technical and economic properties, but also its environmental impact (and health) throughout its life (various emissions, greenhouse gases, acidifying gas, ozone-forming gas, emissions of volatile organic compounds (VOCs), formaldehyde and other harmful products during its life ....) (Jean, 2001).

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Figure 4. Ibrillum of the date palm.

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Figure 5. Petioles of the date palm.

The richness of the date palm's organs in cellulose favours the establishment of a very important textile industry, giving biodegradable and manufactured fibers with respect for the environment. According to Michud and Giustini (2009), the demand for cellulose-based textile fibers is constantly growing for three reasons: a more pronounced requirement for the quality of clothing, the need to meet the needs of a growing population and the interest in specific properties, including hygroscopic and hygienic, wood-based fibers. The availability of cellulose in the organs of the date palm makes it possible to obtain 100 % cellulosic fibers that are technically interesting due to their ecological characteristics. Therefore, they are abundant and renewable raw materials from biomass. In industry, lignin in particular is used as an additive in cement, specifically as cement set retarder (Gosselink et al., 2008).

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Also, as a binder in animal feed to plasticize and hold the pellet together (Kluko, 2009).

The industrial exploitation of the organs of the date palm can be a real valorization of oasis products and an economic gain for the phoenicultural regions.

Made-up articles and their economic importance

The wickerwork of date palm organs is not expensive. The basket maker only needs his hands, simple rudimentary equipment and small quantities of raw material without economic expenses and with short working hours (Table 4). The resulting products are organic and beneficial to nature. There is a wide range of products from wickerwork terroirs, some of which are specific to particular areas. Each locality is distinguished by its woven articles: type of weaving, type of articles and patterns (Figure 6).

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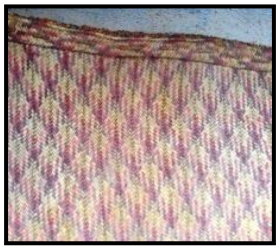
Articles made by braiding of the woven type

Market basket

Big basket

Oval carpet

Rounded carpet



Rectangular carpet

hats

Fan

Articles made by sewn spiral type braiding

Couscous steamers

plats

Small plats

Bowls

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Garden basket

Date basket

Jewelry box

Figure 6. Basketry items in the region of Ouargla.

On the other hand, household utensils: dishes (Tbags), couscous makers...etc., most often decorated and finely woven, are mainly made by women.

As a rule, baskets, large baskets (Adel), small and large garden baskets without decorative motifs as well as hats are produced by men. On the other hand, household utensils such as plats (Tbags), couscous steamers, etc., which are usually decorated and finely woven, are mainly made by women. With the exception of the other Algerian phoenicultural regions, in the Ouargla region, there is work sharing according to the types of basketry and braiding techniques. Results confirmed by Benfoughal (2007).

Table 4. Number of flippers required for making different items and working hours.

Article type	Number of palms leaf used	(Working time (unit /day)
Plat	One leaf for 3 Flat	plat occupies from 2 to 4
Baskets attached on the donkey back to carry herbs and dates	6 palm	3
Fan	5 to 10 spines	2 fans/ day
Couscous steamers cover	1 / 2 leaf	2 Couscous steamers cover/day
Couscous steamers	1 / 2 leaf	2
Rectangular baskets attached on the donkey back to carry herbs and (dates	3 to 5leafs	2 to 3
Large basket	3 to 5leafs	2 to 3

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Article type	Number of palms leaf used	(Working time (unit /day)
Basket	2leafs	1 to 2
Market Basket	3leafs	2
Cylindrical container with lid	2leafs	2 to 3
Water bowl	1/2 leafs	3 to 6 / days
Carpet	2 to5 leafs	from 7 to 10 days 1

Use of Date palm organs in Traditional Medication

Traditional therapeutic preparations based on date palm organs are also very numerous (Table 5).

Table 5. Main uses of date palm organs in traditional medicine.

Organs of the date palm	Medicinal use
Pollen	.Galactogen, nosebleed
Pollen with water	Sterility in men (**aphrodisiac virtues**)
Pollen with goat's milk	Infant who has sucked the gestation milk
Pollen, onion, Artemisia,	Stimulates female ovulation
Pollen, Honey and Alum	Shock
Pollen and dates	Strengthener, cough (**expectorant**) and heart care
Pollen, pistachio, almond, roasted chickpea, bee honey, and sheep's or goat's milk butter	aphrodisiac (**gynecology**)
Pollen with sheep's or goat's milk butter or water or tea	Infant who has sucked the milk of gestation and for sterile women.
Date Seeds	(Fresh date seed = *Rotab*) Chewed and sucked, against gum problems
	Diabetes, burns, kidneys, obesity, tonics
Date seed coffee, Artemisia	Cough (**expectorant**)
The cotyledonary leaf of the date nucleus	After maceration, the liquid is used as drops in the inflamed eye (**anti-inflammatory**)
Roasted Core Powder and Kohl	The eyes
heart of the date palm (*Djamar)*	Blood Coagulant, Stomach Care **(Analgesics)**.
Palm Pines	Ophthalmology (conjunctivitis and trachoma) Podology (**foot diseases**)

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Organs of the date palm	Medicinal use
Epines	Conjunctivitis and heel sores
Spathes	Diabetes
Date palm wood, powdered	Vulnerable and as an antibiotic

The use of date palm organs in cosmetics is an ancient practice. The oasis population of the region of Ouargla has long been able to develop highly effective cosmetic recipes. Kernel-based treatments are effective; this can be explained by their high mineral content. The date kernel contains 1.12 to 2.45 % of ashes (Munier, 1973; Ibrahim et al., 2004).

Usually, to cleanse the eyes, we use saline, which is a physiological solution composed of sterilized water and sodium chloride.

Kohl, produced locally, is made from a mineral powder composed mainly of Potassium, Sodium, Sulphide and Antimony Tartrate (Mahmoud et al., 2009), and date kernel powder, rich in Chloride which gives it, perhaps, this ability to cleanse the eyes, and could be an alternative to saline serum.

Medicinal plants contain highly active substances:

- Polyphenols: they are anti-inflammatory and antiseptic;
- Flavonoids: polyphenolic pigments, antioxidants, anti-inflammatory and anti-viral;
- Essential oils: like terpenes are antiseptics;
- Tannins: promote muscle contraction, they contain bitter substances that stimulate the salivary glands and gastric secretions, increasing appetite and improving digestion;
- Medicinal plants are also rich in minerals (Paul, 2001).

Research has shown that date palm pollen is rich in vitamins, it contains VitA (carotene) VitB: VitB2, VitB6 (pyridoxine), folic acid, VitC and VitE (biological antioxidant, protects lipids (cell membranes), proteins and DNA from oxidation and thus contributes to cell health and essentially enhances fertility. In addition, pollen contains about 2.34% of mineral elements such as phosphorus, iron and calcium, a high level of protein about 40%, certain hormones and enzymes. This composition could be a reason for the aphrodisiac virtues (Abdelsalem, 1994).

The local population also uses it to produce milk for women. This treatment can be explained by the presence of oestrogens in the pollen (Pons, 1970; Abdelsalem, 1994). Indeed, oestrogens stimulate milk production and facilitate childbirth (Yves, 2003).

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It also contains fructose and glucose (reducing sugars) (Yahia, 2003), all these characteristics give it interesting properties for cases of asthenia.

The use of sap as a fortifier may be due to its richness in sugars and mineral salts (Munier, 1973). The effectiveness of the treatment of sap in the case of stomachaches can be explained by the vermifuge properties that sap may have.

Honey provides antioxidants, sugars, vitamin E, vitamin C and minerals. By its two factors glycolytic and cholinergic, is a cardiac and blood reconstituant. The first one, in fact, stimulates an increased use of carbohydrates and is a cardiac muscle tonic. The second, active on the permeability of vessels, promotes myocardial circulation (Kwakman et al., 2010).

Thanks to its high concentration in sugars, its richness in diastases and aromatic essences, honey has a certain effective antiseptic power to treat sore throats, it also opposes any intestinal fermentation (Kwakman et al., 2010).

It contains a rare antibiotic factor (inhibin), which is primarily responsible for its antimicrobial activity. His organic acids are febrifuge and diuretic. Formic acid, on the other hand, stimulates intestinal peristalsis. Invertases and amylases, two enzymes of honey, explain its laxative properties (Kwakman et al., 2010).

Importance of date palm organs for agriculture

The valorization of the organs of the date palm allows the development of organic agriculture, by reusing them in the fertilization of soils, by the technique of composting to produce a compost rich in organic and mineral matter. The project carried out in Tunisia at the Djérid palm grove has produced important results, with 1 ton of solid waste producing 450 kg of compost (Koohafkan etal.,2011).

In the present study, palm groves can provide 40.086 tons of waste (dry palms, petioles, bunches and fibrillum) which produces 18.038.700 tons of compost. It is a rich organic amendment that acts over the long term to improve the physical, chemical and biological properties of poor soils in a fragile ecosystem.

In nurseries and in horticulture it is necessary to think about producing pots made of palms, instead of plastic pots; this is what is met through this study, the reuse of couscous steamers and different containers after amortization are exploited to decorate houses (Figure 7).

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Figure 7. Wickerwork pots (unused couscous steamer) in the region of Ouargla.

These products are natural and exempt from any synthetic components. Thinking about removing the plastic packaging and replacing it with natural products such as palm baskets would lead to a very encouraging economic and environmental benefits.

CONCLUSION

The region of Ouargla is considered a phoenicultural region. In addition to its socio-professional activities, which depend directly or indirectly on date palm, all the products produced from the phoenicultural biomass fall within the range of products from oasis terroirs. All classes of the population exploit and use these products, especially women. Indeed, women's products are generally kitchen utensils and various medicinal and cosmetic preparations. The resulting products have advantages that cannot be found in industrial products. They are, in fact, reputed to be biological, natural and additive-free products. These products require outlets, aid and subsidies from the authorities, at a time when date palms provide the raw material for a highly diversified industry (zootechnics, pharmaceuticals, carpentry, textiles, construction, organic farming, etc.).

The availability and diversity of industrial products on the local market and the consumer's openness to the outside world make it necessary to preserve this heritage by improving knowledge and maintaining these practices, as well as encouraging seal farming and supporting seal growers and craftsmen. The expansion of industry and agritourism in the oasis regions can effectively contribute to giving a new impetus to the local and national economy.

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