



Ethnobotanical and agronomical survey of *Brocchia cinerea* (Delile) Vis. plant used by people in the Figuig and Draa-Tafilalet regions, Morocco

[Estudio etnobotánico y agronómico de la planta *Brocchia cinerea* (Delile) Vis. utilizada por personas en las regiones de Figuig y Draa-Tafilalet, Marruecos]

Nisrine Chlif^{1*}, Mohammed Diouri², Noureddine El Messaoudi³, Aissam Sbai¹, Amar Bentayeb¹

¹Team of Physical-Chemistry of Condensed Matter, Chemistry Department, Faculty of Sciences, Moulay Ismail University, BP. 11201 Zitoune Meknes, Morocco.

²Laboratory of Biotechnologies and Bio-resources Utilization (BioVaR), Biology Department, Faculty of Sciences, Moulay Ismail University, Meknes, Morocco.

³Laboratory of Applied Chemistry and Environment, Chemistry Department, Faculty of Sciences, Ibn Zohr University, Agadir, Morocco.

*E-mail: nisrin.chlif@gmail.com

Abstract

Context: As part of the development of the natural heritage of Morocco, an ethnobotanical and agronomic study was conducted in the regions of Figuig and Draa- Tafilalet.

Aims: To collect detailed information about the usage of *Brocchia cinerea* plant in human therapy and its incorporation into the feed system of livestock.

Methods: The survey was carried out over five months, using semi-structured and structured interviews. A total of 197 interviews with traditional health practitioners and educated villagers were conducted.

Results: Interview results showed that *Brocchia cinerea* is used in indigenous pharmacopeia to alleviate common diseases symptoms of the digestive system (36%), nervous system (19%), respiratory system (17%), ear, nose and throat (ENT) disorders (8%), and rheumatism (7%). The aerial parts of this plant were the most commonly used (36%), and the most preferred method for the preparation of traditional drugs was a decoction (33%). The results obtained from the agronomical survey show that the milk yield and meat production in ruminants noticeably increase after consumption of this plant.

Conclusions: The data collected may help prevent the loss of traditional knowledge on the use of plants characterizing the ecosystem of these study areas and may constitute preliminary information required for a future phytochemical study on the plants most frequently used. The agronomic survey carried out can help the range managers improve the forage quality by using *Brocchia cinerea* for the betterment of animal health and productivity.

Keywords: Asteraceae; *Brocchia cinerea*; *Cotula cinerea*; medicinal plant; phytotherapy; traditional medicine.

Resumen

Contexto: Como parte del desarrollo del patrimonio natural de Marruecos, se realizó un estudio etnobotánico y agronómico en las regiones de Figuig y Draa-Tafilalet.

Objetivos: Recopilar información detallada sobre el uso de la planta *Brocchia cinerea* en la terapia humana y su incorporación al sistema de alimentación del ganado.

Métodos: La encuesta se realizó durante cinco meses, mediante entrevistas estructuradas y semiestructuradas. Se llevaron a cabo un total de 197 entrevistas con profesionales de la salud tradicionales y pobladores educados.

Resultados: Los resultados de la entrevista mostraron que *Brocchia cinerea* se usa en la farmacopea indígena para aliviar los síntomas de enfermedades comunes del sistema digestivo (36%), sistema nervioso (19%), sistema respiratorio (17%), desórdenes en otorrinolaringología (8%) y reumatismo (7%). Las partes aéreas de esta planta fueron las más utilizadas (36%) y el método más preferido para la preparación de medicamentos tradicionales fue la decocción (33%). Los resultados obtenidos de la encuesta agronómica muestran que el rendimiento de leche y la producción de carne en rumiantes aumentan notablemente después del consumo de esta planta.

Conclusiones: Los datos recolectados pueden ayudar a prevenir la pérdida de conocimiento tradicional sobre el uso de plantas que caracterizan el ecosistema de estas áreas de estudio y pueden constituir información preliminar requerida para un futuro estudio fitoquímico sobre las plantas más utilizadas. La prospección agronómica realizada puede ayudar a los gestores de pastizales a mejorar la calidad del forraje mediante el uso de *Brocchia cinerea* para mejorar la salud y la productividad de los animales.

Palabras Clave: Asteraceae; *Brocchia cinerea*; *Cotula cinerea*; fitoterapia; medicina tradicional; planta medicinal.

ARTICLE INFO

Received: December 12, 2020.

Received in revised form: March 2, 2021.

Accepted: March 5, 2021.

Available Online: May 16, 2021.



INTRODUCTION

In the absence of modern medical systems that rely on primary health care and human survival, plants are a valuable heritage for humanity, particularly for the majority of poor communities in developing countries (Tabuti et al., 2003). Traditional medicine of Nord Africa is a special mixture of indigenous native practices and Christian, Arabic, Islamic, and other African traditions (Mrabti et al., 2019). Besides, North Africa has a wide variety of climates and terrain, ranging from the Mediterranean in the North to the desert or semi-desert in the South (El-Hilaly et al., 2003).

Morocco with its large surface area and diversified climate has a varied flora, which is a source of rich and abundant medical substances. Arid areas, in particular, constitute an important reservoir of many plants, which have not been investigated until today.

Figuig and Draa-Tafilalet regions are a part of South-Eastern Morocco, which has historically played an important role as the crossroads for desert caravans between South and North Africa. It is largely called the door to the desert (Eddouks et al., 2002). They are considered among the regions of Morocco in which phytotherapy knowledge is very developed. It should be noted that for the primary health needs, traditional methods of herbal medicine have been used to treat illnesses (Karou et al., 2011; Agbodeka et al., 2016).

The plants are used by the local population of these regions in the agrifood sector, notably as animal feed to meet the herds needs. Trees and shrubs, especially as suppliers of protein, are increasingly recognized as important components of animal feeding (Azim et al., 2011).

Among this flora, species from the *Asteraceae* family have been used in traditional medicine (Cheriti et al., 2013).

Asteraceae (or *Compositae*) family, commonly referred to as the aster, daisy, composite, or sunflower family, is a large angiosperm family of dicotyledonous flowering plants. It comprises ap-

proximately 1 400 genres and more than 25 000 herbaceous plants, tree, and shrub species, distributed across the globe, classified over three subfamilies and 17 tribes (Bremer, 1994; Cheriti et al., 2005; Judd et al., 2007).

Brocchia cinerea (Delile) Vis. is among the spontaneous plants that characterize the ecosystem of arid areas and belongs to the *Asteraceae* family. Although this plant is widespread in South-Eastern Morocco, it is poorly studied and has not received special attention to exploring its full potential.

The purpose of the present investigation was to evaluate the medicinal plant *B. cinerea* that grows in Figuig and Draa-Tafilalet with the aim of promoting the development of this underdeveloped region of the country. In this context, an inventory of traditional indigenous medical knowledge was carried out as a valuable resource of natural medicine, and its transmission to this underprivileged population, unable to afford treatment with modern medicines (Weniger, 1991; Evans, 2009) and to bring a large number of data referring to the use of *B. cinerea* in the agri-food sector, including livestock feed.

MATERIAL AND METHODS

Study area

Ethnobotany and an agronomic inquiry were performed in six areas of Draa-Tafilalet region, including the following villages: Gourama, Er-rachidia, Boudenib, Erfoud, Alnif and H'ssia, and three areas (Bni Tadjite, Talsint, and Anoual) of the Figuig province (Fig. 1).

The Draa-Tafilalet region is an oasis-dominated area (oases occupy 88% of the area of the region).

This region is limited to the North by Fes-Meknes region and Beni Mellal-Khenifra region, to the East by the Eastern region and Algeria, to the West by the region of Marrakech-Safi and the region of Souss-Massa, and by Algeria to the South. According to the latest census (2014), the population in this region is 1 635 008 inhabitants, includ-

ing more than 1 074 270 in rural areas and the illiteracy rate in this region is 34.5% (HCP, 2014).

The climate of the area, characterized by its irregularity, is semi-arid, with relatively low rainfall of less than 100 mm/year (Eddouk et al., 2017).

The geographical location and climatic conditions give this region richness in plant biodiversity, which has provided many medicinal and aromatic plants that have been utilized in traditional medicine by herbalists, competent villagers, and traditional healers (Eddouks et al., 2002).

The main occupation of this population is agricultural production, which is characterized by moderately diversified production, followed by animal husbandry and beekeeping (HCP, 2016).

Figuig province is located in the extreme South-East of the Kingdom and the south of the Eastern region to which it belongs. It is bordered to the North by Jerada province, to the North-West by the Boulemane province, to the West by the province of Errachidia, and by the Moroccan-Algerian frontier to the South and East (Province de Figuig,

2005). Its area is very large and covers 55 990 km² and has a population of 129 430 inhabitants, of which 66 271 are rural, according to the 2004 general population and housing census. The prevailing climate in the province of Figuig is semi-arid and characterized by cold in winter and heat in summer with frequent winds throughout the year. Likewise, it experiences low precipitation generally poorly distributed in time and space. The Figuig province economy is based on the following productive sectors: breeding, mines, trade, and crafts (Province de Figuig, 2005).

The study sites were selected based on the utilization of traditional herbal medicines by the community in these regions (Eddouks et al., 2002).

Ethnobotanical and agronomical survey

The present research was done between January 2018 and May 2018, by carrying out an ethnobotanical and agronomical survey with traditional healers (called "Achab"), herbalists, and persons having acquired traditional knowledge based on medical plants in these regions.

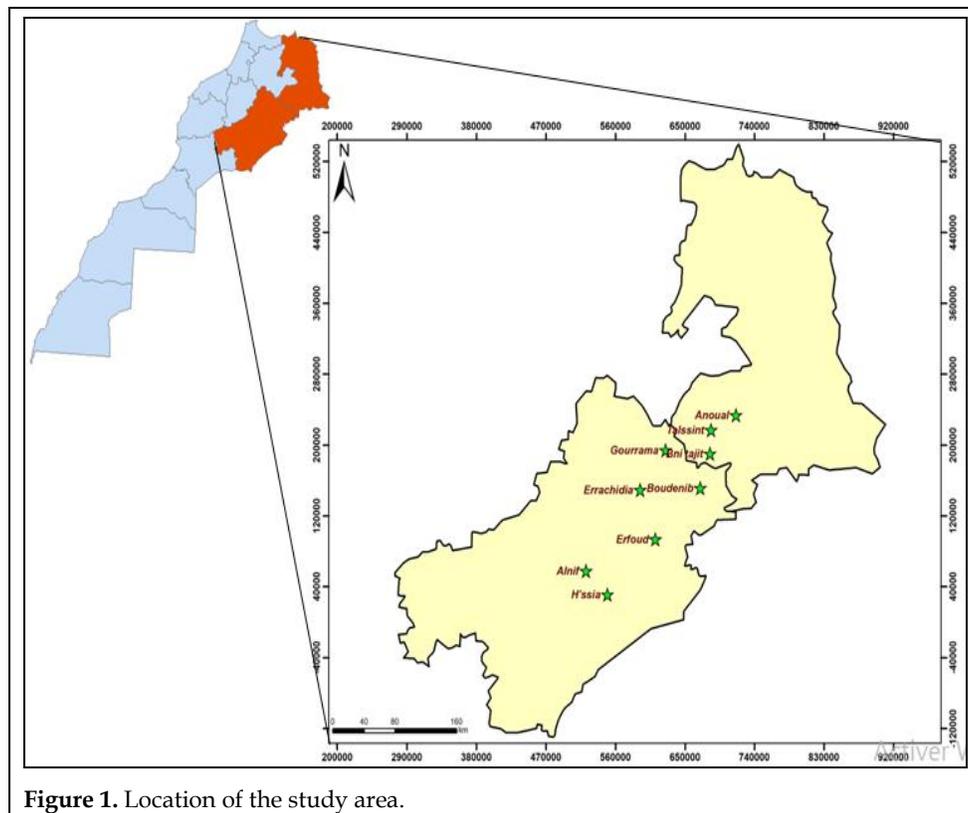


Figure 1. Location of the study area.

In total, 197 persons, native of the studied areas, were interviewed: 131 persons in the region of Draa-Tafilalet, in the villages of H'ssiya (35), Alnif (29), Erfoud (18), Boudenib (15) Errachidia (20) and Gourama (14) and 66 persons in the region of Figuig, in the villages of Bni Tadjite (25), Anoual (23) and Talsint (18). The informants were 17-89 years old, with an average age of 35.

Interviewees were selected by random sampling. Semi-structured and structured interviews were performed to acquire information on the use of *B. cinerea* plant in traditional medicine and livestock feed. The time devoted to each respondent was 30 to 60 minutes.

During the interview, fresh or dried pressed *B. cinerea* plant were shown to the informants to avoid misunderstandings concerning the identification of the plant and to motivate informants to answer questions.

At each interview, the following data were gathered:

(i) Socio-demographic information of the interviewees: Sex, age, academic level, family situation, and income.

(ii) Data relating to the use of *B. cinerea* plant in traditional medicine: vernacular name, ecological distribution (local or imported, cultivated or spontaneous species), traditional uses, parts used, form of preparation, method of administration, dosage.

(iii) Information on the use of *B. cinerea* in breeding: part consumed by livestock, time, and method of harvest (grazing or reaping), state of the plant (fresh or dry), and its effect on the livestock after consumption.

The medicinal plant of this study was collected, and the voucher specimen was deposited under the number code "RAB 110972" at the National Herbarium. The plant was identified by Professors Mohamed Ibn Tattou and Hamid Khmmar, Scientific Institute of Rabat (Morocco).

Statistical analysis

All the results obtained were collected and analyzed by using descriptive statistics. A computer software (Excel 2007) was used to identify the diseases treated by the plant *B. cinerea* and its effect on livestock after consumption. Microsoft Excel was used to calculate the different averages and to draw graphics.

RESULTS AND DISCUSSION

Interviewee's demographic characteristics

One hundred and ninety-seven participants, composed of herbalists (13.20%), competent villagers (60.91%), and traditional healers (25.89%), including 116 women (58.88%) and 81 men (41.12%), were interviewed (Table 1).

In these regions, both sexes are concerned with traditional medicine. However, women were more involved in the use of the medical species *B. cinerea* than men were. This could be explained by the following factors:

- Women learn mainly from their mothers and grandmothers through routine observations (Katiri et al., 2017);
- They are more attached to traditional practices than men (Jamila and Mostafa, 2014);
- Mothers are the ones who give the first care in particular for their children;
- Women are more often at home during the hours of the survey.

Similar findings were also reported in other parts of Morocco (Jamila and Mostafa, 2014; Mrabti et al., 2019) and elsewhere in the world (Savo et al., 2011; Packer et al., 2012).

The study showed that the frequency of medicinal plant use increased with age. The average age was 45.41 years with a minimum of 17 years and a maximum of 89 years, while the age group of 51-

60 years was the most represented (31.98%). *B. cinerea* plant was frequently used by people over 60 years of age (23.86%), followed by age classes [41-50], [31-40], [21-30] and (<21 years) having a frequency of 19.80%, 14.21%, 8.12%, and 2.03%, respectively (Table 1).

Table 1. Socio-demographic characteristics of the respondents.

| Demographic characteristics | No. of informants | Percentage (%) |
|--------------------------------|-------------------|----------------|
| Sex | | |
| Female | 116 | 58.88 |
| Male | 81 | 41.12 |
| Age | | |
| <21 years | 4 | 2.03 |
| 21-30 | 16 | 8.12 |
| 31-40 | 28 | 14.21 |
| 41-50 | 39 | 19.80 |
| 51-60 | 63 | 31.98 |
| 60< years | 47 | 23.86 |
| Education | | |
| Illiterate | 91 | 46.19 |
| Primary | 59 | 29.95 |
| Secondary | 35 | 17.77 |
| University | 12 | 6.09 |
| Income (in MAD) | | |
| <2500 | 122 | 61.93 |
| 2500< | 75 | 38.07 |
| Origin of the knowledge | | |
| Herbalists | 26 | 13.20 |
| Competent villagers | 120 | 60.91 |
| Traditional healers | 51 | 25.89 |

Results obtained effectively show that old people have more knowledge about medicinal plants compared to other categories because the experiences accumulated with the age constitute the main source of information at the local level. These findings are similar to those documented in other

studies (Ishola et al., 2014). Therefore, the transmission of this valuable knowledge is threatened because it is not assured (Ouhaddou et al., 2014). This constitutes a serious threat to the indigenous knowledge; because after the disappearance of the older generation, this knowledge can eventually be lost (Zougagh et al., 2019).

In the study area, the first row in terms of users of *B. cinerea* plant was occupied by the not educated with 46.19%. This high percentage reflects the low level of schooling of the local population (Table 1). Nevertheless, the people having the primary level of education still have an important presence (29.95%) contrary to those having levels of secondary or university education, which represent 17.77% and 6.09%, respectively.

These results indicate that interviewed people having a high level of education are bowed towards modern medicine resulting in loss of valuable herbal-based knowledge. Similar results have been found in several studies in other regions of Morocco (Ziyyat et al., 1997; Jouad et al., 2001).

The respondents having a low income (less than 2500 MAD/month) use *B. cinerea* more than those having an income above 2500 MAD/month (61.93% against 38.07%). This can be explained by the abundance of this plant and the moderate cost of healing plants. Most people prefer traditional herbal remedies because of their low prices compared to modern medicine. Local families have low incomes and often turn to inexpensive traditional medicine.

***B. cinerea* plant used for the treatment of diseases**

The *Asteraceae* family is well presented in the study area, and well distributed throughout Morocco. It also constitutes the major group of medicinal flora in most other Mediterranean countries (Benítez et al., 2010; Savo et al., 2011).

B. cinerea is part of the species of this family, which is frequently used to treat various diseases of the population of Draa-Tafilalet and Figuig thanks to its medical virtues and its abundance in these areas (Fig. 2).

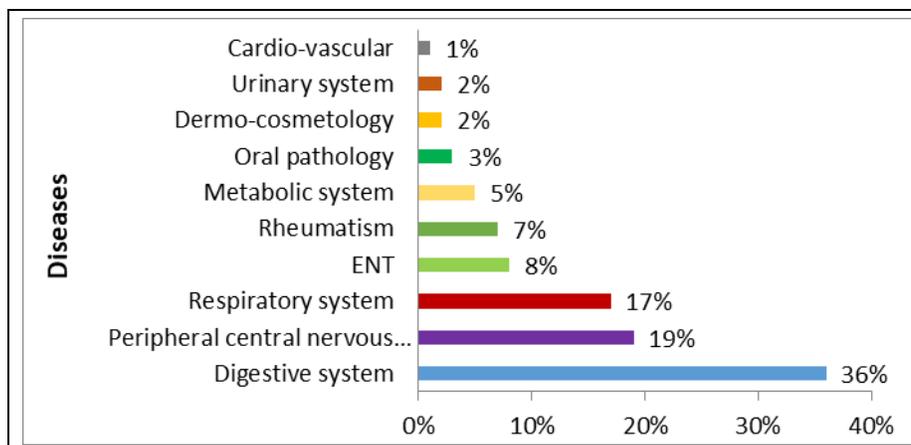


Figure 2. Percentage of therapeutical applications of *B. cinerea* plant used in the traditional medicine of peoples of Draa Tafilalet and Figuig.

ENT: ear, nose and throat (ENT) disorders.

The ethnobotanical study has revealed that this species is used mainly against digestive system diseases with a percentage of 36% especially stomach pain, diarrhea, colic, intestinal gases, constipation, and vomiting, among others. The ethnobotanical survey carried out in other studies reported that gastrointestinal disorders are found to be the most common application of *B. cinerea* plant (Bellakhdar, 1997; Cheriti et al., 2005; Jamila and Mostafa, 2014).

The diseases of the peripheral central nervous system come in the second place with a 19% rate: fever, migraine, and headache. The diseases affecting the respiratory system come in the third position with a 17% rate: asthma, rum, coughs, and lung affections. The ear, nose and throat (ENT) disorders (cold, rhinitis, sinusitis, nasopharyngitis, spasmodic coryza, angina, and pharyngitis) and rheumatism represent 8% and 7% rates, respectively. The other diseases concern metabolic system (5%), oral pathology (3%), dermo-cosmetology (2%), urinary system (2%) and cardio-vascular system (1%).

According to the analyzed data, aerial parts were the most frequently used plant parts (36%), followed by leaves (30%), leafy stems (19%), flowers or flowering tops (11%), and stems (4%) as shown in Fig. 3.

In the field, users tend to pull the whole plant instead of focusing only on the desired part (mainly leaves or flowers), which explains the large percentage of aerial parts being used.

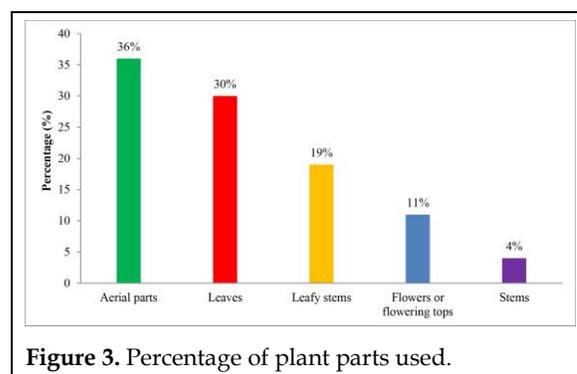


Figure 3. Percentage of plant parts used.

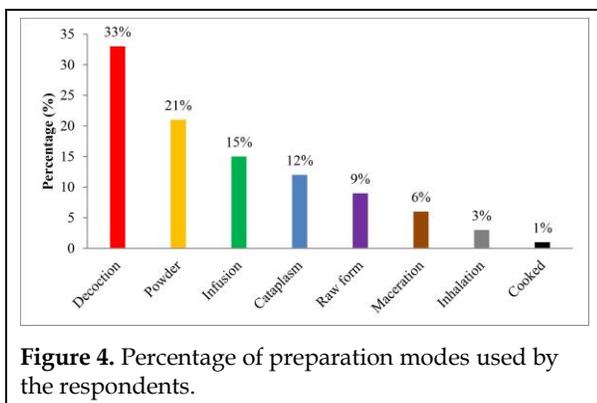
The results of this study showed that aerial parts of this plant play an important role in herbal medicine preparation in these regions, agreeing with the results of studies in Morocco (Eddouks et al., 2002; Jamila and Mostafa, 2014) and other countries (Camejo-Rodrigues et al., 2003; De-la-Cruz et al., 2007).

Besides, the preference for leaves is based on the fact that photosynthesis mainly takes place in this organ. The photosynthesis reservoirs created contain secondary bioactive compounds. Also, tanks and photosynthesis exudates, containing secondary bioactive compounds (alkaloids, glycosides, and essential oils, among others), have medicinal values for the human body (Yetein et al., 2013; Agbodeka et al., 2016).

The local population always looks for the easiest mode to prepare phytomedicaments. The decoction was the major preparation mode of herbal medicines (33%) followed by powder preparation (21%), infusion (15%), cataplasm (12%), raw form

(9%), maceration (6%) inhalation (3%), and cooked (1%) (Fig. 4).

This result agrees with other ethnobotanical studies (Ziyyat et al., 1997; El-Hilaly et al., 2003; Packer et al., 2012), which indicated that decoction was the most used recipe; more than 89.23% of the herbal preparations were in liquid form where water was the solvent most used (Mrabti et al., 2019).



Different parts of the plant were also mixed with tea, oil, milk, or honey to improve their medicinal properties and their acceptability. For example, the powder of *B. cinerea* mixed with oil for rheumatism and mixed with honey for digestive and respiratory system diseases.

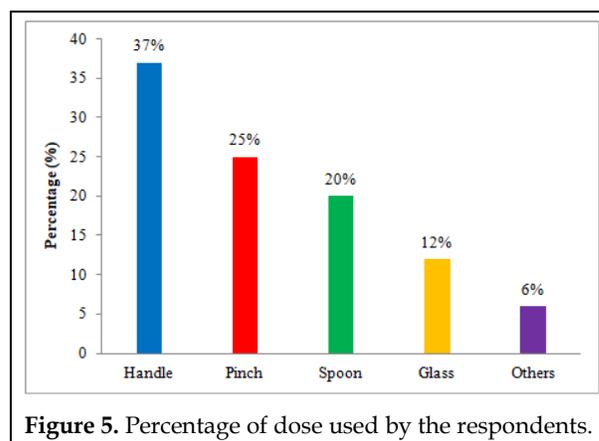
The most widely used mode of administration is oral, followed by external application, inhalation of decoct, and inhalation of the burned plant. Similar findings were observed in other studies (Ed-douks et al., 2002; Semanya et al., 2012).

The doses administered to the patient were not very accurately measured (29%). they used some measurements differ from one person to another. The plant studied was taken with a handle (37%), pinch (25%), spoon (20%), glass (12%), or other tools (6%) (Fig. 5).

The dose used of *B. cinerea* plant was random, which is manifested by harmful effects on the health. The dose is what makes a substance a poison (Bou-Idra et al., 2015).

B. cinerea plant used for livestock feeding

The incorporation of shrub species in animal production systems can be a viable alternative to improve the utilization of land and, at the same time, improve the diet of ruminants (Sánchez et al., 2006). The breeders of South-Eastern Morocco arid areas use the grazed natural pastures as the main feed resources. With increased feed and other farm expenses, pasture is being re-examined as a method to reduce the costs of production.



The contribution of the native pastures to the nutritional requirements of domestic animals is important in the areas of Figuig and Draa Tafilalet. An agronomic survey was carried out to collect the maximum information on the use of *B. cinerea* plant in livestock feed.

Among the 197 people interviewed in these two study zones, 142 answered the questions, of which 72.08% use *B. cinerea* plant as a forage food for herbivorous animals as this native species is present in the wild state and can withstand the hot environment.

During the survey, the majority of interviewees state that the *B. cinerea* plant begins to appear in the last days of January and it wilts at the end of June. The livestock feeding systems carried out in these study areas are predominantly extensive with large herds of indigenous livestock that freely graze on large pieces of land (RIAM, 2017).

One hundred and twenty-seven people let their cattle move from one place to another in search for *B. cinerea* plant and other pasture plants and 59 respondents mow, dry, and store this plant in the spring, when grass growth is at its maximum. The breeders avoid the creation of excess grazing when the supply of grass exceeds the herd's needs.

In animals' habit, the most consumed part of the plant is the upper part, which consists of the flowers, leaves, and stems. The stems must be fine for the forage to be easily harvested by the animal and chewed.

The breeders noted that there is a positive effect on animals when they eat the *B. cinerea* plant. They declared that during this period, there is an increase in milk yield (39%), the appearance of a pleasant flavor to milk and meat (27%), an increased meat production (18%), and an improvement of the growth and finish of young animals (16%).

Study limitation

This study was performed in four areas from Figuig province and five areas from Draa-Tafilalet region. During this study, 197 persons were contacted. However, further studies including other areas and regions, and a larger surveyed population could be performed to better understand the traditional uses of *Brocchia cinerea*.

Additionally, different obstacles were encountered and have influenced the progress of this study, such as:

- The limited access to the population of concern (the respondents were in hard-to-reach areas);
- The population concerned of this study, particularly women, were very shy and sometimes feel discouraged to provide detailed answers;
- The majority of interviewed persons were illiterate, which makes it necessary to use a traditional survey method based on paper surveys and face-to-face interviews, instead of collecting information online to save time and minimize charge.

CONCLUSIONS

The majority of the studied population have difficult access to Western medicines due to the high cost and usually resort to their own traditional remedies. Figuig and Draa Tafilalet have a reputation as important regions of Morocco in which phytotherapy is an integral part of the human healthcare system. *B. cinerea* plant is among the spontaneous and endemic species used specifically in traditional medicine of these regions, which may be shown to have therapeutic value once they have been experimentally and clinically tested.

The elderly and people with no formal education were found the most users of this herbal medicine and consequently are more knowledgeable, which underlies the question on the conservation of this traditional knowledge through generations. Digestive disorders were found as the most ailments treated with the *B. cinerea* plant in these provinces. The most common preparation mode was decoction, powder, and infusion, and most of the medicines are administered orally.

The current study proved that the grazing technique is widely practiced by the population of South-Eastern Morocco. The low socio-economic level of these regions is one of many reasons that species like *B. cinerea* are incorporated into the livestock feeding system to improve the quality of forage and meet the needs of animals.

This work represents valuable documentation, which allows preserving the knowledge on the use of *B. cinerea*. Besides, protective measures are essential to conserving natural herbal resources that are present in these study areas to prevent their overexploitation.

CONFLICT OF INTEREST

The authors declare no conflicts of interests.

ACKNOWLEDGMENTS

The authors gratefully acknowledge Professors Mohamed Ibn Tattou and Hamid Khammar, from the Scientific Institute of Mohammed V University in Rabat, Morocco, for their assistance concerning the identification of the studied plant.

REFERENCES

- Agbodeka K, Gbekley HE, Karou SD, Anani K, Agbonon A, Tchacondo T, Batawila K, Simpore J, Gbeassor M (2016) Ethnobotanical study of medicinal plants used for the treatment of malaria in the plateau region, Togo. *Pharmacogn Res* 8(1): 12-18.
- Azim A, Ghazanfar S, Latif A, Nadeen MA (2011) Nutritional evaluation of some top fodder tree leaves and shrubs of district Chakwal, Pakistan in relation to ruminants requirements. *Pak J Nutr* 10(1): 54-59.
- Bellakhdar J (1997) Contribution à l'étude de la pharmacopée traditionnelle au Maroc: La situation actuelle, les produits, les sources du savoir (enquête ethnopharmacologique de terrain réalisée de 1969 à 1992). Ph.D. Thesis, Département de Science de la vie, Université Paul Verlaine - Metz.
- Benítez G, González-Tejero MR, Molero-Mesa J (2010) Pharmaceutical ethnobotany in the western part of Granada province (southern Spain): Ethnopharmacological synthesis. *J Ethnopharmacol* 129:87-105.
- Bou-Idra M, Rhafour R, Zekkori B, Bahri H, El Omari M, Bentayeb A (2015) Floristic and ethnobotanical studies of three plants, cactus, carob and caper used in the Zerhoun region (Morocco). *Int J Multidiscip Res Dev* 2(12): 1027-1034.
- Bremer K (1994) *Asteraceae: Cladistics & Classification*. Timber Press, Portland.
- Camejo-Rodrigues J, Ascensão L, Bonet MÀ, Vallès J (2003) An ethnobotanical study of medicinal and aromatic plants in the Natural Park of "Serra de São Mamede" (Portugal). *J Ethnopharmacol* 89: 199-209.
- Cheriti A, Belboukhari N, Hacini S (2005) Savoir traditionnel et valorisation des plantes médicinales du sud ouest algérien. *Annales de l'Université de Bechar* 1: 4-8.
- Cheriti A, Belboukhari N, Hacini S (2013) Ethnopharmacological survey and phytochemical screening of some medicinal Asteraceae of Algerian Sahara. *PCBS J* 7(2): 52-56.
- De-la-Cruz H, Vilcapoma G, Zevallos PA (2007) Ethnobotanical study of medicinal plants used by the Andean people of Canta, Lima, Peru. *J Ethnopharmacol* 111: 284-294.
- Eddouks M, Maghrani M, Lemhadri A, Ouahidi ML, Jouad H (2002) Ethnopharmacological survey of medicinal plants used for the treatment of diabetes mellitus, hypertension and cardiac diseases in the south-east region of Morocco (Tafilalet). *J Ethnopharmacol* 82: 97-103.
- Eddouks M, Ajebli M, Hebi M (2017) Ethnopharmacological survey of medicinal plants used in Daraa-Tafilalet region (Province of Errachidia), Morocco. *J Ethnopharmacol* 198: 516-530.
- El-Hilaly J, Hmammouchi M, Lyoussi B (2003) Ethnobotanical studies and ethnobotanical studies and economic evaluation of medicinal plants in Taounate province (Northern Morocco). *J Ethnopharmacol* 86: 149-158.
- Evans WC (2009) *Trease and Evan's Pharmacognosy*, 16th edn. W. B. Saunders Ltd, London, pp. 10-11.
- HCP (2014) Haut-Commissariat au Plan. Caractéristiques Démographiques et Socio-Economiques Region Draa-Tafilalet. Direction régionale de Draa Tafilalet, Errachidia, Morocco. <https://www.hcp.ma/draa-tafilalet/attachment/884248/> [Accessed on 25 February 2021].
- HCP (2016) Haut-Commissariat au Plan. Monographie régionale. Direction régionale de Draa Tafilalet, Errachidia, Morocco. <https://www.hcp.ma/draa-tafilalet/attachment/1453624/> [Accessed on 27 February 2021].
- Ishola IO, Oreagba IA, Adeneye AA, Adirije C, Oshikoya KA, Ogunleye OO (2014) Ethnopharmacological survey of herbal treatment of malaria in Lagos, Southwest Nigeria. *J Herb Med* 4: 224-234.
- Jamila F, Mostafa E (2014) Ethnobotanical survey of medicinal plants used by people in Oriental Morocco to manage various ailments. *J Ethnopharmacol* 154: 76-87.
- Jouad H, Haloui M, Rhiouani H, El-Hilaly J, Eddouks M (2001) Ethnobotanical survey of medicinal plants used for the treatment of diabetes, cardiac and renal diseases in the North centre region of Morocco (Fez - Boulemane). *J Ethnopharmacol* 77: 175-182.
- Judd WS, Campbell CS, Kellogg EA, Stevens PF, Donoghue MJ (2007) *Donoghue: Plant Systematics: A Phylogenetic Approach*, 3rd edn. Sinauer Associates Inc, Sunderland, MA. Hardback, pp. 611.
- Karou SD, Tchacondo T, Tchibozo MAD, Abdoul-Rahman S, Anani K, Koudouvo K, Batawila K, Agbonon A, Simpore J, Souza CD (2011) Ethnobotanical study of medicinal plants used in the management of diabetes mellitus and hypertension in the Central Region of Togo. *Pharm Biol* 49(12): 1286-1297.
- Katiri A, Barkaoui M, Msanda F, Boubaker H (2017) Ethnobotanical survey of medicinal plants used for the treatment of diabetes in the Tizi n' Test Region (Taroudant Province, Morocco). *J Pharmacogn Nat Prod* 3(1): 1000130.
- Mrabti HN, Jaradat N, Kachmar MR, Ed-Dra A, Ouahbi A, Cherrah Y, Faouzi MEA (2019) Integrative herbal treatments of diabetes in Beni Mellal region of Morocco. *J Integ Med* 17: 93-99.
- Ouhaddou H, Boubaker H, Msanda F, El Mousadik A (2014) An Ethnobotanical study of medicinal plants of the Agadir Ida Ou Tanane province (Southwest Morocco). *J Appl Biosc* 84: 7707-7722.
- RIAM (2017) Actes du Forum régional - Synthèse des échanges. 7^{ème} Forum Régional d'Agriculture Durable Agriculture biologique, Agroécologie, Permaculture Région Drâa Tafilalet, Errachidia Morocco. <http://reseauiam.org/wp->

- [content/uploads/2019/11/t_VF7-FORUM-DRAA-TAFILALET.pdf](#) [Accessed 28 February 2021].
- Packer J, Brouwer N, Harrington D, Gaikwad J, Heron R, Elders YC, Ranganathan S, Vemulpad S, Jamie J (2012) An ethnobotanical study of medicinal plants used by the Yaegl Aboriginal community in northern New South Wales, Australia. *J Ethnopharmacol* 139: 244–255.
- Province de Figuig (2005) Monographie de la province de Figuig. Ministère de l'intérieur province de Figuig, Figuig, Morocco. http://www.oriental.ma/upload/MoDUle_1/File_1_99.pdf [Accessed 25 February 2021].
- Sánchez NR, Ledin S, Ledin I (2006) Biomass production and chemical composition of *Moringa oleifera* under different management regimes in Nicaragua. *Agrofor Syst* 66: 231–242.
- Savo V, Giulia C, Maria GP, David R (2011) Folk phytotherapy of the Amalfi coast (Campania, Southern Italy). *J Ethnopharmacol* 135: 376–392.
- Semenya S, Potgieter M, Erasmus L (2012) Ethnobotanical survey of medicinal plants used by Bapedi healers to treat diabetes mellitus in the Limpopo Province, South Africa. *J Ethnopharmacol* 141: 440–445.
- Tabuti JRS, Lye KA, Dhillion SS (2003) Traditional herbal drugs of Bulamogi, Uganda: Plants, use and administration. *J Ethnopharmacol* 88: 19–44.
- Weniger B (1991) Interest and limitation of a global ethnopharmacological survey. *J Ethnopharmacol* 32: 37–41.
- Yetein MH, Houessou LG, Lougbégnon TO, Teka O, Tente B (2013) Ethnobotanical study of medicinal plants used for the treatment of malaria in plateau of Allada, Benin (West Africa). *J Ethnopharmacol* 146: 154–163.
- Ziyyat A, Legssyer A, Mekhfi H, Dassouli A, Serhrouchni M, Benjellon W (1997) Phytotherapy of hypertension and diabetes in oriental Morocco. *J Ethnopharmacol* 58: 45–54.
- Zougagh S, Belghiti A, Rochd T, Zerdani I, Mouslim J (2019) Medicinal and aromatic plants used in traditional treatment of the oral pathology: The ethnobotanical survey in the economic capital Casablanca, Morocco (North Africa). *Nat Prod Bioprospect* 9: 35–48.

AUTHOR CONTRIBUTION:

| Contribution | Chlif N | Diouri M | El Messaoudi N | Sbai A | Bentayeb A |
|------------------------------------|---------|----------|----------------|--------|------------|
| Concepts or ideas | x | x | | | x |
| Design | x | x | x | | x |
| Definition of intellectual content | x | | | | |
| Literature search | x | | x | x | |
| Experimental studies | x | | x | x | |
| Data acquisition | x | | x | x | |
| Data analysis | x | x | | | x |
| Statistical analysis | x | x | | | x |
| Manuscript preparation | x | x | | | x |
| Manuscript editing | x | | | | |
| Manuscript review | x | x | x | x | x |

Citation Format: Chlif N, Diouri M, El Messaoudi N, Sbai A, Bentayeb A (2021) Ethnobotanical and agronomical survey of *Brocchia cinerea* (Delile) Vis. plant used by people in the Figuig and Draa-Tafilalet regions, Morocco. *J Pharm Pharmacogn Res* 9(5): 685–694.