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Ethno-medicinal Use of *Crotalaria retusa* L. (Fabaceae), a Pyrrolizidine Alkaloid Toxic Plant

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Authors' contributions

This work was carried out in collaboration between all authors. The authors AR, VO and IK performed the fieldwork survey. The author AR reviewed the literature and wrote the first draft of the manuscript. The author MC reviewed the literature, helped in preparing first draft of manuscript, checked and corrected the grammar. The author MK corrected and validated the final report. All authors read and approved the final manuscript.

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ABSTRACT

Objective: This current study was designed to investigate the ethno-medicinal uses of *C. retusa* and to learn about the knowledges of its toxicity.
Methods: Questionnaires were administered to herbalists and traditional healers from Ouagadougou town in national language Mooré or Dioula. Data on the ethno-medicinal use of *C. retusa,* the plant part used, the modes of preparation and administration and the knowledges on its toxicity were collected for each interviewed respondents. Relative frequency of citation of each disease was calculated using Microsoft Excel software
Results: *C. retusa* is mentioned by all the respondents to be used in the folklore system of medicine for the treat of various diseases including infectious and psychotropic diseases. Nine (09) diseases treated with *C. retusa* have been cited by respondents. The most diseases cited were congenital syphilis (72.5%) followed by malaria (7.5%) and hallucinations (7.5%). The whole plant is more used

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and the decoction is the main form of preparation. The main modes of the administration of the drug were purgative, drink and bath. The toxicity of *C. retusa* hasn't been stated by no respondents.
Conclusion: *C. retusa* is a potent medicinal plant of the folklore system medicine of Burkina Faso. A general lack of knowledge on the potential toxicity of this plant among the herbalists and traditional healers is also evident. Further investigations are necessary to inform about the toxicity of this plant and preventive measures to undertake for the prevention of any intoxication.

Keywords: Crotalaria retusa; ethno-medicinal; herbalist; pyrrolizidine alkaloid; traditional healers.

1. INTRODUCTION

Burkina Faso is a low income country. A large proportion of its 17 million residents lives in rural communities under an extreme poverty and strongly depends on local plant products for their livelihood. Previous ethno-medicinal investigations demonstrated the importance of traditional medicine in maintaining people's health in Burkina Faso [1]. A large number of medicinal plants were traditionally used for the treatment of numerous diseases including infectious diseases, neuronal disorders, diabetes, inflammation and cardiovascular diseases [2]. However, a general lack of knowledge of the potential toxicity of these plants among the herbalists and traditional healers is a startling situtation that exposes to patients a plausible intoxication.

Crotalaria retusa L. belongs to the Fabaceae family and is found in tropical and subtropical regions of the globe [3]. All plant parts of *C. retusa* are used in folklore medicine in many countries for treatment of numerous diseases. So, the whole plant infusion is used to treat skin infections while the roots are employed against coughing up blood. The leaves and flowers are used to treat fever and lung diseases [4,5]. The powdered seeds are indicated in leprosy, flatulence and act as an analgesic against the pain of scorpion stings and snake venom [6]. Previous studies reported promising pharmacological properties of *Crotalaria retusa* such as antioxidant, anti-proliferative, antibacterial, thrombolytic, anti-inflammatory and antinociceptive activities [7,8,9]. According to these reports, these pharmacological properties of *C. retusa* are due to its richness in variety of secondary metabolites including alkaloids, flavonoids, saponins, steroids and phenolic compounds [7,10].

Crotalaria retusa is a pyrrolizidine toxic plant. Its abundant alkaloid monocrotaline is a hepatotoxic compound which is responsible of many intoxications caused by this plant [4]. In this current study, the ethno-medicinal use of *C. retusa* in the folklore medicine of Burkina Faso and the evident knowledges or not on its toxicity were investigated.

2. MATERIALS AND METHODS

2.1 Study Area

Burkina Faso (Fig. 1) is a savannah country subdivided into 45 provinces regrouped in 13 regions. It is located in the heart of West Africa and enclosed between six (06) countries: north by Mali, east by Niger, south by Benin, Togo, Ghana and south-west by Cote d'Ivoire. It is located inside the loop of the Niger River between 10 and 15 north latitude and between 2 east and 5 30' west longitude. Its total area is 274,200 km² sheltering approximatively 17 million residents subdivided mainly into seven (07) main ethnic groups including Mossé, Gourmantché, Bwaba, Gourounsi, Lobi, Dagara and Peulh. Three main religions such as Islam, Christianity and animism are practiced. The climate is characterised by a long dry season (from October to May) and an irregular rainy season (from June to September). Average monthly temperatures range between 22°C and 42°C. Burkina Faso is characterised by considerable rainfall variations ranging from an average of 350 mm in the north to over 1000 mm in the south-west The survey was carried out in Ouagadougou, the capital of Burkina Faso (12°21′58″ nord, 1°31′05″ oust). The survey is conducted in Ouagadougou, capital of Burkina Faso. The majority of the population lives in extreme poverty and can't get modern medicines for the diseases cure. The folklore medicine is frequently use as an alternative to treat numerous diseases. The practice of this traditional medicine constitute an important source of income herbalists and traditional healers. Two common languages such as Mooré and Dioula are spoken by the population which have been used in our interview.

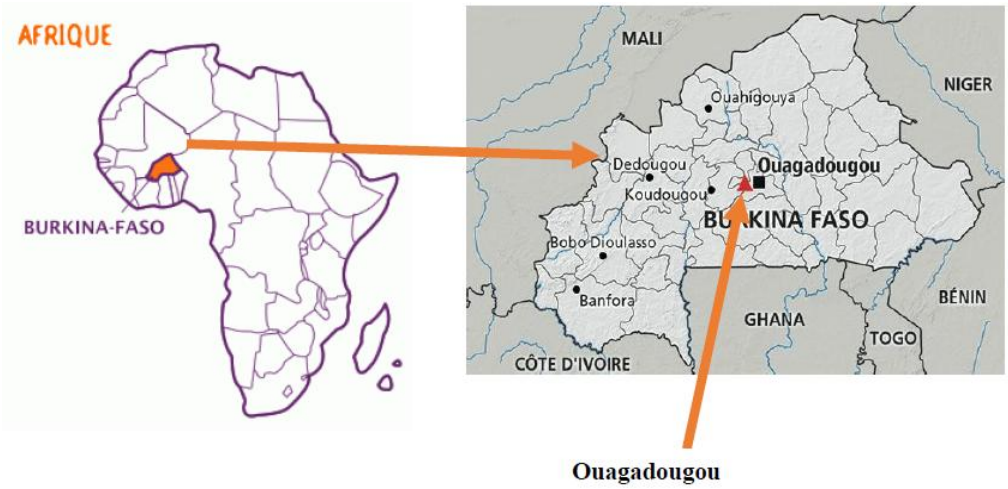

Fig. 1. Maps of survey area

2.2 Data Collection and Analysis

Plant was purchased with the local herbalists and identified by Professor Jeanne Millogo, a botanist of the laboratory of vegetal ecology from university Ouaga 1 Pr. Joseph KI-ZERO (Burkina Faso). A voucher specimen was deposited at department herbarium (IC: 15934). Studies on the ethno-medicinal used and evident knowledges on the toxicity of *C. retusa* were carried out based on questionnaire addressed to 40 herbalists and traditional healers including women and men. Interview had been made individually because each traditional healer doesn't want to divulge her knowledge to the others healers. Data were collected following a structured interview with the respondents. Herbalists and traditional healers which practice the trade for more than 5 years and have a lot of knowledges on the ethno-medicinal uses of the medicinal plant had been chosen. The forty (40) respondents of the survey were aged between 40 and 70 years including herbalists and traditional healers. Women represented 85 % of respondents and 15% of respondents were men. Two main national languages such as Moore and Dioula were used. This interview allowed us to make an inventory of diseases or disorders treated with *Crotalaria retusa*. Furthermore, the plant organs used in the treatment, the mode of remedy preparation, the mode of administration and the posology were also recorded. Relative Frequency of Citation (RFC) of each disease was calculated using Excel software according to the followng equation:

$$REF\ (\%) = \frac{FC}{N} X100$$

FC: number of people having quoted the disease
N: total number of interviewed people

3. RESULTS AND DISCUSSION

.During the survey, nine (09) diseases treated with *C. retusa* have been cited including infectious diseases and psychotropic disorders (Table 1). Congenital syphilis was the most cited disease (72.5%). Other infectious diseases were also cited such as malaria (7.5%) and yellow fever (2.5%). This finding suggested that *C. retusa* contains potent antimicrobial phytomolecules.

In previous pharmacological investigations, *C. retusa* exhibited antimicrobial activities on *Bacillus subtilis*, *Staphylococus aureus*, *Pseudomonas aeruginosa, Aspergillus niger* that could justify its multiple uses in infectious diseases treatment [7]. The use of *C. retusa* to treat infectious diseases such as fever and skin infections has been mentioned in previous ethno-medicinal investigations [11] (Table 2). However, congenital syphilis, the most cited disease in ours study hasn't been mentioned in any previous ethno-medicinal investigation carried out on *C. retusa.* Moreover, psychotropic diseases were cited by some respondents in this study including hallucination, melancholy and madness (Table 1). The magical use of *C. retusa* has been cited in the literature such as highly sought in love matters and acceptance [5]. The multiples pharmacological and medicinal properties of *C. retusa* may be due to its diversified secondary metabolites content

Table 1. Ethno-medicinal uses of *Crotalaria retusa*

Indications	Frequency of citation (%)	Organs used	Preparation mode	Mode of administration	Posology
Prenatal syphilis	72.5	Leaves, stem or whole plant	Decoction or maceration	Bath	Morning and evening until healing
Malaria	7.5	Whole plant	Decoction	Bath , purgative	Every evening until healing
Yellow fever	2.5	Whole plant	Decoction	Bath , purgative	Every evening until healing
Hallucination, madness	7.5	Whole plant	Powder	Burn in the room	Every night
Convulsion	2.5	Whole plant	Decoction	Drink, bath, purgative	Every evening until healing
Constipation	2.5	Whole plant	Decoction	Drink	Morning and evening until healing
Aches	2.5	Whole plant	Decoction	Bath, drink	Every evening until healing
Melancholy	5.0	Whole plant	Powder	Burn in the room	Every night
Otitis	2.5	Leaves	Squeeze to get the sap	Drip the sap in the ear	Once a time

Table 2. Phytochemical constituents, pharmacological proprieties and previous reports on ethno-medicinal uses of *C. retusa*

Part plant	Phytochemical compounds	Pharmacological properties	previous reports on ethno-medicinal uses
Seeds	Alkaloids, saponins, tannins, steroids, flavonoids [12]	Acute poisoning of sheep [14]	Driving away snakes [5]
	Albumin [9]	Anti-inflammatory, antinociceptive [9]	
	Alkaloid monocrotaline [13,16]	Genotoxic and cytotoxic on glial cells [13]	
Leaves	Alkaloids, saponins, tannins, steroids, flavonoids [12]	Anti-DPPH (IC50= 57.5 µg/mL) and bactericidal [8]	Fever and skin diseases [11]
	Saponins, tannins, alkaloids, flavonoids, reduce sugars [10]	Thrombolytic [10]	Highly sought in love matters, acceptance [5]
	Monocrotaline [17]	Leishmanicide action [18]	Uterine hemorrhages, dysentery, and inflamed wounds [17]
	Monocrotaline and tricodesmine alkaloid [15,19]	Neurotoxic [15]	Eye infection Sheila [11]
Roots	Alkaloids Saponins Tannins Cardiac glycosides Steroids Flavonoids [7]	Bactericidal on *B. Subtilis*, *S. aureus, P. aeruginosa*, *A. niger* [7]	Anti-diabetes [20], hemoptysis and colic [11]
Seeds, pods, flower, stem, leaves	Glycoside, saponins, tannins, alkaloids, flavonoids, sterol [21]	Antiproliferative and antioxidant [22]	Scabies, loss of menses, Stomach colic and flatulence [5]

Part plant	Phytochemical compounds	Pharmacological properties	previous reports on ethno-medicinal uses
Shoot		Antifeedant properties on flea beetles *(P. uniformis)* [23]	

including alkaloids, saponins, tannins, steroids, flavonoids [10,12].

Remarkably, a general lack of knowledge on the potential toxicity of *C. retusa* among the herbalists and traditional healers is also evident. However, the genotoxic, neurotoxic and acute poisoning properties of *C. retusa* on human and animal are well documented [13,14]. According to previous pharmacological investigations, the alkaloid monocrotaline, an abundant pyrrolizidine alkaloid from *C. retusa* leaves and seed is responsible of the toxicity of *C. retusa* [13,15]. So, alkaloid monocrotaline is a hepatotoxic alkaloid causing many liver diseases and altering behaviors, such as dullness or hyper excitability, head pressing against physical barriers, compulsive walking or circling and occasionally, violent uncontrollable galloping [13].

Regarding to the mainly modes of administration of *C. retusa* drug which are purgative, drink and bath, it is evident that a plausible intoxication of the population of Burkina Faso by *C. retusa* is a real situation.

4. CONCLUSION

C. retusa is a potent medicinal plant. It is used in the folklore system of medicine from Burkina Faso to treat diverse diseases including infectious diseases and psychotropic disorders. Unfortunately, the toxicity of this specie isn't known by the herbalists and traditional healers of Burkina Faso. Future investigations will be undertaken to inform about the toxicity of *Crotalaria retusa* and the preventive measures to undertaken for the prevention of any intoxication.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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