

Food and therapeutic uses of the leaf vegetable *Bidens pilosa* “Sokontwe” collected in the province of Haut-Katanga, in DR Congo

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Abstract

In this article, data relating to the food and medicinal uses of *Bidens pilosa* “SOKONTWE” collected in two villages, Shinangwa and Magombo, in the mining province of Haut-Katanga, in the Democratic Republic of Congo, are reported.

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1. Introduction

There are vegetables characterized by their nutritional and therapeutic virtues. They are therefore both food and medicine. Such curative vegetables are also called food-medicine vegetables or medicine-food vegetables abbreviated respectively by neologisms as “Nutraceutical” vegetables or “medicinal” vegetables ^[1-3]. This is the case for the leaves of the wild plant *Bidens pilosa*, commonly called “SOKONTWE” in Kiswahili from the Congolese province of Haut-Katanga, the capital of which is the city of Lubumbashi.

This plant grows naturally here in practically all sites inhabited by man, especially in fields and gardens. For the majority of the urban population of our region, “SOKONTWE” has always been an undesirable plant whose dry flower needles attach very easily to clothes. This property also justifies the name “Nsele twende” meaning “Take me” in another language of Greater Katanga, Kiluba. In Kirega and Mashi of South Kivu, *Bidens pilosa* is called Nyasa and Kashisha respectively.

It was during the period of the great famine which had struck the southern part of Katanga in general and the city of Lubumbashi and its surroundings in particular, the period of “Le Vimba”, that the nutritional aspect of the leaves of this wild plant species had been brought to the attention of a wider urban public. And this is how, as part of the project on the “Valorisation of wild vegetables and traditional fermented drinks from the DR Congo” ^[4, 5], initiated within the Chemistry department of the Higher Pedagogical Institute of Lubumbashi, an investigation was carried out in two villages, Shinangwa and Magombo, located between the two largest cities in the Haut-Katanga province, Lubumbashi and Likasi, separated by 120 km from each other.

The results of this investigation corroborated literature data showing that the leaves of the plant species under study were used as a vegetable in several sub-Saharan African countries and that *Bidens pilosa* was also a plant medicinal in many regions of Africa, America and Asia ^[6].

As mentioned above, the objective pursued in the present study is mainly to provide data relating to the food and medicinal uses of the leafy vegetable of *Bidens pilosa* of Congolese origin with a view to enriching the numerous existing knowledge on this

interesting plant species [7]. To achieve this objective, we collected several ethnobotanical data during the survey and carried out qualitative and quantitative chemical analyses.

2. Materials and Methods

2.1 Data collection

A double survey carried out among 121 people, 78 in the village of Shinangwa, located 35 km from the town of Likasi and 10 km from the Lubumbashi road, and 43 in the village Magombo, located 54 km from the town of Likasi and 19 km from the Lubumbashi road, made it possible in particular to record data relating to therapeutic uses and the operating procedure for the preparation of the leafy vegetable *Bidens pilosa*.

Concerning the edible aspect of the leaves of this plant, the preparation of the latter takes place through their blanching or not.

2.2 Physicochemical analyses

The nutritional value of the leafy vegetable of *Bidens pilosa* “SOKONTWE” involved the qualitative analysis of some vitamins. As for the data relating to nutrients, they were extracted from an interesting study in which the authors presented the status of work on *Bidens pilosa* in 2013 [7]. The determination of the concentration of the metals analysed was made using the atomic absorption spectrometer. For the qualitative analyses of natural substances belonging to several different botanical families that can justify the therapeutic properties of *Bidens pilosa*, we used the classic methods usually used for this purpose and characterized either by the formation of precipitates or foam, or by the appearance of specific colorings [8-10].

3. Results and Discussion

3.1 Presentation and analysis of results

3.1.1 Vernacular name “SOKONTWE”

The name “SOKONTWE”, which has been introduced into the Kiswahili language spoken in the Congolese province of Haut-Katanga is the name that the indigenous people of this province belonging to several ethnic groups (Bemba, Kaonde, Lamba, Sanga, etc.) give to the *Bidens pilosa*.

3.1.2. Bromatological, mineral and phytochemical analyses

All the results of the present study are grouped in three tables. The first table relates to food value; the second, for mineral and phytochemical analyses of the leafy vegetable *Bidens pilosa* “SOKONTWE”. As for the third table, it concerns both the names of the pathologies and symptoms which are treated by the organs of SOKONTWE, and the methods of preparation and administration of said organs as remedies in traditional medicine.

The results recorded in the first two tables allow us to draw the following observations:

1. The presence of vitamins A, B, C as well as that of carbohydrates (6-8.4%), proteins (2.8-3.8%), dietary fibers (1.3-3.9% and lipids (0.5-0.6%) in the leaves of *Bidens pilosa* ;
2. The distribution of the metals analyzed into three categories according to their concentrations expressed in mg/Kg:
 - The highest contents oscillating between 1660-2433mg/Kg and 84.4-129mg/Kg correspond to the following five metals: Fe > Ca > K > Mg > Al;
 - The average contents varying between 26.7-40mg/Kg and 2.06-2.1 mg/Kg also correspond to five metals: Na > Mn > Zn > Cu > Co;

The lowest contents relate to four elements and their concentrations are practically zero, that is to say 0.00 and 0.001 mg/Kg: Cd, Cr, Ni, Pb

Table 1: Food value of *Bidens pilosa* “SOKONTWE”

o.	Analyses Carried Out	Raw Plant ⁷	Dry Plant ⁷
01	Ashes (%)	2.2	2
02	Dietary fiber (%)	3.9	1.3
03	Carbohydrates (%)	8.4	6
04	Humidity (%)	85.1	88.6
05	Fat (%)	0.5	0.6
06	Protein (%)	3.8	2.8
Vitamins /Qualitative tests			
07		Bleached FE	Unbleached FE
	A	++	++
	B	++	+++
	C	++	++
	D	-	-
	E	-	-

Legend: Very large presence (+++), Large presence (++) , Presence (+), Absence (-), Leaf (FE).

Table 2: Mineral and phytochemical analyzes of the leafy vegetable of *Bidens pilosa* “SOKONTWE” blanched and unblanched

I	Metals analyzed	Mineral analyses (mg/Kg)	
		Bleached FE	Unbleached FE
01	Aluminum (Al)	84.4	129.1
02	Cadmium (Cd)	0.001	0.001
03	Calcium (Ca)	493	589
04	Chromium (Cr)	0.00	0.00
05	Cobalt (Co)	2.06	2.1
06	Copper (Cu)	2.9	4.0
07	Iron (Fe)	1660	2433
08	Magnesium (Mg)	144.5	217.9
09	Manganese (Mn)	20.6	23.2
10	Nickel (Ni)	0.001	0.001
11	Lead (Pb)	0.001	0.001
12	Potassium (K)	224	320
13	Sodium (Na)	26.7	40.0
14	Zinc (Zn)	7.8	9.2
II.	Phytochemical analyses		
15	Alkaloids	-	-
16	Anthocyanins	-	+
17	Flavonoids: Totals	++	++
	Flavones	++	++
	Flavonols	-	+
	Isoflavones	-	++
18	Cyanogenic glycosides	-	-
19	Leuco anthocyanins	+	++
20	Quinones	-	-
21	Saponins	+	++
22	Steroids	++	++
23	Tannins: Totals	++	++
	Gallic	++	++
	Catechics	+	-
24	Terpenoids	-	-
II.	Phytochemical analyses		
15	Alkaloids	-	-
16	Anthocyanins	-	+
17	Flavonoids: Totals	++	++
	Flavones	++	++
	Flavonols	-	+
	Isoflavones	-	++
18	Cyanogenic glycosides	-	-
19	Leuco anthocyanins	+	++
20	Quinones	-	-
21	Saponins	+	++
22	Steroids	++	++
23	Tannins: Totals	++	++
	Gallic	++	++
	Catechics	+	-
24	Terpenoids	-	-

3. The absence of alkaloids, cyanogenic glycosides, quinones, terpenoids and the presence of tannins, anthocyanins, flavonoids, saponins and steroids.

2.1.3. Medical uses of *Bidens pilosa*

In the second table below are mentioned on one hand several therapeutic uses of *Bidens pilosa* that we collected from 121 people surveyed (78 in the village of Shinangwa and 43 without the village of Magombo) and on the other hand, methods of administering organs traditionally used as medicines.

The table relating to the traditional medical aspect of “SOKONTWE” (*Bidens pilosa*) reveals three observations below:

1 The 121 resource persons surveyed cited 18 pathologies/symptoms that are treated by *Bidens pilosa*, among which anemia, jaundice, typhoid fever, otitis and

hemorrhage presented the highest frequencies. In this leading group, anemia is characterized by the highest frequency (81/121, or 2/3 of the people surveyed);

2. Three organs of *Bidens pilosa* are most used as traditional medicines against the diseases and symptoms listed in table 3: first the leaf (FE), then the whole plant (PE) and finally the root (RA);

3. In most cases, the decoction was the method of preparation of traditional medicines and the administration of the latter was done orally. In the other cases, the organs were either heated or pounded before their application to the part of the body affected by this or that pathology.

3.2. Discussion

3.2.1. Vernacular name “SOKONTWE”

To the four numerous ethnic groups of the population of Haut-Katanga that we have cited (Bemba, Kaonde, Lamba,

Sanga) correspond respectively to the mother tongues Kibemba, Kikaonde, Kilamba and Kisanga whose native speakers are the Babemba, the Bakaonde, the Balamba and the Basanga. Furthermore, when we know that the Democratic Republic of Congo, our country, is made up of a population belonging to more than two hundred ethnic groups, it becomes logical to consider that the indigenous inhabitants of Haut-Katanga mining province come from different tribes ^[11-13].

3.2.2. Food value

The presence of nutrients in the leaves of *Bidens pilosa* "SOKONTWE", that is to say organic and mineral compounds assimilated by our body for its development and maintenance, highlighting the nutritional character of this plant species, is not surprising because they are found in vegetables in different proportions. Indeed, as we know, apart

from the specific roles of carbohydrates, lipids and proteins, these major organic compounds or macronutrients have the energy role in common. While for their part, proteins and lipids also have a plastic role in common ^[14].

As for the water-soluble vitamins B and C on one hand, and fat-soluble vitamins A on the other hand, present in the leafy vegetable of *Bidens pilosa*, they are certainly minor organic molecules or micronutrients in terms of quantity, like the mineral constituents; however this category of food constituents also plays an important nutritional role. And it is all of the food molecules thus presented which confer, as Denis Lorient said, to the food its four qualities, namely: sanitary or nutritional quality (health), sensory or organoleptic quality (flavor), the quality of food safety (security) is the quality of service (service) depending on the chemical composition of the molecules it contains ^[15].

Table 3: Diversity of therapeutic uses of *Bidens pilosa* organs collected in the Shinangwa and Magombo villages of Haut-Katanga

Pathologies and symptoms treated	Organs	Frequencies			Usage	
		Partial	Totals	%	Preparation	Administration
01 Anemia	FE FL FR PE	22 12 21 26	81	66.9	Decoction	Mouth
02 Jaundice	FE PE	25 16	41	33.9	Decoction	Mouth
03 Typhoid fever	PE	39	39	32.2	Decoction	Mouth
04 Otitis	FE	32	32	26.4	Infusion	Ear
05 Hemorrhoid	FR RA	06 25	31	25.6	Powder	Anus
06 Hernia	RA	26	26	21.5	Powder	
07 Hypertension Hypotension	And PE	26	26	21.5	Decoction	Mouth
08 Stomach wash	FE RA PE	05 17 03	25	20.7	Decoction	Mouth
09 Anal fissure	FE RA	07 17	24	20.0		Anus
10 Diabetes	FE PE	09 14	23	19.0	Decoction	Mouth
11 "Kasumbi" digestive candidosis	FE RA	05 17	22	18.2	Poultice	Anus
12 Stomachache	FE RA PE	11 01 09	21	17.4	Decoction	Mouth
13 Malaria (at the child)	FE PE	05 15	20	16.5	Decoction	Mouth
14 Fever	RA PE	04 13	17	14.0	Decoction	Mouth
15 Lily of the valley "Lukunga"	FE	16	16	13.2	Poultice	
16 Angina "Kapanshingo"	FE	16	16	13.2	Infusion	Nose
17 Eye pain	FE	13	13	10.7	Infusion	Eye
18 Cough	PE	6	6	5.0	Decoction	Mouth

Legend: FE (leaf); FL (flower); FR (Fruit); PE (whole plant); RA (root)

3.2.3. Mineral analyses

Of all the fourteen metals analyzed in the *Bidens pilosa* leaves submitted to our investigations, iron was characterized by the highest concentration: 2433mg/Kg in the unbleached samples and 1660mg/Kg in those which had undergone bleaching. This allows us to consider that not only the soil of Shinangwa and Magombo on which the plant species studied was collected is essentially iron-bearing, but also that *Bidens pilosa* would have a large iron absorption capacity. The result relating to the iron-bearing nature of the soil concerned by

our study agrees with those of an old study which showed that the soils around the city of Lubumbashi belonged in the vast majority to the group of ferrillitic soils ^[16]. And if the concentration of unbleached samples is higher than that of bleached samples, it is quite simply because during the bleaching operation part of the mineral elements detaches from the sheet and passes into the water.

In fact calcium, magnesium and potassium are present in high concentrations in the leaves of *Bidens pilosa* and this agrees with several data from the literature: these three metals are

major minerals or macroelements, unlike other elements such as Fe, Cu, Co, Mn, Cr and Ni which are rather trace elements in foods [17]. Added to this are the following considerations: potassium is generally the most abundant element in higher plants and in our body it is quantitatively the third mineral element after calcium and phosphorus [18]; magnesium constitutes the central atom in the cationic state (Mg^{2+}) in the chlorophyll molecule which is doubly responsible for the green coloring of plants and the photosynthesis reaction [19]; Calcium, like proteins, lipids and phosphorus, plays a substantial role in the growth and repair of our tissues. The content of calcium, which is mainly a constituent of the skeleton, which we mentioned in the leafy vegetable under study (493 mg/kg in blanched leaves and 589 mg/kg in unblanched leaves) is still lower than that reported in the literature, that is to say, 340 mg/100g in the raw plant and 111 mg/100g in the dry plant. [20].

Regarding cadmium and lead, their very low content recorded in the leaves of *Bidens pilosa* is very interesting insofar as this value is below the tolerance threshold for these two toxic metals in foods. It is in fact known that the two aforementioned metals are notably and respectively responsible for lead poisoning and Itai-Itai [21].

3.2.4. Therapeutic uses

When we examine the high number of pathologies and symptoms that are treated in traditional medicine by *Bidens pilosa* in the villages of Shinangwa and Magombo, where the survey was carried out, we realize that this plant species constitutes a versatile medicine. In fact, we have listed eighteen of which anemia, followed by jaundice, typhoid fever, otitis and hemorrhage, was the pathology corresponding to the highest frequency. If the treatment of anemia is, in view of our results, the main therapeutic use in the two villages surveyed, this seems to indicate that several people have already experienced the effectiveness of "SOKONTWE" with regard to this pathology. It is then logical to think that the anti-anemic activity of the leaves of *Bidens pilosa* is attributable to the abundant presence of iron in this vegetable given that this metal is, as we know, the fundamental element of red blood cells.

The medical versatility of the leaves of *Bidens pilosa* thus highlighted is moreover one of the essential characteristics of phytotherapy in traditional medicine which is justified by the fact that the drugs are administered here in form of complex mixtures containing several active ingredients belonging to such or such botanical families of the natural substances having made the object of our qualitative phytochemical analyses (table 1). The presence of flavonoids in the leaves of *Bidens pilosa* is in agreement with literature data according to which this plant constitutes an extraordinary source of natural substances, in particular flavonoids and polyynes [7]. By comparing our results with those reported in the literature by other researchers on the same plant species, several similarities and complementarities emerge in terms of pathologies treated and drug administration. This is particularly the case for the treatment of jaundice in Ivory Coast, stomach ulcers and hernia pain in Zimbabwe, ear infections in Uganda, and malaria in southern Africa. Among the other medical uses to which the resource persons surveyed did not allude, we can cite among others, the use of the juice of crushed leaves to accelerate the coagulation of fresh wounds, the decoction of the leaves to treat headaches,

the concoction from the whole plant used as an antidote to poisons or to facilitate childbirth [6].

Conclusion

In order to promote wild vegetables from the DRC, in this study we have enriched the range of food and medicinal uses of the leafy vegetable *Bidens pilosa* with data collected in the southern Congolese province of Haut-Katanga.

The nutritional aspect of said leaves was highlighted through the presence of organic nutrients (proteins, carbohydrates, lipids, vitamins) and minerals (Ca, Mg, Fe, K, etc.). For its part, the curative aspect, demonstrated via several uses in traditional medicine collected following a survey carried out in two villages in this Congolese province, led us subsequently to carry out a phytochemical screening intended to qualitatively identify the existence of botanical families of natural substances capable of justifying the medicinal properties exploited by traditional practitioners

As a case study, the plant species *Bidens pilosa*, "SOKONTWE", constitutes a natural invitation addressed to multidisciplinary skills (Agronomists, Biochemists, Biologists, Chemists, Doctors, Pharmacists, Traditicians, etc.) to better understand and exploit in a manner complementary to the multiple opportunities offered by the plant species under study in terms of improving human health, especially in developing countries.

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