

# 1. A Survey of Ackee Fruit Utilization in Ghana

\*Joycelyn Anima Osei,<sup>1</sup> Edward Ken Essuman,<sup>2</sup> Daniel Owusu Kyeremateng,<sup>1</sup> and Jacob Agbenorhevi<sup>1</sup>

<sup>1</sup>Department of Food Science and Technology,  
Kwame Nkrumah University of Science and Technology,  
Ghana; <sup>2</sup>Ken Consult

\*Email address: sweetjoy50@gmail.com

**ABSTRACT:** *Blighia sapida* is a woody perennial fruit tree species native to West Africa. The fleshy arils of the ripened fruits are edible while the seeds and capsules of the fruits are used for soap making. Our ethnobotanical survey revealed that although the ackee fruit is overlooked by researchers in Ghana, the fresh ackee aril is traded in some local markets. People have different interests in using ackee and variable knowledge of its uses. Preferred bakery products from suggestions in the survey conducted were cake, chips and rock cake.

**Keywords:** Ackee fruit, Consumer preference, Local names

## INTRODUCTION

Ghana is endowed with ackee fruits which are cheap, underutilized and consumed currently in relatively low amounts. There is increase in public interest in ackee fruit utilization as in other part of the world especially Jamaica where it forms part of the national dish [1] and Nigeria where it serves as a staple food [2] because of its high dietary protein and many disease preventive properties. The ackee fruit is an African native crop introduced to the Caribbean by British slave traders. The ackee tree (*Blighia sapida*) of the family Sapindaceae is indigenous to the tropical forests of West Africa and grows to a height of 10 to 12 m at maturity.

Not surprisingly, there are ackee place-names such as Ackee Walk in Kingston and Ackee Parade in St. Thomas.[3] There are also ackee business-place names: Ackee Tree Hideout and Jerk Pork Center. The capital city of Kingston is named the “Big Ackee”.[4] The economic potential of ackee is largely untapped in West Africa. The ackee industry in Jamaica, which is well developed, generated approximately US\$ 400 million in revenues in 2005 [1]. This indicates the potential for developing an ackee industry in West Africa.

The only economic data available from West Africa come from a survey of one rural township in Benin. An ethnobotanical survey conducted in Benin found that farmers characterize ackee types using criteria that are mostly related to the fruit and its different parts.[5]

The trivial name ackee is derived from the terms “anke” and “akye-fufuo” which are used to describe the fruit in West Africa. In Ghana the name Ankye which refers to ackee comes from the Twi language. The fruit was named by Koenig as *Blighia sapida* in honor of the infamous Captain William Bligh of Mutiny on the Bounty who transported the fruit from Jamaica to the England scientific community at Kew in 1793.[6,7,8,9,3,10]

Consumption of ackee is mainly in Jamaica, Haiti and some parts of West Africa. Unlike Ghana and other parts of West African countries, ackee fruit is freshly sold in the local markets and common on the roadsides of the island of Jamaica. Most Jamaicans eat the fruit cooked, while others consume it raw. Fresh arils, dried arils and soap made from ackee are traded in local and regional markets in Benin providing substantial revenues for farmers, especially women.[11,12]

## A Survey of Ackee Fruit Utilization in Ghana

Despite the abundance of ackee fruit in Ghana, information necessary to elaborate a clear domestication strategy is still very sketchy. However, research to increase the value of this underutilized species and to make it more widely available would broaden the agricultural resource base and increase the livelihood options for rural communities. The aim of this investigation is to address the indigenous knowledge and utilization of ackee fruit in Ghana.

### MATERIALS AND METHODS

#### *Research location*

The study was undertaken at two regions in Ghana namely Ashanti region and Brong Ahafo region.

#### *Sampling and data collection*

Open- and closed-ended questionnaires concerning *Blighia sapida* (ackee fruit) were prepared for the study. A total of 156 respondents were selected from the study area using simple random sampling technique. Each individual was chosen entirely by chance and each member of the respondent has an equal chance of being included in the sample size. Information that was collected includes background data of respondents, local name of the ackee fruit and its meaning in the local language, local uses and processing of ackee products. The different traditional products obtained from ackee trees were recorded.

#### *Statistical Analysis*

Statistical Package for the Social Sciences[13] was used to analyse survey data using descriptive analysis such as frequencies and percentages and presented using tables, bar and pie charts.

### RESULTS AND DISCUSSION

#### Demographic Information and Indigenous Knowledge of Ackee Fruit

A total of 158 respondents were used for data collection: 106 females and 52 males. In general, indigenous knowledge about ackee varied among gender

groups. While women conserve ackee for soap making and food preparation, men keep the trees for shade.[5] People have different interests in using ackee and variable knowledge about ackee fruits. Regardless of gender and level of education, only some respondents consumed ackee fruit. Out of 156 respondents, 12 had no knowledge of ackee fruit (**Table 1**). Of the 12 who had no knowledge of ackee, 8 had only heard of it and the remaining 4 knew nothing at all about ackee.

About 41.8% of the respondents said the ackee fruit is sold in the market. Among the towns where the survey was conducted, Techiman recorded the highest number of respondents who perceived that the ackee fruit was sold in the market (**Table 1**). It is sold in a town called Ofuman, near Techiman in the Brong Ahafo Region of Ghana.

**Table 1. Demographic distribution and knowledge of ackee by respondents**

		Frequency	Percentage
Gender	Female	106	67.1
	Male	52	32.9
Location	Techiman	47	29.7
	Pankrono	20	12.7
Town	Wenchi	20	12.7
	Bantama	13	8.2
	Ago go	45	28.5
	Atebubu	13	8.2
Knowledge about ackee	Yes	146	92.4
	No	12	7.6
Sold in Market	Yes	66	41.8
	No	48	30.4
	Don't know	44	27.8
Do you eat ackee	Yes	93	58.9
	No	65	41.1
Total		158	100

#### Local names of ackee

Ackee is derived from the original name 'Ankye' which comes from the Twi language of Ghana. *Blighia sapida* is commonly known in English as ackee, akee or akee apple. *B. sapida* is designated in each town by different local names including kyeraa, achin, akyii, finjeri, ache, achiaa, achena, atee, atina, atiaa,

## A Survey of Ackee Fruit Utilization in Ghana

peena, semina aba, akye fufo and semina dua. Although 31% of the respondents do not know the local name of ackee, majority called it kyeraa representing 29.7% (Table 2).

Respondents mentioned that the name “semina aba” or “semina dua” is derived from the soapy nature of the ackee capsule. All others local names do not have any particular meaning. In Benin, more than 20 local names are known for ackee, each given by different ethnic groups.[14,7,11] On the Ivory Coast of West Africa and Mali, it is called kaka or finzan and finza in the Sudan.

### Reasons for using ackee, forms of consumption and Preservation

Consumption of the ackee is mainly in Jamaica, Haiti and some parts of West Africa. In Jamaica, the fruit serves as a major component of the national dish ackee and codfish.[15]

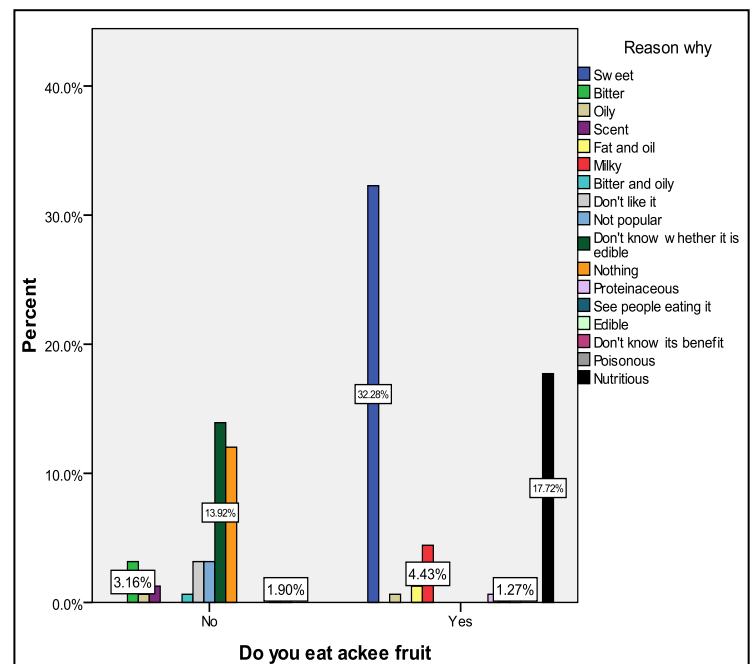
**Table 2. Names commonly used to refer ackee fruit**

Local names	Frequency	Percentage
Kyeraa	47	29.7
Achin	8	5.1
Akyii	4	2.5
Don't know	49	31.0
Finjeri (Banna)	1	0.6
Achee	8	5.1
Achiaa	18	11.4
Achena	10	6.3
Atee	1	0.6
Atina	2	1.3
Atiaa	2	1.3
Peena	1	0.6
Semina aba	3	1.9
Akye fufo	3	1.9
Semina dua	1	0.6
<b>Total</b>	<b>158</b>	<b>100.0</b>

Out of the 158 respondents, only 93 (58.9%) eat ackee fruit (Table 1). At maturity, arils are consumed directly fresh, added to sauce to replace sesame (*Sesamum indicum* L.) seeds or peanuts (*Arachis hypogaea* L.), or dried and presumably grounded into powder and added to sauce mainly to release its oil contents. Most of the respond-

ents use the aril in soup preparation in place of okra while others make it into a paste and eat with kenkey. Consumers eat the aril because of its sweetness (32.3%) followed by its nutritiousness (17.7%) as shown in Figure 1. Ackee is indeed nutritious as it is high in fatty acids and rich in protein, potassium, iron, and vitamin C. [10]

Some respondents also eat ackee because of its fats and oils. It is a major food in Jamaica and is noted for its high protein and fat contents.[16] A large percentage of the ackee (arils) consists of lipids, 51-58% by dry weight. [17] The major fatty acids found are linoleic, palmitic and stearic acids with 55% of this being linoleic acid.[10] Although ackee arils contain linoleic acid (a polyunsaturated omega-6 fatty acid) which is an essential fatty acid (the body does not make it and we have to obtain it from our diet), only 1.3% of the respondents mentioned they eat ackee aril because of its fat and oil. This type of fatty acid is known to be important for membrane development in the eye and brain. However, too much omega-6 has been implicated in prostate cancer.[18] It is therefore advisable to mix ackee with fish (which is rich in omega-3 fatty acids), as in the saltfish and ackee combination.



**Figure 1. Reasons for eating ackee fruit**

## A Survey of Ackee Fruit Utilization in Ghana

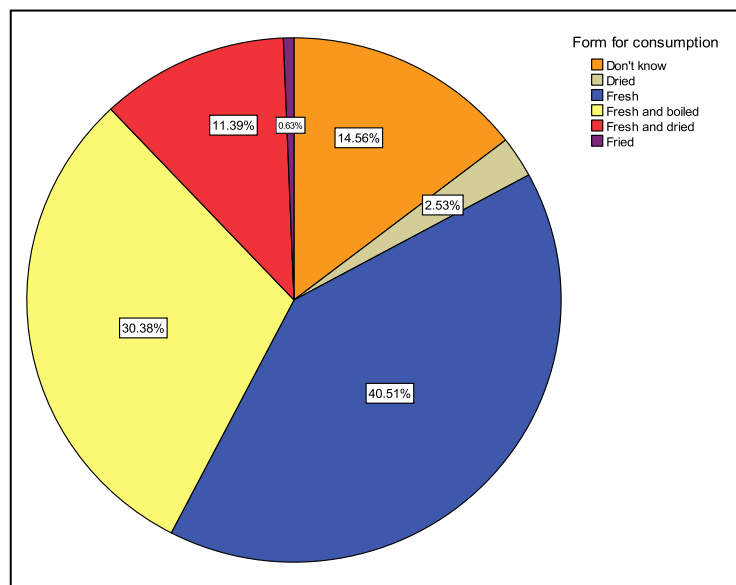
Sixty-five (65) of the respondents representing 41.1% do not eat ackee fruit, the reasoning being that they do not know whether the ackee is edible and the benefit they will derive from eating it. Others say it is not popular and that they have not seen it before or known of it being used as recipe in food preparation, while others say it is poisonous or contains poison. The poisonous nature is the main drawback to its application because of the toxicity which manifests as diarrhea, hypoglycemia, nausea and vomiting commonly known as Jamaican vomiting sickness (JVS) or toxic hypoglycemic syndrome.[18]

Ackee fruits are noted for their poisonous effects when consumed unripe or overripe.[19] Both the skin and seeds of the ackee are also poisonous. The presence of amino acids, hypoglycin A and B, cause the fruit to be toxic. The hypoglycin content diminishes after sunlight reaches the mature arils. The mature ackee fruit splits open naturally when it is ripe, and then is picked and prepared. There is a traditional saying worth remembering - the ackee must 'smile' before being picked off the tree.[20] Several papers and review articles have been published on the toxic nature of ackee and the biochemical activity and pathway of hypoglycin A and B.[21-23,24,25,26,3,27,28,10] On the whole, properly picked and prepared ackee is delicious and considered safe to eat.

Preferences of the respondents to various form of consumption of ackee aril are shown in Figure 2. Among these, fresh aril is mostly consumed representing 40.51%, followed by fresh and boiled (30.38%). The respondents who said they do not know any form of ackee consumption represent 14.56% (Figure 2).

Large numbers of the respondents use ackee aril mainly in preparation of food such as soups. More generally, other recipes of ackee aril such as ackee pudding and rum sauce, braco-style ackee bread, jerk ackee gizzada [29], ackee fritters, ackee stuffed breadfruit [20] have also been docu-

mented. Although the arils of ackee fruit can be parboiled with salt and sometime spices, they are mainly dried for conservation purpose and this is usually the commercialized form at local markets [5]. As shown in Table 3, respondents who preserve ackee by drying formed 35.4 % followed by those who have no idea of preservation methods for ackee (32.9%).



**Figure 2. Forms of ackee fruit consumption**

### *Products derived from ackee*

Apart from the fleshy arils of the ripened ackee fruits being used as a vegetable in food preparation, other utilizations of the aril have been reported in other West African countries. [30,31] The seeds and capsules of the fruits are also used for soap-making and for fishing and all parts of the tree have medicinal properties.[5] Out of the 158 respondents questioned, 91 (57.6%) know about ackee fruit products (Table 4). However, most of the respondents mentioned that they themselves do not use the ackee in making these products but heard of other people who use it. This means that the ackee is not being well utilized in Ghana as compared to other West African countries like Benin where they generated US \$ 10,000 of revenue[5] representing almost 20% of the family income competing with major staples such as maize (20%), sorghum (21%) and common beans and cowpeas (15%).[12]

## A Survey of Ackee Fruit Utilization in Ghana

Table 3. Forms of preservation of ackee aril

Preservation methods	Frequency	Percentage
Drying	56	35.4
In brine/salting	1	0.6
Freezing	3	1.9
Frying	1	0.6
Drying and freezing	44	27.8
Salting and freezing	1	0.6
Don't know	52	32.9
<b>Total</b>	<b>158</b>	<b>100.0</b>

Regardless of variations in proportion of respondents with knowledge of ackee products, respondents showed highest preference for use of ackee fruit for soap making (29.7%) followed by oil (11.4%). The majority of the respondents mentioned more than one product that ackee fruit could be used for. The pods of ackee (capsule or pulp/skin) are mainly used for laundry in times of scarcity. Innovative women trying to cope with the lack of washing soap would remove the pods and rub them on the clothing. According to the respondents, this type of utilization was very popular in the past across the country before the introduction of manufactured soap. This produced suds and left the clothes clean. This cleaning property is due to the high levels of saponins in the pods or capsules which lather in water and are used as a soap substitute and in soap making.[1,5]

#### ***Respondents' preferences on the type of ackee aril product***

Respondents' preferences for types of ackee aril product are shown in Figure 3. The bar chart shows that the highest number of respondents preferred cake and chips (20.3 %) followed by chips (19.0 %) and cake (16.5 %). Almost all of the respondents expressed interest in the development of ackee into pastry products, except for 3.8 % of the respondents who do not know the kind of product to be developed from ackee as

Table 4. Products derived from ackee fruits

Products from ackee	Frequency	Percentage
Oil	18	11.4
Soap	47	29.7
Medicine	1	0.6
Oil and soap	14	8.9
Soap and medicine	2	1.3
Oil, soap and medicine	9	5.7
N/A	67	42.4
<b>Total</b>	<b>158</b>	<b>100.0</b>

shown in Figure 3.

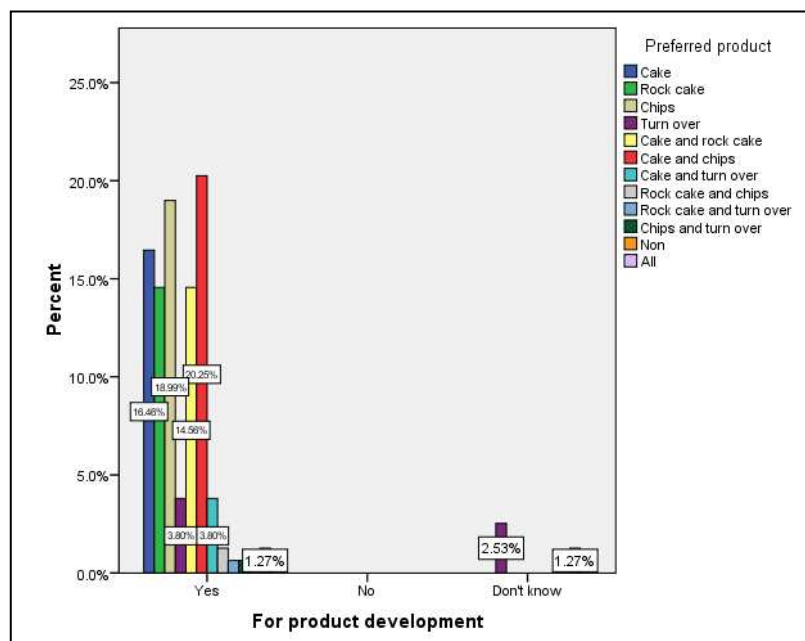
Some respondents mentioned other products not listed in the questionnaire, like ackee flour, canned ackee oil, canned ackee and ackee paste, which are not well known in Ghana but are being produced in other countries. Canned ackee has earned Jamaica US \$ 4.3 million (J\$223.3 million for 1,507,635 kg of ackee) in 1999 and US \$ 8.5 million in 2002 [18]. The economic potential of ackee is largely untapped in West Africa. This indicates the potential for developing an ackee industry in Ghana.

#### **CONCLUSION**

In general, the ethnobotanical survey revealed clearly that unlike other West African countries, indigenous knowledge about ackee (*B. sapida*) is not well developed in Ghana although a majority of the respondents eat the ackee aril. Ackee has been utilized for centuries and is still an important plant genetic resource today. Respondents have different names for the species indicating age-old knowledge and uses. Apart from ackee aril being processed into paste, findings in this study have shown the potential for the production of bakery products such as cake and chips.



## A Survey of Ackee Fruit Utilization in Ghana



**Figure 3. Respondents' choices of the type of product from ackee aril**

## REFERENCES

- [1] Ekué, MRM. *Blighia sapida*, ackee. Conservation and sustainable use of genetic resources of priority food tree species in sub-saharan africa. Bioversity International (Rome, Italy); 2011.
- [2] Oyeleke GO, Oyetade OA, Afolabi F, Adegoke BM. Nutrients, Antinutrients and physiocochemical compositions of *Blighia sapida* pulp and pulp oil (Ackee apple). *IOSR Journal of Applied Chemistry*, 2013; 4(1): 5-8.
- [3] Rashford J. Ackee poisoning and the evolutionary biology of Jamaica's ackee motif; 1997. Proceedings of the Thirtysecond Annual Meeting of the Caribbean Food Crops Society, Zamorana, Honduras, Central America, 7-13 July 1996. St Croix, US Virgin Islands: CFCS. pp. 185-192.
- [4] Ulrich R. Destination Jamaica: the official visitor magazine of the Jamaica hotel and tourist association. Ulrich / communications Corp., Miami, Florida; 1998.
- [5] Ekué, MRM, Sinsin B, Eyog-Matig O, Finkeldey R. Uses, traditional management, perception of variation and preferences in ackee (*Blighia sapida* K.D. Koenig) fruit traits in Benin: implications for domestication and conservation. *Journal of Ethnobiology and ethnomedicine*, 2010; 6:12.
- [6] Lewis CB. Information Bulletin of the Scientific Research Council, 1965; 1: 12-14.
- [7] ICRAF. Agroforestry Database: *Blighia sapida*. World Agroforestry Centre; 2009.
- [8] Lancashire RJ. The Jamaican national fruit; 2004.
- [9] Koenig KD. *Blighia sapida* Ann Bot (Konig and Sims), 1806; 2: 571, t. 16-17.
- [10] Lancashire RJ. Jamaican Ackee; 2006.
- [11] Ekué, MRM, Assogbadjo AE, Mensah GA, Codjia JTC. Overview: Ecological distribution and traditional agroforestry system around the ackee (*Blighia sapida*) in mid Sudanese in northern Benin. *Bulletin of Agricultural Research of Benin*, 2004; 44: 34-44.

## A Survey of Ackee Fruit Utilization in Ghana

- [12] Dossou MKR, Codji JTC, Biaou G. Role of forest resources *Blighia sapida*
- [13] SPSS (Statistical Package for Social Sciences). Application Guide. SPSS Inc.; 2008.
- [14] Morton J. Akee, 1987; pp. 269-271. In: Fruits of warm climates. Julia FM, Miami Fl. (<http://www.hort.purdue.edu/newcrop/morton/akee.html>) downloaded August, 2013.
- [15] McDowell SAC, Walcott JA. A computational study of hypoglycin A, the toxin of the unripe Jamaican ackee fruit. *Molecular Physics: An International Journal at the Interface Between Chemistry and Physics*, 2011; 109(3): 397-405.
- [16] Ashurst PR. Toxic substances of ackee. Review Journal of science resources council, Jamaica, 1971; 2: 4-16.
- [17] Odutuga AA, Asemoto HN, Musac I, Golden KD, Kean EA. Fatty acid composition of arilli from ackee (*Blighia sapida*) fruit. *Jamaican Journal of Science and Technology*, 1992; 3: 30-32.
- [18] Mitchell S, Seymour AW, Ahmad M. Ackee, Jamaica's top fruit. *Jamaican Journal of Science and Technology*, 2008; 31: 84-89.
- [19] Annongu AA, Joseph KJ, Adeyina AO, Wopetu VA. Investigation on some biochemical and histopathological indices in broiler chicks fed detoxified *Blighia sapida* seed meal in diets. *African Journal of General Agriculture*, 2010; 6(4): 295-300.
- [20] Rashford J. Those that do not smile will kill me: the ethnobotany of the ackee in Jamaica. *Economic Botany*, 2001; 55(2): 190-211.
- [21] Golden KD. Hypoglycin: a toxic amino acid of the ackee plant. Caribbean Poison Information Network (CARPIN) First Scientific Conference 2006 June; 3-4,
- [22] Golden KD, Williams JO, Bailey-Shaw Y. High-performance liquid chromatographic analysis of amino acids in ackee fruit with emphasis on the toxic amino acid hypoglycin A. *Journal of Chromatographic Science*, 2002; 40 (8): 441-446.
- [23] Golden KD, Kean EA, Terry SI. Jamaican vomiting sickness: A study of two adult cases. *Clin Chim Acta*, 1984; 142 (3): 293-298.
- [24] Kean EA, Hare ER.  $\gamma$ -Gutamyl transpeptidase of the ackee plant. *Phytochemistry*, 1980; 19(2): 199-203.
- [25] Brown M, Bates RP, McGowan C, Cornell JA. Influence of fruit maturity on the hypoglycin A level in ackee (*Blighia sapida*). *Journal of food safety*, 1992; 12(2): 167-177.
- [26] Singh P, Gardner M, Poddar S, Choo-Kang E, Coard K, Rickards E. Toxic effects of ackee oil (*Blighia sapida* L.) following subacute administration to rats. *West Indian Medical Journal*, 1992; 41(1): 23-26.
- [27] Rashford J.. A critique of Scott's theory of the relationship between ackee seasonality and ackee poisoning. *Tropical Fruits Newsletter*, IICA, Trinidad, Newtown, 1999; 32: 7-10.
- [28] Storozhenko S, Belles-Boix E, Babiychuck E, Herouart D, Davey MW, Slooten L, Montagu MV, Inze D, Kushnir S.  $\gamma$ -Gutamyl transpeptidase in Transgenic Tobacco Plant. Cellular location, Processing and biochemical properties. *Plant Physiol*, 2002; 128: 1109-1119.
- [29] Bowen C. Ackee – More than food. *Gleaner* Nov 24th; 2005. <http://www.jamaicagleaner.com/gleaner/20051124/eye/eye1.html>
- [30] Baumer M. Trees, shrubs and shrubs foster care in West Africa Dakar, Senegal: Enda; 1999.
- [31] Ambe GA. The fruit edible wild of Guinean savannahs of Cote d'Ivoire: state of knowledge by a local population, the Malinke. . *Biotechnology, agronomy, Society and Environment*, 2001; 5:43-58.