

Comparative Study of Two Taxa of the Genus *Prosopis* (Fabaceae): *Prosopis juliflora* (Sw) DC. And *P. chilensis* (Molina) Stuntz

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Abstract

Original Research Article

This work is a contribution to a better knowledge of the species of the genus *Prosopis*. It proposes specifically, to highlight the similarities and dissimilarities between *Prosopis juliflora* and *P. chilensis*. To achieve the results, observations and measurements were made on the different organs of the species. The comparison of the data obtained shows that the discriminating features are the spines which are more frequent on the branches of *P. chilensis* and rare on those of *Prosopis juliflora*. The distinguishing traits are related to the inflorescence of *P. juliflora* which is longer and denser than that of *Prosopis chilensis*. The top of the pod (beak) is more tapered in *P. juliflora*. This work allowed the identification of the two species of the genus *Prosopis*.

Keywords: *Prosopis*, *Prosopis juliflora*, *P. chilensis*, inflorescence, flowers.

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INTRODUCTION

The genus *Prosopis* belongs to the family Fabaceae or Leguminosae, subfamily Mimosoideae. It has 44 species (Pasicznick, *et al.*, 2001). Due to its resistance to arid and semi-arid conditions and its remarkable forms of dissemination and reproduction, the genus *Prosopis* is very well distributed in western Asia, sub-Saharan Africa, in the dry regions of America, in the southwestern United States, in Chile and in Argentina (Marcelo, 1990; Ba, 2008). Over the last two centuries, the genus *Prosopis* has had a wide distribution throughout the world. In Africa, the first known introductions of *Prosopis* date from 1822 in Senegal, 1880 in South Africa and 1900 in Egypt (Johansson, 1990; Choge *et al.*, 2007).

The great morphological similarity between the different taxa of the genus *Prosopis*, in particular *Prosopis juliflora* and *Prosopis Chilensis*, has made their taxonomic discrimination difficult to the point that in some documents they are considered as synonyms (Berhaut, 1971-1979; Grouzis *et al.*, 1997). This work aims to contribute to a better identification of these two taxa based on morphological traits.

MATERIAL AND METHODS

The samples were collected at the Cheikh Anta Diop University of Dakar (UCAD), behind the Central Library and at the BRGM. Observations and measurements were carried out on 25 samples from different individuals. The observation of the morphological characters was carried out with the naked eye and then with the help of a binocular magnifying glass. The comparative study of *Prosopis juliflora* and *P. chilensis* is made on the basis of the description of the vegetative and reproductive systems. Stable discriminating traits were selected on the basis of their easy observation in the field and their high taxonomic value.

Qualitative Traits of the Organs of the Adult Plant

Observations were made on the part of the plant, the stem, the leaves (type of leaves, phyllotaxis, shape of the blade, base and top of the blade, presence of crateriform gland, number of leaflets, venation of the blade, of the petiole, of the petiolule), the shape of the stipules, the presence or not of stipules, the inflorescence (type, arrangement and density), the flower (number of sepals, number of petals as well as their lengths, color of the corolla, shape of the lobes of

the calyx, number of stamens, length of the stamens), the pod (shape, orientation, number of seeds), the pilosity of the organs

Quantitative Traits of the Organs of the Adult Plant

Measurements were made on leaflet length and width, rachis length, petiole and petiolule length, stipule length, inflorescence length, calyx lobe length, flower stalk length, pedicel length, pod length and width.

RESULTS

The comparative study between *Prosopis juliflora* and *P. chilensis* shows a great morphological similarity between the two taxa. This taxonomic similarity is related to a high number of common morphological traits (Table 1). These include:

- A generally erect woody habit;
- Bipinnate, fasciculate, alternate leaves, opposite pinnules, with a gland between each pair of pinnules, opposite leaflets, glabrous and barely perceptible venation;
- Paired and axillary spines;
- An inflorescence in axillary raceme with yellow flowers very short pedicels;
- Linear pods with a curved beak at the end.

However, the presence of some relevant morphological characters allows to differentiate the two taxa (Table 2). These are:

- The arrangement of the leaves which is fasciculate, with 2 to 5 leaves at each insertion point in *Prosopis chilensis*, 3 to 7 leaves in *P. juliflora*;
- The number of pinnules is more important in *P. juliflora* (2 to 4 pairs) whereas in *P. chilensis*, it varies between 2 to 3 pairs;
- In *Prosopis chilensis*, spines are very frequent at the base of each leaf whereas in *P. juliflora*, spines are sometimes rare;
- In *Prosopis juliflora*, the inflorescence is 9 to 12 cm long whereas in *Prosopis chilensis*, it is about 8 to 10 cm ;
- The inflorescence is rather dense in *Prosopis juliflora* and loose in *Prosopis chilensis*;
- The beak of the fruit is curved, longer and thicker in *Prosopis juliflora*;
- The number of seeds is relatively higher in *Prosopis juliflora* (15 to 27) whereas in *Prosopis chilensis*, this number varies between 10 to 20 seeds.

Table 1: Common characteristics

Character traits	<i>Prosopis chilensis</i>	<i>Prosopis juliflora</i>
Port	drawn up	drawn up
Color of the branch	green/greyish	green/greyish
Thorn on the branches	present	present
Sheet type	bipennials	bipennials
Glands	1 gland between each pair of pinnules	1 gland between each pair of pinnules
Length of leaflets	4 to 10 mm	4 to 8 mm
Width of leaflets	2 to 3 mm	2 to 3 mm
Number of leaflets	10 to 20 paires	8 to 18 paires
Leaflet arrangement	opposite	opposite
Pilosity of the leaves	hairless	hairless
Type of venation	penned	penned
Arrangement of spines	2 spines at the base	2 spines at the base
Length of spines	5 to 10 mm	5 to 10 mm
Color of flowers	yellow	yellow
Type of fruit	Pods	Pods
Fruit shape	linear	linear

Table 2: Discriminant traits

Traits de caractères	<i>Prosopis chilensis</i>	<i>Prosopis juliflora</i>
Size	3 to 10 m	3 to 8 m
Presence of spines	2 spines at the base of each leaf	Present/absent at the base of the leaves
Leaf appearance one hour after harvesting a leafy branch sample	Non-spreading leaves	Spreading leaves
Inflorescence length	8 to 10 cm	9 to 12cm
Type of flower	Dense raceme	Loose raceme
Length of the inflorescence in relation to the leaf	less long than the leaf	longer than the leaf
Nombre de graines	15-20	15-27
Fruit beak shape	robust and less curved	pointed and curved
Number of pinnules	2 to 3 pairs	2 to 4 pairs
Layout of the leaves	fasciculated 2 to 5 leaves	fasciculated 3 to 7 leaves
Petiole length	1,5 to 4 cm	1,5 to 2 cm
Length of the spine	1 to 4 cm	0,5 to 3 cm

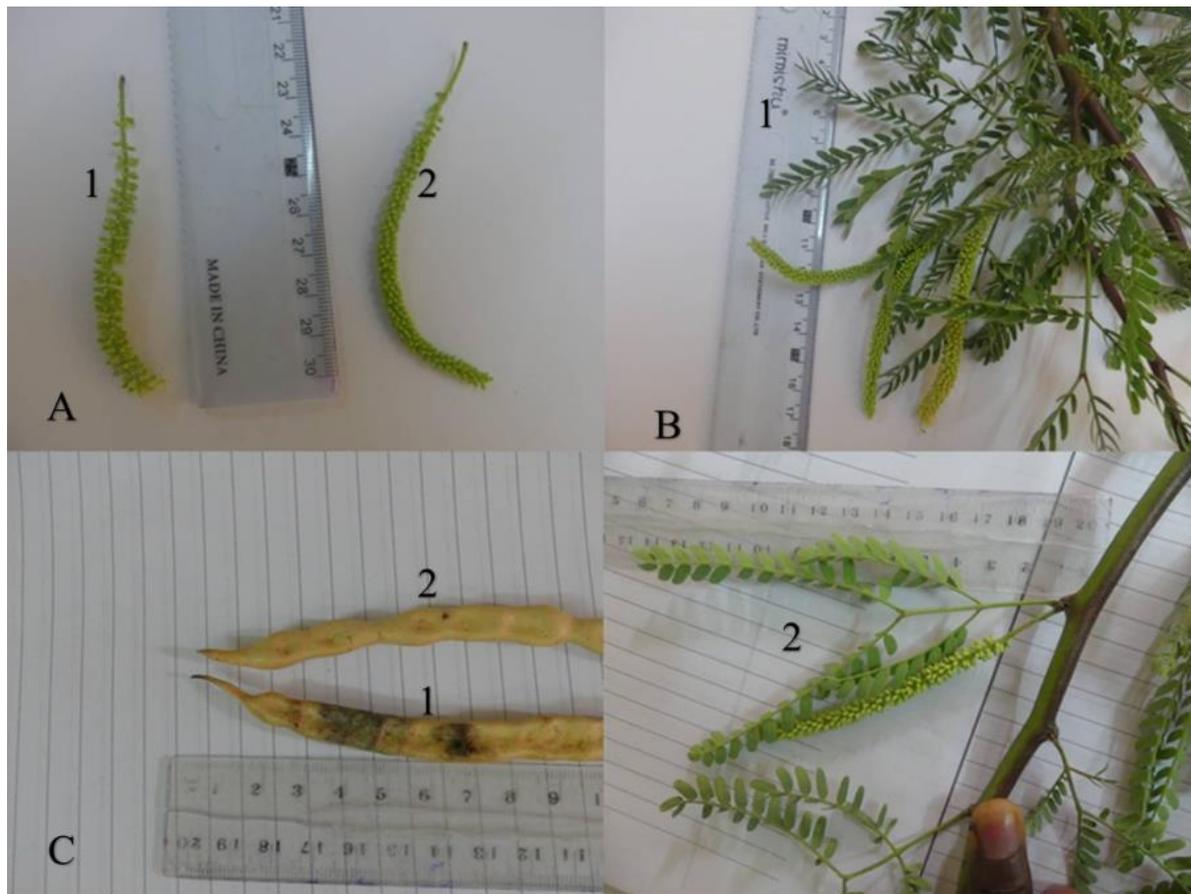


Figure 1: Discriminating characters between *P. juliflora* and *P. chilensis*

A. Inflorescences

1. *P. juliflora*;
2. *P. chilensis*

B. Inflorescent Shoots

1. *P. juliflora*;
2. *P. chilensis*

C. Fruits

1. *P. juliflora*;
2. *P. chilensis*

DISCUSSION

Following the comparative study of *P. juliflora* and *P. Chilensis*, although they share many similarities, present very distinct morphological characters. This difference is mainly related to the frequency of spines on the twigs, the length of the inflorescence, the density of flowers on the inflorescence and the shape of the beak. These results are similar to those obtained by some authors, such as BA (2008), Manzo *et al.*, (2009), Mukuria Muturi (2012), in Senegal, Niger and Kenya respectively. These authors all considered these two taxa as two different species. The length of the leaves in relation to the inflorescence, the shape of the lower end (beak) of the fruits is also very determining. These results are in line with those of Burkart (1976). However, Kazmi (2009) in his paper titled "ecological

and socio- economic assessment of the use of *Prosopis juliflora* for bio-char production in Pakistan", listed synonyms of *Prosopis juliflora*: *Algarobia juliflora* (Swartz) Benth. Ex Heynh. *Mimosa juliflora* Swartz. *Mimosa salinarum* Vahl. *Netuma juliflora* (Swartz) Raf. *Prosopis cumanensis* Kunth. *Prosopis dominguensis* DC. *Prosopis vidaliana* Naves, without mentioning *Prosopis chilensis*. However, Berhaut (1971-1979); Grouzis *et al.*, (1997) all considered *Prosopis chilensis* and *Prosopis juliflora* to be synonyms. The inflorescences of these two taxa, called spikes by Berhaut (1947), are in fact cylindrical racemes, of variable length according to the species, with short pedicellated flowers. These different discriminating features have been taken into account by many authors Burkart, (1940 and 1976), Habit (1981), Schinini (1981), Akrimi (1986), Le Hou  rou and Pontanier (1987), Chaieb (1992). The comparative study of the morphology of these two taxa has clearly shown the discriminating characters between the two species. However, independently of their origin and taxonomic differences, the species of *Prosopis* develop in the arid and semi-arid zones of Africa to sub- Saharan, North and South America. However, this work did not take into account the morphological variability of the organs that may be related to the habitat (climatic conditions, soil, etc.).

CONCLUSION

The results of this work have clearly established that *Prosopis chilensis* is a distinct taxon from *Prosopis juliflora*. The morphological traits that allow us to differentiate between the two are:

- The number of pinnae which is greater in *P. juliflora* (2 to 4 pairs) than in *P. chilensis*, (2 to 3 pairs);
- In *Prosopis chilensis*, spines are generally present at the base of each leaf, whereas in *P. juliflora*, spines are sometimes rare;
- In *Prosopis juliflora*, the inflorescence is 9 to 12 cm long, whereas in *Prosopis chilensis*, it is about 8 to 10 cm long;
- The raceme inflorescence is dense in *Prosopis juliflora*, whereas it is loose in *Prosopis chilensis*;
- The beak of the fruit is longer in *Prosopis juliflora*.
- In perspective, genetic studies could confirm or deny the differences noted between the two taxa.

REFERENCES

- Akrimi, N. (1986). Le *Prosopis* en Tunisie. Situation actuelle et perspectives de développement. Rapport de mission. *Institut des Régions arides, Medenine*, 8.
- Andersson, S. (2005). Spread of the Introduced Tree Species *Prosopis juliflora* (Sw.) DC in the Lake Baringo Area, Kenya. *Institutionen for Skoglig Vegetationsekologi, SLU (Swedish Agricultural University)*, UMEA, Sweden.
- Ba, E. H. M. (2008). *Etude des propriétés biomécaniques et de la capacité de vie symbiotique des racines d'arbres d'Acacia senegal Willd et de Prosopis juliflora DC (Doctoral dissertation, Bordeaux 1)*.
- Berhaut, J. (1971-1979). *Flore illustrée du Sénégal. Gouvernement du Sénégal. Ministère du Développement Rural & de l'Hydraulique, Direction des eaux et forêts, Dakar*, Tomes 6.
- Burkart, A. (1940). Materiales para: una monografía del género *Prosopis* (Leguminosae). *Darwiniana*, 4(1), 57-128.
- Burkart, A. (1976). A monograph of the genus *Prosopis* (Leguminosae subfam. Mimosoideae). *Journal of the Arnold arboretum*, 450-525.
- Chaieb, M. (1992). Biology and ecological behavior of *Prosopis stephaniana* (MB) Kunth, at the western limit of its range (Case of the Gabès site). *Mediterranean Forest*, 13 (2), 85-90.
- Choge, S. K., Ngunjiri, F. D., Kuria, M. N., Busaka, E. A., & Muthondeki, J. K. (2002). The status and impact of *Prosopis* spp in Kenya. *Unpublished report, Kenya Forestry Research Institute and Forest Department*.
- Grouzis, M., & Akpo, L. E. (1997). Influence of tree cover on herbaceous above-and below-ground phytomass in the Sahelian zone of Senegal. *Journal of Arid Environments*, 35(2), 285-296.
- Harzallah –Skhiri, F., Ben Ou ada, H., Bouzid, S., & Dutuit Pierre, P. (2004). Diversité morphologique des populations à base de *Prosopis*, identification et évaluation de ces ressources génétiques. In: Ferchich i A. (comp.), Ferchich i A. (collab.). *Réhabilitation des pâturages et des parcours en milieux méditerranéens*. Zaragoza : CIHEAM, 62, 125-129.
- Johansson, S. G. (1990). Controlling and Containing the Spreading of *Prosopis* spp. at Bura. An Outline of Options and Required Actions. *Research Component in Bura Fuel wood Project. Unpublished Working Paper 47*.
- Kazmi, S. J. H., Shaikh, S., Zamir, U. B., Zafar, H., Rasool, A., Tariq, F., ...& Arif, T. (2009). Ecological and socio-economic evaluation of the use of *Prosopis juliflora* for bio-char production in Pakistan. *Pakistan: Drynet*, 1-54.
- Laminou, M. O., Ibrahim, D., Campanella, B., & Paul, R. (2009). Effets de l'inoculation mycorhizienne du substrat sur la croissance et la résistance au stress hydrique de cinq espèces fixatrices de dunes : *Acacia raddiana* Savi ; *Acacia nilotica* (L.) Willd. Ex Del. var. *adansonii* ; *Acacia senegal* (L.) Willd ; *Prosopis chilensis* Stunz. et *Bauhinia rufescens* Lam. *Geo-Eco-Trop*, 33, 115-124.
- Le Houérou, H. N., & Pontanier, R. (1987). Les plantations sylvo-pastorales dans la zone aride de Tunisie. *Notes techniques du MAB 18. UNESCO*, 13.
- Muturi, G. M. (2012). Ecological impacts of *Prosopis* invasion in Riverine Forests of Kenya. *The Arnold Arboretum*, 57(3), 219-249, 450-525. *Habit* (1981).
- Pasiiecznik, N., Felker, P. J., Harris, L. N., Harsh, G., Cruz, J. C., Tewari, K. C., & Maldonado, L. J. (2001). The *Prosopis juliflora*-*Prosopis pallida* complex: A monograph HDRA. *Coventy, UK*.
- Schinini, A. (1981). Contribution à la floradelparaguay. *Bomplanclia*, 5: 101-108. Cité par Juan. *Hunziker and Forest Ecology and Management*, 16, 301-315.