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SAPONIN CONTENT OF COWPEA VARIETIES GROWN IN AGBOR, DELTA STATE, NIGERIA

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Abstract
Seven varieties of cowpea (Vigna unguiculata), Ife Brown, IT98K-128-3, IT98K-506-1, IT93K-452-1 and IT95K-1072-57, IT06K-149-1, and IT06K-136 were obtained from the International Institute of Tropical Agriculture, Ibadan (IITA) and evaluated at the Biological Garden of the University of Delta, Agbor, for the levels of saponins present. The results obtained revealed the following contents:- Ife Brown (0.11 mg/100^{-1}), IT98K-128-3 (0.13 mg/100^{-1}), IT98K-506-1 (0.20 mg/100^{-1}), IT93K-452-1 (0.18 mg/100^{-1}) and IT95K-1072-57 (0.15 mg/100^{-1}), IT06K-149-1 (0.23 mg/100^{-1}), and IT06K-136 (0.22 mg/100^{-1}) respectively. Consequently, Ife Brown, IT98K-128-3 and IT95K-1072-57 were recommended for cultivation in commercial quantities by farmers in Delta State due to their lower contents of saponins.

Key word: Saponins, Cowpea, Biological, Agbor

Introduction

Cowpea, (*Vignaunguiculata* [L.] Walp.) is an important pulse found in the tropical as well as subtropical countries covering about 65 countries in Asia and Oceania, the Middle East, Southern Europe, Africa, Southern USA, Central and South America (Singh *et al.,*1997; Rachie and Roberts, 1974; Chinma *et al.,* 2008). Mahalakshmi *et al.,* (2007) reported that cowpea belongs to the family Fabaceae, sub-family Papilionoideae, tribe Phaseoleae and genus, *Vigna.* By 1981, cowpea was traditionally considered as food legume of the poor in Nigeria, but recent survey showed that this perception has changed (Nnanyelugo *et al.,* 1997). Cowpea is now considered to be food for the rich, the informed, the salaried worker and those who can afford it. Cowpea grown in different parts of the tropics vary widely in seed colour and type, and preference changes from region to region (IITA, 1983). In West Africa, the preferred types are white and brown seeds with rough seed coat. In East Africa and parts of Latin America, red and brown seeds with smooth coat are preferred (IITA, 1983).

According to Olorunmaiye (2010), the grain legume is consumed in different processed forms, with many local variations. Most often it is cooked together with vegetables. It may be ground into flour and mixed with sliced onion, spices and made into cakes which are deep fried (akara balls) or steamed (moin-moin) among the Yoruba ethnic group in Nigeria (Kay, 1979, cited by Olorunmaiye, 2010; Fery, 2002). Fresh green immature seeds and pods are sometimes boiled and eaten as vegetable.

Saponins

According to Khokhar, *et al.,* (2003), saponins are glycosides with a distinctive foaming characteristic. They are found in many plants, but derive their name from the soapwort plant *Saponaria caryophyllaceae*, the root of which was historically used as a soap. Other plant sources of saponins include soapnut (horse chestnut), legumes (beans, peanuts and soy) as well as vegetables like potatoes and tomatoes, seeds such as quinoa and the herb ginseng. Commercial saponins are extracted from *Yucca schidigera* and *Quillaja saponaria*.

Podolak, *et al.,* (2010), noted that saponins have a bitter taste. Some saponins are toxic and are known as sapotoxin. The bitter saponins reduce the palatability of livestock feeds. However, if they have a triterpenoid aglycone they may instead have a licorice (a firm black substance with a strong taste used for making sweets) taste as glucuronic acid replaces sugar in triterpenoids. Among the beneficial effects of saponins, yucca and quillaja extracts are used in beverages such as soda to produce a foamy head. Podolak *et al.,* (2010) further observed that they are also used industrially in mining and ore separation, in preparation of emulsions for photographic films, and extensively in cosmetics.

Hendricks (2013) futher indicated that saponins have been found to control ammonia and faecal odours of animals such as pigs and poultry. When yucca saponins are added to animal feed it passes through their digestive tract without being absorbed. When it passes out in the faeces, the saponins bind the ammonia and other odour-producing compounds and keep the smells down. It was further reported that while the high quantities of saponins contained in forage plants such as corn, cockle, alfalfa, broomweed and soapwort can be toxic for grazing livestock, other saponin-containing plants can be helpful. Yucca extract has been proven by the Canadian Agricultural Institute to kill giardia, often found in untreated drinking water and coccidiosis protozoa found in livestock. Cud-chewing animals such as cattle and sheep (ruminants) were also reported to often have rumen protozoa which interfere with digestion. Allowing them to graze on yucca plants has proven to be effective in reducing the infestation of rumen protozoa. In addition, Hendricks (2013) and Shi, *et al.,* (2004), highlighted that humans generally do not suffer severe poisoning from saponins. The cholesterin in humans inactivates them so that they only affect the mucus membranes. Clinically, saponins significantly lower cholesterol levels. This is accomplished because saponins bind to cholesterol-carrying bile. Instead of being reabsorbed, saponins bind to the cholesterol and bile acids, enabling them to be excreted.

Problem of the Study

The strategic position of cowpea in the dietary needs of people and livestock in the tropics has attracted the attention of several research workers to the study of this crop (Fery, 1990). Saponins are among the anti-nutrient factors present in legumes. Johnson *et al.,*(1986), noted that the saponins' amphiphilic structure allows them to latch on to cholesterol molecules attached to the surface of intestinal cells, stimulating a reaction that creates pores in the cell surface, producing increased permeability (that is, leaky gut) and allowing substances to enter the bloodstream. This is believed to be one of the deleterious effects of saponins. Hence efforts are being made to utilize existing variability in the compositions of saponins in different accessions of the crop plant to determine cowpea varieties with lower amount of saponins that could be recommended for domestication in Delta State.

Objectives of the Study

The overall aim of the study is to determine the saponins contents of selected cowpea varieties that would adapt to the ecological zone of Agbor, Ika land of Delta State.

Methodology

The research was an evaluation study of seven cowpea varieties for the level of saponins present. The research comprised of two field trials (during the wet seasons of the 2011 cropping seasons, and 2012 cropping season respectively) that were carried out at the Biological Garden of the College of Education Agbor, Delta State. The experiments comprised of seven cowpea varieties of *Vigna unguiculata (L.) Walp.* namely: Ife Brown, IT98K-128-3 , IT98K-506-1, IT93K-452-1 and IT95K-1072-57, IT06K-149-1, and IT06K136that were laid out in a complete randomized block design (CRBD) with seven replications. The dry season plants were watered at the end of the wet season. Harvested seeds were analysed for levels of saponins.

Determination of Saponins

The procedure of Brunner (1984) was used in the determination of saponins. A uniform solution was obtained from 2g of weighed sample added to 100 ml of Isobutyl alcohol (octanol) and left on a UDY shaker for 5 hours. The mixture was later filtered with No.1 Whatman filter paper. The filtrate was transferred and was saturated with magnesium carbonate solution. The mixture was further transferred into 100 ml volume flask and made up to mark with distilled water. Thereafter, the resulting mixture was filtered to obtain a clear colourless solution to be read on a spectrophotometer at 380 nm. 0 to 5 ppm of standard saponins solutions were prepared from 1000 ppm saponins stock standard solution and saturated with magnesium carbonate as above and also filtered. The absorbances of the prepared saponins standard solution (0-5 ppm) were also read at 380 ppm to obtain the gradient of plotted curve.

Results and Discussion

The saponins content was more in IT06K-149-1 (0.23mg/100g^{-1}), IT06K-136 (0.22mg/100g^{-1}) and IT98K-506-1 (0.20mg/100g^{-1}) respectively (Table 1). It was lower in IT93K-452-1 (0.18mg/100g^{-1}) and IT95K-1072-57 (0.15mg/100g^{-1}) and comparatively much lower in IT06K-128-3 (0.13mg/100g^{-1}) and in Ife Brown (0.11mg/100g^{-1}) respectively (Table 11). These results are similar to reports of Okwu and Orji (2007) on Ife Brown, Iron beans and potasco varieties of cowpea. However, higher levels of saponins in rubber seed (*Havea brasiliensis*) (11.8mg/g), and Lablab *purpureus* varieties (4.9mg/g) were recorded by Osagie *et al.,* (1996) and Soetan, (2012) respectively.

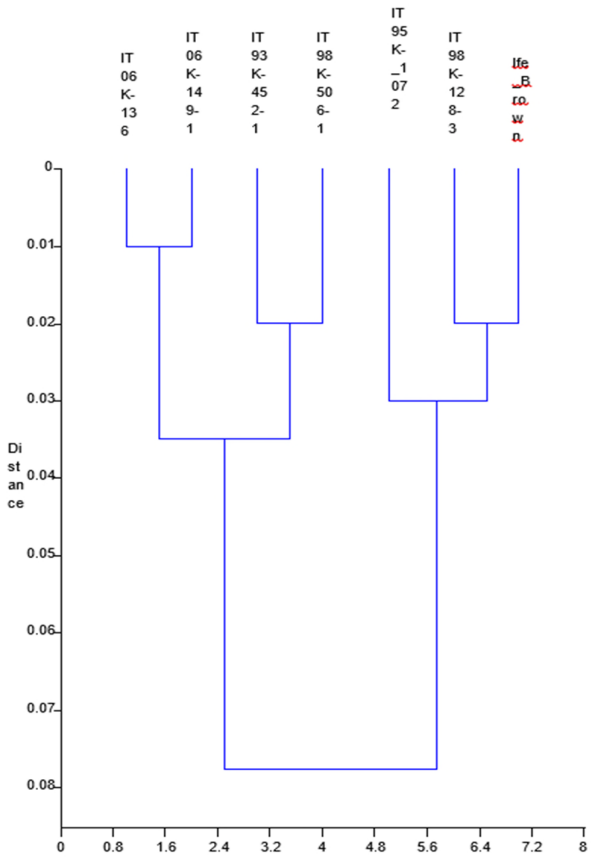
The cluster analysis in Fig.1 categorized the cowpeas into two groups, one comprising of cowpea varieties with low saponins and the other with varieties with high saponin content. Among the low-saponin cowpea varieties, Ife Brown (0.11 mg/100g^{-1}) and IT98K-128-3 (0.13 mg/100g^{-1}) formed a cluster which showed that both varieties had similar content of saponins. Distantly attached to this was an individual cluster formed by IT95K-1072-57 (0.15 mg/100g^{-1}) which did not show similarity with other cluters. Among the high-saponin cowpea varieties, IT06K-136 (0.22 mg/100g^{-1}) and IT06K-149-1 (0.23 mg/100g^{-1}) formed a cluster of cowpea

varieties with the highest value of saponins, followed by the cluster formed between IT06K-136 (0.22 -mg/100g^{-1}) and IT06K-149-1 (0.23 mg/100g^{-1}).

Table 1. Mean saponin compositions of seven cowpea varieties studied

S/no.	Cowpea varieties	Saponins (mg/100g^{-1})
1	Ife Brown	0.11
2	IT93K-452-1	0.18
3	IT98K506-1	0.20
4	IT95K-1072-57	0.15
5	IT06K-128-3	0.13
6	IT06K-136	0.22
7	IT06K-149-1	0.23

Fig.1: Cluster analysis of saponin contents of seven cowpea varieties



Among the features of saponins is the formation of foams in aqueous solution, haemolytic activity and cholesterol binding properties and bitterness (Sodipo, *et al.,* 2000).While there are suggestions that the consumption of saponins should be encouraged because of their hypocholesterolaemic activity, forage saponins were reported by Cheeke, *et al.,* (1978) to cause toxic and anorexic effects in rats and swine, thereby limiting the feeding value of high-saponin animal feeds such as alfalfa. The values of saponins in this study was generally low so the cowpea varieties may not be toxic and anorexic as reported by Cheeke, *et al.,* (1978).

The cluster analysis in Fig.1 categorized the cowpeas into two groups, one comprising of cowpea varieties with low saponins and the other with varieties with high saponin content. Among the low-saponin cowpea varieties, Ife Brown (0.11 mg/100g^{-1}) and IT98K-128-3 (0.13 mg/100g^{-1}) formed a cluster which showed that both varieties had similar content of saponins. Distantly attached to this was an individual cluster formed by IT95K-1072-57 (0.15 mg/100g^{-1}) which did not show similarity with other cluters. Among the high-saponin cowpea varieties, IT06K-136 (0.22 mg/100g^{-1}) and IT06K-149-1 (0.23 mg/100g^{-1}) formed a cluster of cowpea varieties with the highest value of saponins, followed by the cluster formed between IT06K-136 (0.22 -mg/100g^{-1}) and IT06K-149-1 (0.23 mg/100g^{-1}). Thus Ife Brown and IT98K-128-3 with lower values of saponins could be cultivated by farmers in Agbor, Ika land, Delta State.

Conclusion and Recommendations

Conclusion

Saponins are anti nutrient components of legumes, soapnut such as chestnut, as well as vegetables such as potatoes, tomatoes, and seeds such as ginseng. Although saponins have been indicated in increased pores in the cell surface of the gut and reduced palatability of livestock feeds, literature suggests that humans do not suffer severe poisoning from them. Clinically, saponins significantly lower cholesterol levels. Consequently, it is essential that farmers cultivate cowpea varieties whose levels of saponins were minimal. From the two field experiments conducted at different times of the cropping seasons, and from the results reported in this study on the level of saponins, Ife Brown (0.11 mg/100^{-1}), and IT98K-128-3 (0.13 mg/100^{-1}) are recommended for cultivation by farmers in Agbor, Ika land, Delta State.

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