



Ethnobotanical and Floristic Investigations of Datura Species in Mali

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Authors' contributions

This work was carried out in collaboration among all authors. Author IT designed the study, wrote the protocol, participated to the data collection and wrote the first draft of the manuscript. Author MAK performed the statistical analysis, managed the literature searches and corrected the first draft of the manuscript. Authors ND and MK participated to the data collection and identified the found species. All authors read and approved the final version of the manuscript.

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ABSTRACT

Aims: This work aimed to investigate the floristic composition and the different medicinal uses of Datura species in addition to people perceptions about them.

Place and Duration of Study: The floristic study has been conducted in three sites located in the region of Sikasso (Mali) during October, 2019. The ethnobotanical one was carried out in five zones located in different regions of Mali in order to register the maximum of relevant information about Datura's therapeutic virtues.

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Methodology: A floristic and ethnobotanical investigation on *Datura* species was carried out based on a stratified probabilistic sampling plan. The free consent and the availability of the respondents was an important criterion during the ethnobotanical survey. Besides, the characteristic parameters of floristic diversity and relative frequencies were calculated based on literature formula.

Results: The floristic survey allowed to register three species of *Datura*: *D. stramonium* (65.38%), *D. innoxia* (19.23%) et de *D. ferox* (15.38%). Around these species, 148 plants belonging to 39 species divided in 32 genus and 18 families. Herbaceous represented 94.87% of these inventoried species. With high coefficients of similarity ($C_s > 50\%$), we noted an identical floristic diversity inside the three sites. Moreover, Tousséguela had the highest specific diversity index (1.21). The ethnobotanical survey targeted 118 people in five 5 localities with about 77% of men. If 50% of them found *Datura* to be useful, 50% considered it to be useful with distrust or dangerous. The data showed that the local populations use *Datura* in the treatment of many diseases; the most cited were dermatosis (16.98%) and swelling (14.15%). The leaves (93.83%) and seeds (14.81%) were the most exploited organs mainly in the form of decoction (61.18%) and by oral route, massage (15.66%) and bath (13.25%).

Conclusion: These results reveal the floristic richness of *Datura* genus and its associated species.

Keywords: *Datura* species; ethnobotany; floristic composition.

1. INTRODUCTION

In African countries, the phytotherapy remains one of the main means used by the local population to treat themselves. This choice of herbal medicine by the local population is generally related to the inexistence or rudimentary state of health infrastructures, the high cost of pharmaceutical preparations, as well as the modest income of the populations [1–3]. However, the transmission of knowledge in herbal medicine is threatened by the modern medicine, since it is currently held by only a limited number of people [1]. In view of this situation, it is urgent to conduct ethnobotanical research on medicinal plants in order to safeguard this valuable traditional knowledge and translate it into scientific knowledge. Ngbolua et al. [4] had mentioned this urgency of safeguarding traditional therapeutic knowledge through, among others, field surveys and the study of pharmacological and toxicological activities. These activities will enable researchers to design phytomedicines based on traditional knowledge. In this view, the Department of Traditional Medicine (DMT) in Mali, a structure specializing in the exploration and development of phytomedicines, has carried out numerous works [5–7].

Many works have reported the richness of Malian flora in medicinal especially in Sikasso [8]. The work of Kouyaté et al. [9] has identified 277 forest species in this region, including 250 local species and 27 exotics that belong to 182 genera and 58 families. Surveys conducted in the region showed that 30 local forest species are on the verge of extinction from village lands [10]. Among

these species, those belonging to the genus *Datura*, which are the subject of much controversy due to their mystical and hallucinogenic effects, occupy an important place. Many works conducted on *Datura* species have revealed their richness in bioactive compounds and antioxidants [11–14]. However, in Mali, to our knowledge, there is no work related to the floristic composition and ethnobotanical characteristics of species belonging to this genus. This work aimed to fill this gap by collecting the maximum of information concerning the therapeutic virtues of *Datura* species through an ethnobotanical survey and establishing a catalogue of associated species in its natural habitat.

2. MATERIALS AND METHODS

2.1 Presentation of the Study Area

Geography and Habitat: The cercle of Kolondiéba is a territorial collectivity of Mali located in the Sikasso region. It is bordered to the north by the rural communes of Koumantou and Zantiébougou (Bougouni cercle), to the south by the Republic of Ivory Coast and to the east by the rural communes of Zagnèna and Milo (Bougouni cercle). With an area of 92,000 km², it is subdivided in 12 communes including those of Kolondieba, Kebila and Tousséguela. The capital of the cercle, Kolondieba, is located at 240 km from the capital of the Sikasso region and 245 km from Bamako. The total population of the cercle was estimated at 188,818 inhabitants in 2009 and according to the projections, this population will reach 277,184 inhabitants in 2022 [15].

Climate and vegetation: The climate is tropical. The mean temperatures are usually 30°C. As for the vegetation cover, it remains an attraction for Fulani herders coming from the northern Mali. The soils are covered with clear deciduous forests accompanied by a very vigorous herbaceous carpet: the savanna. All the vegetation grows on lateritic or slightly sandy soils characteristic of tropical countries. Reputedly poor, these soils are however easy to work. Their physical texture constantly plowed with a sufficient water supply gives a margin of guarantee to the agricultural work more than those of the North of the country.

Rainfall: The area is subject to a favorable Sudanian-type rainfall regime. Comparatively to the country, the district experiences an alternating rainy and dry season. The average annual precipitations are around 1,250 mm, distributed over 58 to 60 days per year.

Relief: Its relief is characterized by the tabular model, characteristic of lateritic countries. The hills are seeable in the south-western parts towards the commune of Fakola and the large

plains in the north-west (Neguela plain) and south-west (Kadiana and Djedieba plains).

2.2 Floristic Study

The investigations were conducted at three sites (Kolondieba, Kebila and Tousseguela) located in the Kolondieba Cercle (Fig. 1).

The floristic study consisted of an inventory of the different species of *Datura* present and their associated species. For the inventory of species associated with *Datura* spp. the minimum area method (16 m²) or area-species method was adopted. Within a 16 m² area, all seeable plant species were registered [16].

2.2.1 Relative frequency

The relative frequency (Fr) of a given plant species is defined as the ratio of its absolute frequency (Fa) or number of surveys where it is mentioned to the total number (N) of surveys conducted on a given site. It is expressed as follows:

$$Fr (\%) = (Fa / N) \cdot 100$$

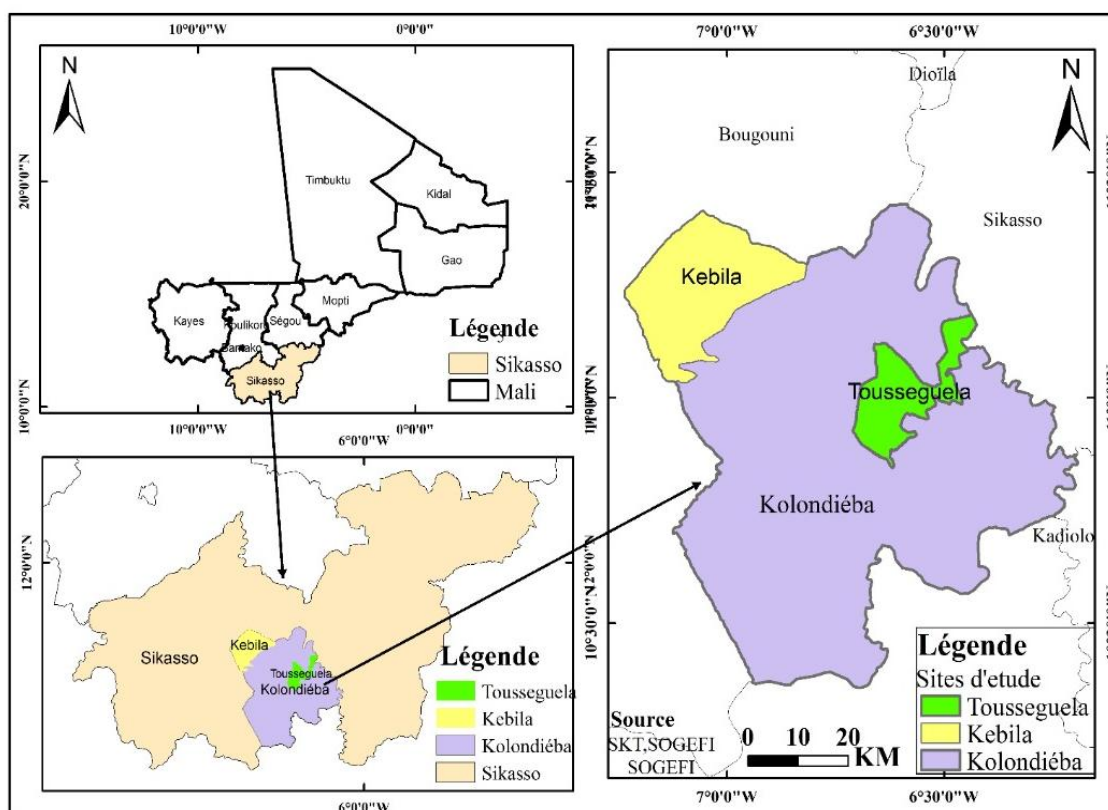


Fig. 1. Floristic study area with location of sites

2.2.2 Characteristic parameters of floristic diversity

The diversity of the flora of the different sites was characterized by the following parameters:

➤ **Coefficient of similarity (Cs)**

It allows to verify the homogeneity of the survey sites with regard to their floristic composition. It was determined according to the Sorensen formula reported by [17].

$$Cs (\%) = \left[\frac{2 \times a}{(2a + b + c)} \right] \times 100$$

where b and c represented the numbers of species unique to each of sites b and c, where a is the number of species common to both sites b and c.

The similarity coefficient (Cs) varies from 0 to 100% depending on whether the sites are of totally different floristic composition (c = 0) or identical (b = c). For a similarity coefficient

greater than or equal to 50%, the sites concerned are considered floristically identical.

➤ **Index of generic diversity (Idg)** which is the ratio between the number of genera and the number of families recorded.

$$Idg = \frac{\text{Number of genera}}{\text{Number of families}}$$

➤ **Index of specific diversity (Ids)**, ratio between the number of species and genera recorded.

$$Idg = \frac{\text{Number of species}}{\text{Number of genera}}$$

2.3 Ethnobotanical Survey

In addition to the cercle of Kolondieba where the floristic study was conducted, the ethnobotanical study was extended to other sites: Bamako, Bougouni, Fana and Sangha (Fig. 2) in order to gather as much information as possible on the medicinal uses of *Datura* species.

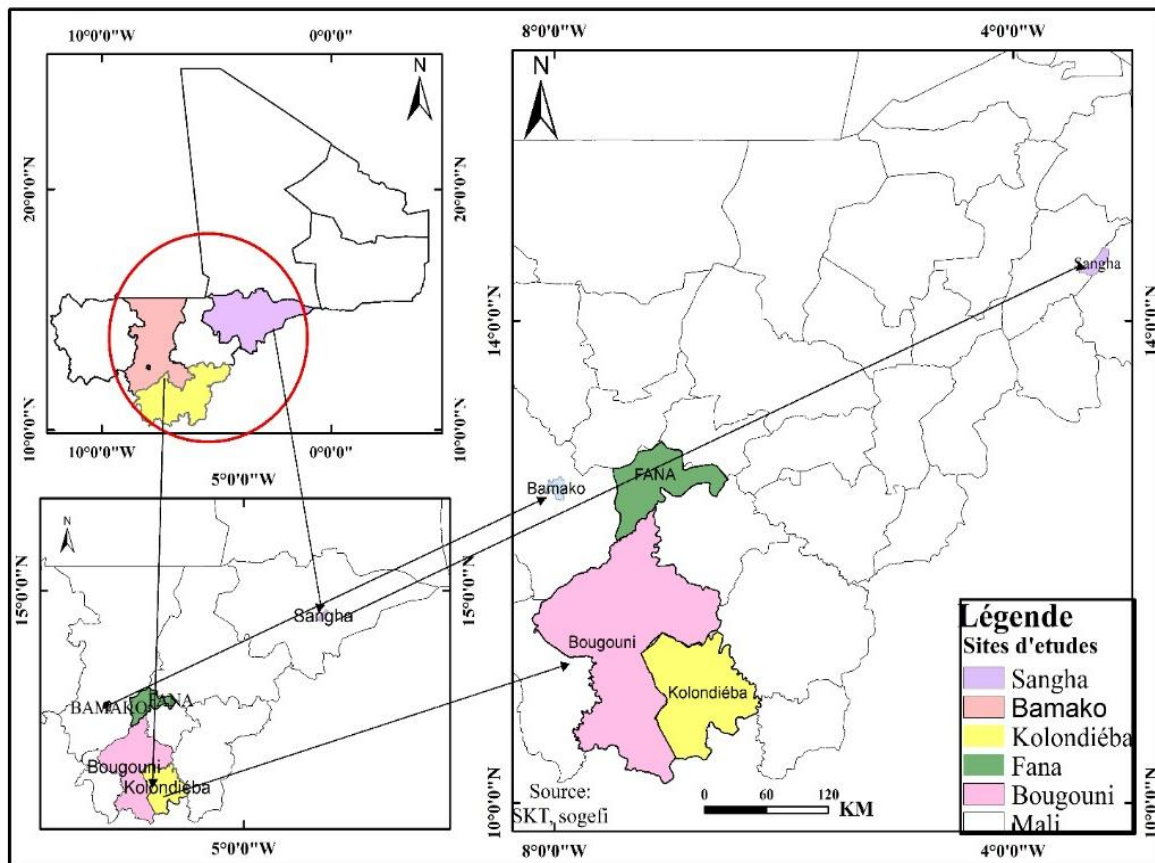


Fig. 2. Sites of ethnobotanical survey

Based on questionnaires, a series of ethnobotanical surveys was conducted from February to March 2020 among the local population of the targeted sites. During the survey, the information on the surveyed people (age, profession, etc.) and their perceptions and medicinal uses about *Datura* species. The respondents were randomly selected based on their availability and their free consent [2] [4]. The dialogue was done in local language (Bamanankan).

2.4 Plant Identification

The identification of the plants was carried out at the Tropical Ecology Laboratory of the Faculty of Sciences and Techniques (FST).

2.5 Data Analysis

The ethnobotanical and floristic data collected were entered and analyzed by Microsoft Office Excel version 2016.

3. RESULTS

3.1 Data from Floristic Study

3.1.1 Species of *Datura*

The investigations carried out in the three localities (Kolondieba, Kebila and Tousseguela) allowed the identification of three species of *Datura* (*D. stramonium* L., *D. ferox* L. and *D. innoxia* Mill.) (Table 1). Of the twenty-six (26) species, *D. stramonium* was the most frequent with 17 individuals (i.e. 65.38%) followed by *D. innoxia* (19.23%) and *D. ferox* (15.38%). While two species of *Datura* were recorded in the Kolondieba and Tousseguela stations, none of the sites contained all the three species of *Datura*.

3.1.2 Species associated to the genus *Datura*

The list of plant species found around these *Datura* species is listed in Table 2. Around these

Datura species, there were a total of 148 plants belonging to 39 species in 32 genera and 18 families. The most common plant species were *Sida carpinifolia* L. and *Amaranthus spinosus* L. with a frequency of 10.81% each. The most represented families were Malvaceae (22.97%) and Amaranthaceae (15.54%) (Fig. 3). Thirty-seven (37) of these 39 recorded species were herbaceous (94.87%) against only two shrubs (5.13%).

The genus and species composition of each botanical family is summarized in the Table 3.

Nine (9) of the 18 botanical families (50%) are common to all sites. The Malvaceae family has the most species (6) and genera (5).

The Table 4 presents the distribution of species according to the major taxonomic groups.

The analysis of Table 4 shows a large and varied number of families, genera and species recorded at the three sites. The greatest number of families (15), genera (24) and species (29) were recorded at the Tousseguela station. In addition, this station had the highest species diversity index ($I_{ds} = 1.21$), but the highest generic diversity was observed at Kolondieba ($I_{dg} = 1.72$). The data in Table 5 confirm this diversity of families, genera and species. With high coefficients of similarity ($C_s = 53.66\% > 50\%$), floristic diversity is identical for all sites taken in pairs and for all the three sites. A total of 11 species are common to all the investigated sites. There is more similarity between the sites of Kolondieba and Kebila (72.73%) and Tousseguela (71.11%) (Table 5).

3.2 Data from Ethnobotanical Survey

3.2.1 Socio-demographic characteristics of respondents

The Table 6 illustrates the socio-demographic profile of the populations surveyed in the three localities.

Table 1. *Datura* species recorded by site

Sites	Species of <i>Datura</i>			Total per site
	<i>D. stramonium</i> L.	<i>D. ferox</i> L.	<i>D. innoxia</i> Mill.	
Kolondieba	7	2	0	9
Kebila	10	0	0	10
Tousseguela	0	2	5	7
Total per species	17	4	5	26

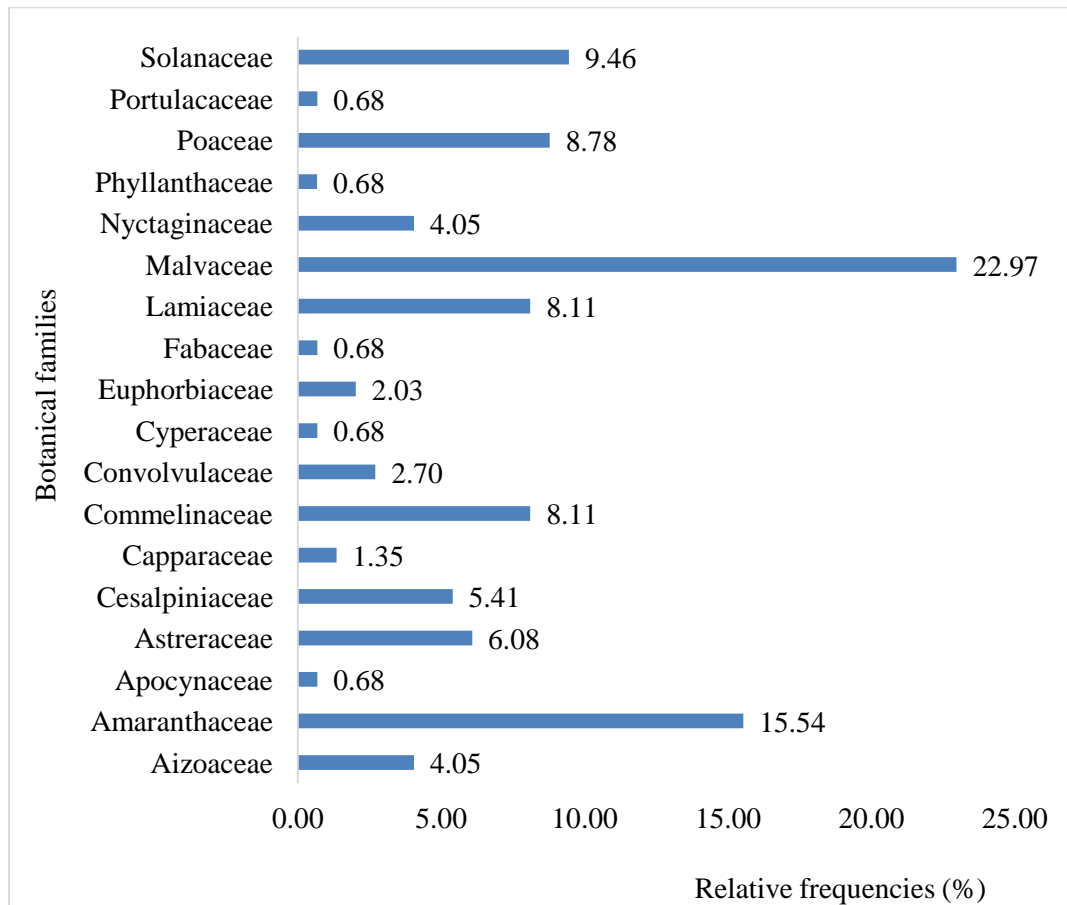


Fig. 3. Major botanical families associated with datura spp

Table 2. Directory of plant species found in the vicinity of Datura species

Families	Scientific names	Sites			Number	Frequencies (%)
		Kol	Keb	Tou		
Aizoaceae	<i>Trianthema portulacatrum</i>	1	2	3	6	4.05
Amaranthaceae	<i>Amaranthus spinosus</i>	3	8	5	16	10.81
	<i>Celosia trigyna</i>	1	0	3	4	2.70
	<i>Gonphrena globosa</i>	3	0	0	3	2.03
	<i>Leptadenia hastata</i>	0	0	1	1	0.68
Asteraceae	<i>Acanthospermum hispidum</i>	0	2	0	2	1.35
	<i>Ageratum conyzoides</i>	3	2	2	7	4.73
Caesalpiniaceae	<i>Cassia occidentalis</i>	5	0	0	5	3.38
	<i>Cassia tora</i>	1	1	1	3	2.03
Capparaceae	<i>Cleome viscosa</i>	0	0	2	2	1.35
Commelinaceae	<i>Commelina benghalensis</i>	4	4	4	12	8.11
Convolvulaceae	<i>Ipomea batatas</i>	0	0	1	1	0.68
	<i>Ipomea sp</i>	0	0	1	1	0.68
	<i>Ipomea triloba</i>	1	0	1	2	1.35
Cyperaceae	<i>Cyperus sp</i>	0	1	0	1	0.68
Euphorbiaceae	<i>Acalypha ciliata</i>	1	0	1	2	1.35
	<i>Ricinus communis</i>	0	0	1	2	0.68
Fabaceae	<i>Indigofera hirsuta</i>	0	1	0	1	0.68

Families	Scientific names	Sites			Number	Frequencies (%)
		Kol	Keb	Tou		
Lamiaceae	<i>Hyptis spicigera</i>	0	0	1	1	0.68
	<i>Hyptis suaveolens</i>	2	2	2	6	4.05
	<i>Leucas martinicensis</i>	1	1	0	2	1.35
	<i>Occinum sp</i>	1	1	1	3	2.03
Malvaceae	<i>Corchorus tridens</i>	1	0	1	2	1.35
	<i>Hibiscus esculentus</i>	0	0	2	2	1.35
	<i>Sida carpinifolia</i>	5	5	6	16	10.81
	<i>Sida rhombifolia</i>	2	0	0	2	1.35
	<i>Sida urens</i>	0	0	1	1	0.68
	<i>Triumfetta pentandra</i>	2	1	3	6	4.05
	<i>Urena lobata</i>	1	0	1	2	1.35
Nyctaginaceae	<i>Boerhavia erecta</i>	0	2	4	6	4.05
Phyllanthaceae	<i>Phyllanthus amarus</i>	0	0	1	1	0.68
Poaceae	<i>Eleusine indica</i>	1	5	2	8	5.41
	<i>Paspalum scrobiculatum</i>	0	1	0	1	0.68
	<i>Pennisatum pedicellatum</i>	0	1	1	2	1.35
	<i>Setaria sp</i>	0	0	1	1	0.68
	<i>Zea mays</i>	0	1	0	1	0.68
Portulacaceae	<i>Portulaca oleracea</i>	0	1	0	1	0.68
Solanaceae	<i>Physalis angulata</i>	1	2	6	9	6.08
	<i>Physalis micrantha</i>	0	2	3	5	3.38
Cumulative number per site		40	46	62	148	100.00

*Kol: Kolondiéba; Keb: Kebila; Tou: Tousséguéla

Table 3. Distribution of species by botanical families and by site

Botanical families	Station of Kolondiéba		Station of Kébila		Station of Tousséguéla	
	Number of genera	Number of species	Number of genera	Number of species	Number of genera	Number of species
Aizoaceae	1	1	1	1	1	1
Amaranthaceae	3	3	1	1	2	2
Apocynaceae	0	0	0	0	1	1
Asteraceae	1	1	2	2	1	1
Caesalpiniaceae	2	2	1	1	1	1
Capparaceae	0	0	0	0	1	1
Commelinaceae	1	1	1	1	1	1
Convolvulaceae	1	1	0	0	2	2
Cyperaceae	0	0	1	1	0	0
Euphorbiaceae	1	1	0	0	1	3
Fabaceae	0	0	1	1	0	0
Lamiaceae	3	3	3	3	2	3
Malvaceae	4	5	2	2	5	6
Nyctaginaceae	0	0	1	1	1	1
Phyllanthaceae	0	0	0	0	1	1
Poaceae	1	1	4	4	3	3
Portulacaceae	0	0	1	1	0	0
Solanaceae	1	1	1	2	1	2
Total	19	20	20	21	24	29

Table 4. Distribution of species following major taxonomic groups at sites

Sites	Taxonomic levels	Numbers	Frequencies (%)	Idg	Ids
Kolondieba	Number of families	11	61.11	1.72	1.05
	Number of genera	19	59.38		
	Number of species	20	51.28		
Kebila	Number of families	13	72.22	1.54	1.05
	Number of genera	20	62.50		
	Number of species	21	53.85		
Toussequela	Number of families	15	83.33	1.60	1.21
	Number of genera	24	75.00		
	Number of species	29	74.36		

* Idg : Index of genera diversity; Idg : Index of specific diversity; Cs : Coefficient of similarity

Table 5. Coefficient of similarity (%) between the sites

Sites	Kolondiéba	Kebila	Tousseguela	General Cs
Kolondieba	0			53.66%
Kebila	72.73	0		
Tousseguela	71.11	63.64	0	

Table 6. Sociodemographic profiles of respondents

Characteristics	Elements	Number	Percentages
Gender	Female	27	22.88
	Male	91	77.12
Age groups (years)	[18 - 40[44	37.29
	[40 - 60[56	47.46
	[60 and over]	18	15.25
Sites	Bamako	59	50.00
	Bougouni	18	15.25
	Fana	20	16.95
	Sangha	7	5.93
	Kolondiéba	14	11.86
Status of sites	Urban	58	49.15
	Rural	60	5.85
Profession	Teachers	28	25.23
	Traditional practitioners	16	14.41
	Traders	12	10.81
	Farmers	12	10.81
	Housewife	12	10.81
	Students	13	11.71
	Computer scientists	5	4.50
	Drivers	3	2.70
	Shepherd	2	1.80
	Laboratory assistant	8	7.21

A total of 118 people were interviewed in the five localities investigated, with approximately 77% men and 23% women. 47.46% of these respondents were between 40 and 60 years old. Various socio-professional categories were interviewed, teachers (25.23%), traditional practitioners (14.41%), farmers (10.81%) and students (7.21%).

3.2.2 Perceptions on Datura

The Fig. 4 presents the respondents' perceptions about Datura.

This figure shows that while Datura is useful for some people (50%), it is considered harmful by others (20%) or is considered useful but to be taken with distrust (30%).

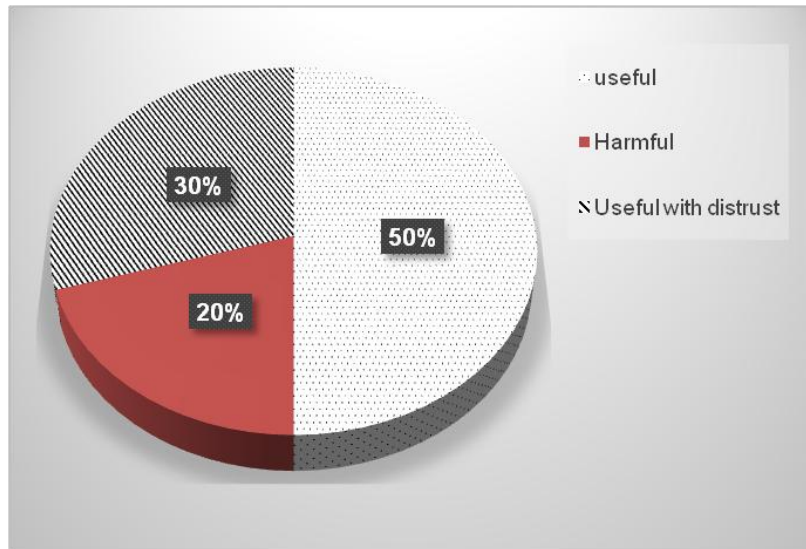


Fig. 4. Perceptions of people about Datura

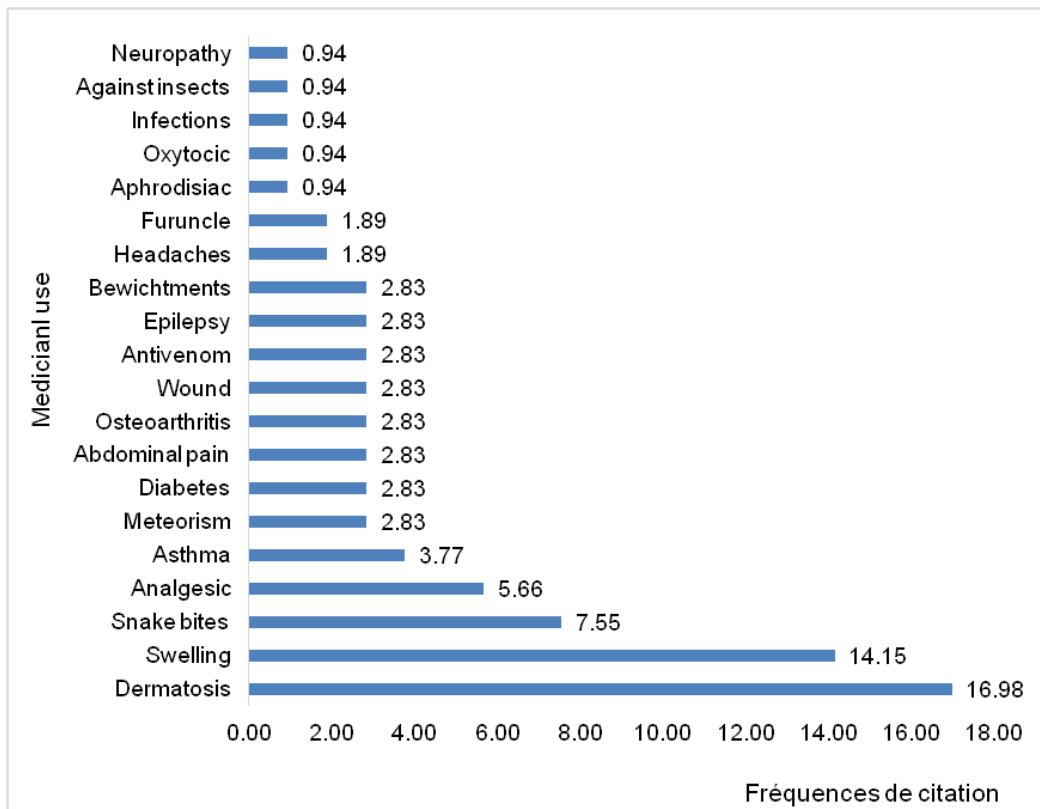


Fig. 5. Medicinal uses of Datura species

The Fig. 5 summarizes the medicinal use of Datura plants.

This Fig. 5 shows that the local populations surveyed use Datura species to treat many ailments including dermatosis (16.98%), swelling (14.15%), snake bites (7.55%).

The Fig. 6 shows the frequencies of use of organs or parts of Datura for therapeutic purposes. The main ways of use and preparation of these organs or parts are respectively illustrated by the Figs. 7 & 8.

According to the Fig. 6, all parts of *Datura* species are exploited for therapeutic purposes. Leaves and seeds were the most used organs by 93.83% and 14.81% of respondents respectively. The data of Fig. 7 show that for the treatment of ailments, these organs are used in different forms with oral route as the main mode (60.24%) followed by massage (15.66%) and bath (13.25%). Fig. 8 shows a diversity of preparation modes of the exploited parts. Although the crude powder of the organs is used by 12.94% of the respondents, decoction with 61.18% remains the main mode of preparation.

4. DISCUSSION

4.1. Floristic Data

4.1.1 *Datura* species

Three different species of *Datura* of which the most frequent was *D. stramonium* L. with 65.38% followed by *D. innoxia* Mill. (19.23%) and *D. ferox* L.; (15.38%). This predominance of *D. stramonium* would be related to its mode of reproduction which is mainly by self-pollination (direct pollination) [18]. Previous floristic studies had shown that these three mentioned *Datura* species coexist in mixed populations in various combinations [19]. The same authors reported the predominance of *D. stramonium* since it was the most common variant found as a spring weed in fields, roadsides and dumpsites

The calculated index showed a generic diversity (Idg) ranging from 1.54 to 1.72 and a specific

diversity (Idg) ranging from 1.05 to 1.21. Largely above zero, these indexes show a fairly high diversity at all three sites. This diversity of families, genera and species is confirmed by high coefficients of similarity (Cs = 53.66% > 50%). This floristic diversity is identical for all sites taken two by two (Cs = 63.64 - 72.711%) and for all three sites (Cs = 53.66%), since when Cs > 50%, the floristic diversity is considered identical [20]. A total of 11 species are common to all three sites. But there is more similarity between the sites of Kolondieba and Kebila (72.73%) and Tousseguela (71.11%). This similarity observed between the sites could be linked to their closed climatic and agronomic characteristics [20].

4.1.2 Species associated with the genus *Datura*

The floristic investigation identified 148 plants belonging to 39 species with *Sida carpinifolia* and *Amaranthus spinosus* having the highest relative frequencies (10.81%). Thirty-seven (37) of these 39 species were herbaceous (94.87%) against only two shrubs (5.13%). The most frequent families were the Malvaceae (22.97%) and Poaceae (15.54%) ones. These data show the floristic richness of the studied sites. They confirm the previous results on the floristic composition conducted in the same region of Mali, which identified 89 woody species belonging to 73 genera and 30 botanical families [9]. The Fabaceae family was mentioned as one of the dominant families associated with *Datura* [21].

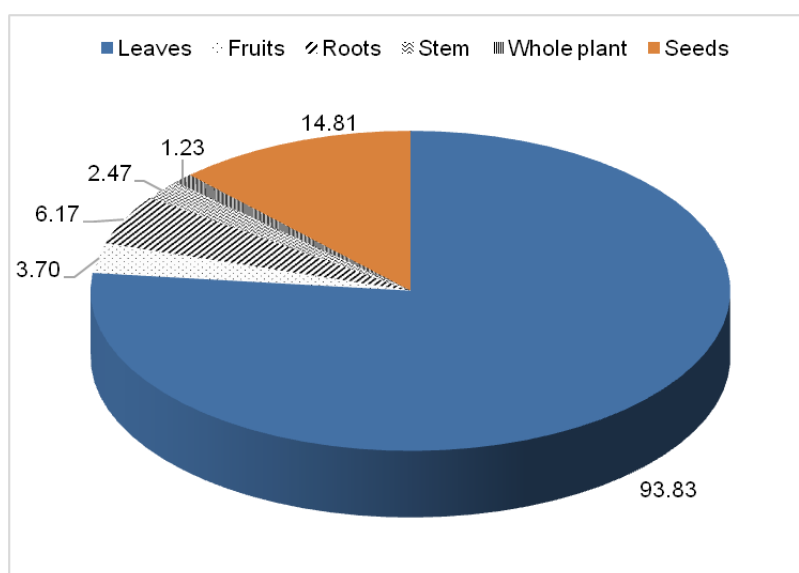


Fig. 6. Organs or parts of *Datura* used for medicinal needs

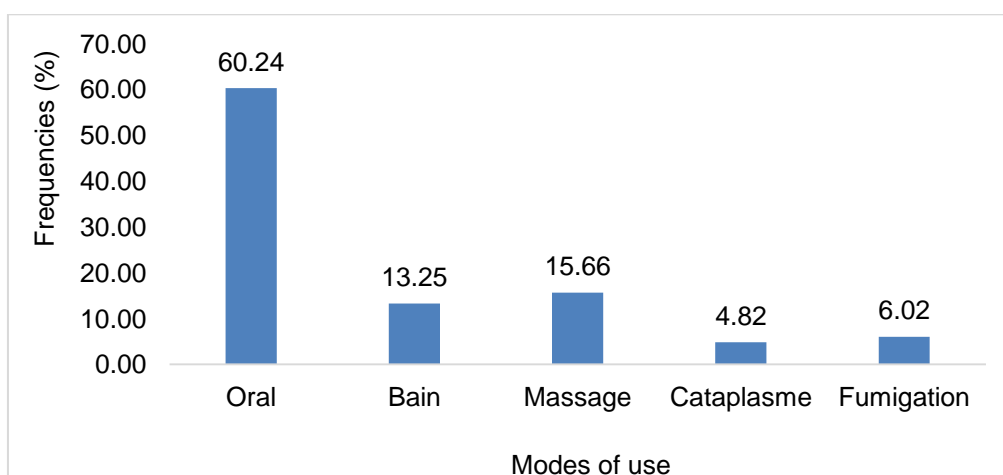


Fig. 7. Modes of use

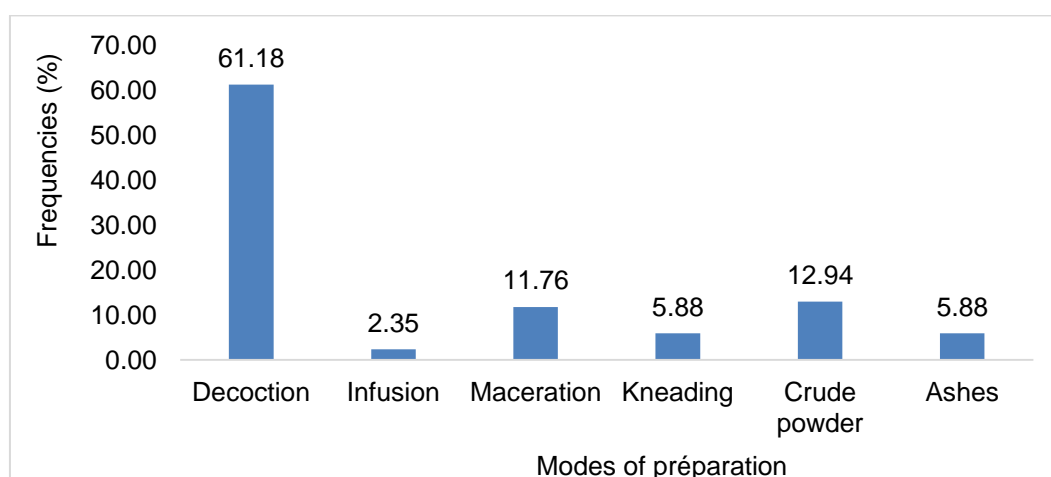


Fig. 8. Preparation modes

4.2 Ethnobotanical Data

4.2.1 Perceptions of *Datura* species

The survey involved 118 people, with a predominance of men (77.12%). Other authors have reported the results similar to ours; 85.7% for men against 14.3% for women [22]. The same authors thought that this male predominance would be linked to the primary place of men in traditional society and therefore the exercise of therapeutic professions, with women being rather absorbed by child education and household tasks. On the opposite, in a previous survey Briguiche & Zidane [1] noted a slight predominance of women with 56%.

The unequal distribution of respondents observed between sites is mainly related to the

refusal rate which is very high in some cases (39.4%) as had mentioned Jazy et al. [22]. As the survey was based on free consent and availability to answer questions, 50% were from Bamako. This high number of people available to answer would be linked to the sacred and mystical nature of traditional knowledge in Africa, which has been cited as a cause of non-availability or refusal to comply by holders of this knowledge [2,22]. Most of our respondents (62.71%) were over 40 years old. The same trends have been reported by many authors [23,22,8,3]. To become a traditional therapist, you must acquire a great deal of knowledge in traditional medicine, which takes many years [22]. The transmission of this knowledge is essentially from father (or mother) to son (or daughter) in 97.22% of cases according to Bio et al. [24].

Our survey confirmed once again the interest given to *Datura* plants in Malian society. 20% of respondents find these species dangerous while others (30%) are suspicious of them despite their usefulness. These different negative connotations are linked to its hallucinogenic effects widely mentioned by 34.91% of our respondents. These connotations confirm the work of some authors who had pointed out the strongly hallucinogenic character of *Datura* [12,25].

4.2.2 Medicinal uses

It appears that *Datura* species are used by local populations to treat many ailments, including dermatitis (16.98%), swelling (14.15%) and snake bites (7.55%). This infatuation with herbal medicine by local populations is most often due to the inexistence or rudimentary state of health infrastructures, the high cost of pharmaceutical preparations, as well as the low incomes of the populations [1]. Many previous works had already reported these therapeutic virtues attributed to these plants. Anti-cancer effects have been proven by Bagewadi, et al. [26] Iqbal et al. [13], anti-inflammatory, antimicrobial and antioxidant ones have also been demonstrated ([26,27,28]. These mentioned pharmacological properties are linked to the richness of *Datura* plants in bioactive compounds such as alkaloids, cardiac glycosides, tannins, phenolic compounds, and triterpenes [11,13]. These compounds are known for their anti-inflammatory and anti-diabetic potentials [29,30]. *Datura* species are renowned to have a long history of use as a beneficial therapy for asthma symptoms due to their richness in atropine, an active antiasthmatic agent [31].

The data show that all parts of *Datura* species are used in traditional medicine by the interviewed populations. The leaves with 93.83% and seeds with 14.81% were the most used organs. These organs are used in various forms, with the oral route (60.24%) in first place, followed by massage (15.66%) and bathing (13.25%). There are prepared mainly in the form of decoction with 61.18%. These data corroborate those of many previous works that mentioned the leaves as the main part used [3,1,4]. A study conducted by Sharma & Sharma [14] revealed that the leaf extracts had the highest antimicrobial potential compared to root, stem and fruit extracts. This increased use of leaves could be explained by the ease of harvesting the aerial parts and the ease of

accessibility [3]. It is also known that the leaves are the site of photosynthesis and storage of secondary metabolites responsible for the pharmacobiological properties of the plant [31]. On the other hand, by listing plants used for the management of erectile dysfunction, Togola et al. [2] have reported a massive use of roots with 50%; similarly Bio et al. [24] had also reported a dominant use of roots with 36%.

The decoction represented the most used method (61.18%) to prepare the organs for treatment. It has been mentioned that this method of preparation would allow the extraction of the most active principles and would mitigate or cancel the toxicity of some recipes. In addition, it allows a good preservation due to the long boiling time that facilitates the destruction of microorganisms [22]. The survey showed that the preparation of *Datura* species is mainly administered internally, by oral ingestion (60.24%), or externally, by massage (15.66%) and by bath (13.25%). These results are in agreement with other studies which reported the oral route as the main mode of use of plants (66.4%) [3].

5. CONCLUSION

Through this study, a floristic composition and medicinal virtues of *Datura* species were carried out. The data let show the floristic richness of species and associated species. Three different species of genus *datura* were found: *D. stramonium*, *D. innoxia* and *D. ferox*. They were associated with numerous species belonging to 39 species led by *Sida carpinifolia* and *Amaranthus spinosus*. Herbaceous was the most frequent morphological type. The calculation of different index of diversity reveals an identical floristic diversity inside the three sites. According to the data obtained from ethnobotanical survey, although *Datura* species has many therapeutic virtues, they are still distrusted by some people. All parts of these species are used by local population for their therapeutic needs. Regarding the mode of use, the oral route and the decoction remain the main ways. Other works are needed to be undertaken in order to evaluate the listed biological activities for a better efficient use.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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