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Studies on the propagation, phytochemical properties, storage, utilization and shelf-life of *Asystasia g angetica*.

Chuku, E.C, Chuku, O.S & Ajuru, M.G.
Rivers State University, Port Harcourt, Nigeria

ABSTRACT Studies on the methods of propagation, phytochemical composition, storage and the utilization of *Asystasia gangetica* were carried out in the Rivers State University, Port Harcourt. It was observed that *A. gangetica* a potent herbaceous plant can be propagated by seeds and stem, the stem being the most effective method. Analysis of the phytochemical composition of the leaves showed that the plant is rich in several food nutrients such as moisture, ash, carbohydrate, fibre and protein and vitamin C. Mineral constituents of the plant include calcium, iron, potassium, sodium and phosphorus. These minerals are major mineral elements required for effective body metabolism. Other phytochemicals include tannins, saponins, oxalates and cynogenic glycosides which also performs numerous functions against microbial agents. Shelf-life study also showed that the plant can be effectively preserved by alternating air drying and sun-drying accompanied by oven drying to ensure proper sterilization of the samples against microorganisms for a period of five days and further crushing the dry leaves into powder and storage in glass bottles. The powdered leaves stored for a Period of six months without nutrient quality reduction an indication of shelf-life stability.

Keywords: Asystasia gangetica, propagation, phytochemicals, storage, utilization, shelf-life

Introduction

Asystasia gangetica popularly known as Chinese violet, creeping foxglove, Ganges prime rose, autumn belle and *Asystasia* is an herbaceous weed that grows along roadsides, rubbish dumps, vacant residential lands, waste lands and in open areas along jungles (Gann *et al,* 2001, Pooley, 1998). It is believed to have been introduced to Malaysia from Africa and Asia over ninety years ago and has become a serious weed in most of the plantations found in Malaysia. This weed is quite unknown in several areas and as such is quite unpopular. It grows prolifically and tolerates shades and produces numerous seeds. Once established, spreads rapidly and aggressively and could become very difficult to eradicate (Rauch, 1997). It has the capability of sprawling on the ground and along fence for support. It is a successful colonizer that has spread across different geographical locations because of its easy establishment, fast growth rate and easy flowering. (Thye, 1977). This plant competes very well with cultivated crops for soil nutrients and if not controlled or checked could lead to crop failure. Under favourable environmental condition it can grow up to 1m tall. The leaves are usually pale green under shades and deep green when exposed to sunlight. The leaves are elliptical and rounded at the base. They are

arranged in equal pairs opposite each other. The blooms are in the form of terminal inflorescence with so many single flowers that are bell-shaped measuring between 20 to 25mm long. The flowers are creamy white with tings of purple blotches in two parallel lines on the keel petals. The seeds are in form of capsules and about 30mm long and club shaped which turn brown and explodes when fully matured (Thye, 1977).

The plant grows very well in humid areas of the tropics especially in Africa where it has become naturalized. It does well in areas with mean annual rainfall between 1200- 2100mm. The plant may not survive without irrigation in areas with a dry season of four months or more. Some of the uses of this potent herb are as follow: Leaves and young shoots are cooked; leaves and flowers are eaten as pot herbs (Grubben *et al*, 2004). The leaves are also consumed as vegetables mixed with beans, groundnuts and other legumes. The plant is also used traditionally as medicine in many parts of the world. The plant sap is used as a vermifuge and is applied externally to swellings and rheumatic joints. The sap is put on nose to stop nose bleeding. A leaf decoction is used in the treatment of fever-aches, epilepsy, stomach pains, heart pains and urethral discharge. The pulped leaf is used as suppository for piles, treatment of asthma (Akah *et al*, 2003), and eases child birth by boiling and mixing it with pepper then given to the pregnant mother through syringe in later pregnancy as enema to ease child birth. The infusion is also taken orally for the same purpose (Idu and Onyibe, 2007). In Congo the leaf sap placed on the stomach of women in child birth to facilitate labour.

Materials and methods

Propagation of A. gangetica

Collection of stem cuttings

Stem cuttings from one year plant were collected from Atali in Obio/ Akpor local government area and transported to the Rivers State University. The stem cuttings measured between 30 cm to 40 cm depending on the location of nodes as each of the stem cuttings had a maximum of three nodes.

Planting of stem cuttings

Stem cuttings of 30- 40 cm in length from the stem tips, middle and hard stems were planted in perforated polyethene bags filled with garden soil. The cuttings in polyethene bags were watered twice daily in the morning and in the evening until the cuttings sprouted. Watering continued until the rains became regularly because the cuttings were planted in November at the onset of dry season (Chuku and Jaja, 2012)

Transplanting of the sprouted cuttings

The sprouted cuttings were transplanted into the field at one month during the four leaf stage. The plants were constantly watered throughout the dry season because of their inability to with stand severe drought as was evidenced during the dry season here in the tropics (Onuegbu, 2002).

Weeding

Weeding was done regularly to prevent unhealthy competition with the cultivated plant. The weeds were removed both by hand pulling and by the use of the West African hoe. However, because of the ability of the plant to trail on the ground surface most of the weeds were smothered (Chuku and Ugorji, 2012).

Fertilizer application

Humus soil from refuse dump was applied at the base of the plant and green manure from decomposing leaf litter was also occasionally added to boost the soil nutrient supply to the plant.

Phytochemical analysis

The plants were allowed to establish fully before the leaves were collected for phytochemical analysis. At the sixth month after planting the leaves were harvested and taken to the Food Science and Technology Laboratory for phytochemical analysis using the AOAC (2006) methods of analysis.

Shelf life preservation of the A. gangetica

To determine the shelf-life of *A. gangetica* fully mature leaves were harvested by cutting off the branches from the plant. The leaves were plucked out of the stem, washed in tap water and place inside a metallic tray and dried. Drying was achieved by alternating air drying and sun drying for about five days in order to achieve the required moisture level (Chuku and Chuku, 2014). The dried leaf samples were oven dried for 2 minutes in order to sterilize the samples against microbial contamination. The dry leaf samples were further taken to the Food Science and Technology Laboratory for the determination of the phyto chemical composition (AOAC, 2006). To further determine the shelf life of the dry leaf samples, the dried leaves were crushed in a sterilized electric blender and the powdered leaf samples were stored in sterilized glass bottles and stored for a period of six months and the phyto chemical composition monitored on monthly basis.

Results

Results from the various parts of stem cuttings in the polyethene bags showed that cuttings collected from the middle of stems sprouted faster than the ones from the base and the tip of the stems. Sprouting of these cuttings were first noticed from the 7^{th} day after planting to the 10^{th} day for the middle cuttings. However, cuttings from the tip of stems failed to sprout while the ones from the base started sprouting after 14 days (Table 1).

Table 1: Sprouting of various stem cutting.

Sprouting days after planting	Cuttings from stem tip	Cuttings from middle of stems	Cuttings from base of stem
1-7	_	++	_
8-14	_	+++	+
15-21	_	+++	++

Proximate composition of the leaves of A. gangetica.

Results of the proximate composition of *A. gangetica* are presented in Table 2. The leaf samples of *A. gangetica* contain high amount of moisture and vitamin C. Other nutrient composition such ash, lipid, carbohydrate, fibre and protein were also present in appreciable quantity.

Table 2: Proximate composition of *A. gangetica*.

Nutrient elements	Values (%)
Moisture	70.9 ± 0.04
Ash	2.5± 0.01
Lipid	2.63±0.01
CHO	5.83±0.06
Fibre	5.7±0.03
Protein	12.5±0.02
Vitamin C	35.7±0.01

Mineral composition of *A. gangetica* is represented in Table 3. The fresh leaf samples of *A. gangetica* contain essential mineral elements needed for healthy growth and development in humans. Such major mineral components include calcium, phosphorus, sodium, iron and potassium.

Table 3: Mineral composition of *A. gangetica*.

Mineral composition	Values (%)
Calcium	0.72 ± 0.13
Phosphorus	0.66 ± 0.11
Sodium	1.77 ± 0.23
Iron	0.23 ± 0.21
Potassium	2.83± 0.01

Anti-nutritional components of *A. gangetica*
Other phytochemicals analysed include the anti-nutritional constituents of *A. gangetica*. The plant is found to contain tannins, saponins, oxalates and cynogenic glycosides (Table 3).

Anti-nutrient components of A. gangetica	Values (%)
Tannins	0.09 ± 0.04
Saponins	1.96 ± 0.01
Oxalates	0.60 ± 0.33
Cynogenic glycosides	0.54 ± 0.11

Shelf life studies of A. gangetica.

Results of the shelf-life studies of *A. gangetica* is presented in Table 4-6.
Dried powdered leaf samples of A. gangetica recorded low moisture value against the fresh sample. The values of ash, lipid carbohydrate, fibre and protein were also higher in dried leaf sample than that of fresh samples.

Table 4: Proximate composition of powdered dried leaf of *A. gangetica*

Nutrient elements	Values (%)
Moisture	22.5 ± 0.02
Ash	4.38± 0.01
Lipid	3.65±0.03
CHO	36.75±0.05
Fibre	12.54±0.03
Protein	20.17±0.02
Vitamin C	30.6±0.01

The mineral composition of dried leaf samples of *A. gangetica* increased more than was recorded for the fresh leaf samples. However, it was observed that potassium concentration in dried leaf samples was very high (25.5 ± 0.01) compared to what was recorded for fresh samples (2.83±0.01). All other mineral components of the dried leaf samples of *A. gangetica* slightly increased.

Table 5: Mineral composition of dried leaf sample of *A. gangetica.*

Mineral composition	**Values (%)**
Calcium	0.95 ± 0.13
Phosphorus	0.67 ± 0.11
Sodium	1.80 ± 0.23
Iron	0.4 ± 0.21
Potassium	25.5± 0.01

Anti-nutrient properties of both the fresh and dried leaf sample of *A. gangetica* did not vary much except for tannins which increased from (0.09±0.04) in fresh leaf samples to (0.88±0.02) in dried leaf.

Table 6: Anti nutrient composition of *A. gangetica*

Anti-nutrient components of *A. gangetica*	**Values (%)**
Tannins	0.88 ± 0.02
Saponins	2.0 ± 0.01
Oxalates	0.60 ± 0.03
Cynogenic glycosides	0.75 ± 0.01

Discussion

Almost every plant that grows around our environment is useful either as a vegetable or a medicinal herb (Onuegbu, 2002). The only constraint we have is our limited knowledge of the uses of plants found in our vicinity. The early man consumed most of the plants and fruits found in the wild for so many decades before the conscious and deliberate effort by man to cultivate these plants. However, literature abounds on the nutritional qualities of most tropical vegetables, fruits and nuts (Achinewu, 1996, et. al., 2012). The proximate composition of *A. gangetica* revealed the presence of

moisture and other essential nutrient elements an indication that it is a potent vegetable that could be consumed to obtain a balanced diet. The high moisture , protein and vitamin c contents of this plants is an indication of the potency of this plant as a diet for weight loss and an antioxidant that could boost the human immune system thereby preventing the accumulation of certain unwanted food materials in the body that can lead to serious health challenge. The results obtained from this study further buttressed the fact that *A. gangetica* could be consumed as a vegetable in a similar way *Vernomia amygdalina* is consumed (Grubben and Denton, 2004). The plant also contains vital mineral elements such as calcium and potassium for strong building of the body frame work (Idu and Onyibe, 2007). Sodium and phosphorus help in balancing electrolytes in the body and regulates the body sugar while Iron is the haemoglobin booster (Idu and Onyibe, 2007).

The consumption of this plant promotes healthy living which may be the reason why the local people cherish it. Apart from the nutrient constituents of this plant, it also contains some anti-nutrient elements such as tannins, saponnins, oxalates and cynogenic glycosides. These anti nutrient elements help to protect the plants from herbivores especially the tannins and saponnins which deter the consumption of these plants by animals. For the shelf life preservation, drying of fruits, vegetables and herbs is a very easy process and can be done without any special equipment or expertise. The essence of drying is to reduce the moisture contents of these materials to their safe level bearing in mind that high relative humidity and moisture encourage the deterioration of most agricultural produce leading to microbial infection (Chuku *et al*; 2004). Shelf life study also revealed that most of the nutrient as shown in the proximate composition became more concentrated and increased in values. The protein content, ash, lipid, carbohydrate and fibre increased an indication of quality stability. The explanation here is that drying the leaf of *A. gangetica* gave rise to increased nutrient quality accompanied by reduction in moisture content. Other phyto-chemicals such the mineral components of *A. gangetica* also increased considerably in dried leaf samples than the records from the fresh leaf samples.

Conclusion

This preliminary study has shown that *A. gangetica* is very rich in essential nutrient components, minerals and anti -nutrient properties. It could be consumed as a vegetable either in the fresh or dried form. However, since most vegetables are prone to microbial deterioration if not consumed within a short period, the leaves of this potent herb could be air dried and alternated with sun drying and ground into powder and preserved in air tight containers and consumed at convenient without quality losses.

Recommendation

It is therefore recommended that A. *gangetica* be included as an important vegetable considering the high nutrient it possesses. The leaves should be dried and consumed as the nutrients are consolidated more in the dried leaf samples.

Correspondence
Chuku, E.C, Chuku, O.S and Ajuru, M.G.
Department of Plant Science and Biotechnology
Rivers State University
Port Harcourt, Nigeria

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