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Production, utilisation and indigenous knowledge of spider plant in Kenya

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Abstract The importance of spider plant has been discussed in the context of biodiversity conservation and food security because the vegetable is rich in micronutrients and phytochemicals associated with antioxidant, anti-malaria, and anti-microbial properties. Spider plant (*Cleome gynandra)* exists as cultivated or semi-cultivated crop with ecological, social and cultural values. It plays a significant role in the nutrition and food security of people in Kenya. A structured questionnaire was administered to ninety randomly sampled respondents distributed in the Western and Nyanza communities of Kenya. Among the traditional leafy vegetables identified, the spider plant was the most preferred vegetable. The study observed that over 98% of the respondents grow spider plant mainly for its nutritional and medicinal value. Sun drying was the main preservation method for spider plant. The spider plant was reported to be grown mainly for home consumption (57%) and income generation (43%). All the respondents indicated that spider plant is grown for subsistence and 70% of the farmers allocated 5-30% of their land for its cultivation. Spider plant cultivation was reported to be rain fed (58%) using organic sources of manure that are available on-farm. The major constraints facing production of spider plant included mainly insect pests (56%) and lack of quality seed (20%). 86% of spider plant was sold at open air markets and < 10% in supermarkets and green grocery stores with 80% of the consumers preferring varieties with purple stems and leaf petioles. The prices of bundles ranging between 300-500 g ranged between US dollar 0.19 and 0.25. The study showed that there is widespread and intense cultivation of spider plant amongst other African leafy vegetables. This is mainly done as home gardening or intercrop systems. The spider plant, therefore, has a huge potential as a source of food, and has nutritional benefits and health promoting properties for the communities growing it.

Key words: African leafy vegetables, *Cleome gynandra*, communities

Introduction

Spider plant (*Cleome gynandra*) belongs to the *Capparaceae* family and is an important vegetable in the rural areas of Kenya. The vegetable is a rich source of nutrients, especially vitamins (A and C) and minerals (calcium and iron), and therefore, plays a significant role in household food security (Van den Heever & Venter 2007). Nutritional studies of spider plant (*Cleome gynandra*) have reported that it is nutritionally superior when compared to exotic vegetables like cabbage because it contains higher levels of â-carotene, vitamin C, protein, iron, calcium and magnesium that are crucial in counteracting deficiency related diseases (Mbugua *et al.,* 2011).

Many Sub-Saharan countries including Kenya are faced with food and nutritional insecurity. The consumption of indigenous vegetables like spider plant has been crucial in many African countries for income generation and in promoting health and food security (Chadha, 2007). The declining production and utilisation of indigenous vegetables may lead to reduced dietary diversity at household levels with associated adverse nutritional consequences (Van den Heever & Venter, 2007). Since 1998, the AVRDC-Regional Center for Africa (RCA) has been working on R&D, training, and information on indigenous vegetables with major emphasis on eco-geographic assessment, collection, evaluation, and identification of promising germplasm (Chadha, 2007). Subsequently, more than 5 tonnes base seed of traditional leafy vegetables have been produced and distributed to the NARES, NGOs, private sector, and over 12,000 farmers in Africa. As a result, spider plant is becoming popular and is also a good source of income to small scale farmers in Kenya.

The research priorities for traditional vegetables such as spider plant have been identified by the farmers to include crop production practices, vegetable preparation and utilisation; postharvest handling especially preservation methods and simple processing, introduction of new species, demonstrations and seed production techniques (Mbugua *et al*., 2011). However, owing to the lack of information on their total yields and sales, the spider plant has been regarded as a minor crop and has been given low priority in most agronomic research and development programs. The objective of this study was, therefore, to determine the status of spider plant production, marketing and indigenous knowledge on utilisation among different communities in Kenya.

Materials and methods

Using a structured pretested questionnaire, a survey was carried out in Nyanza (Migori and Kisii) and Western (Kakamega) regions of Kenya. A total of 90 individuals were interviewed. The survey determined the type of leafy vegetables grown, the traditional vegetables grown, the most preferred traditional vegetable, the proportion

(percentage) of land under spider plant, the type grown, how it is grown, reasons for growing it, the proportion of income from spider plant if any, traditional uses of spider plant, the source of spider plant seed, traditional methods of seed preservation, problems encountered in growing spider plant.

In addition, a survey was carried out in 30 supermarkets (10 in the 'Nakumatt' chain, 10 in the 'Uchumi' chain and 10 in the 'Turskys' chain), 10 independent green grocers' stores and 10 open air market vendors in Nairobi. The survey determined the types of traditional leafy vegetables (TLVs) sold, the manner in which they were sold, their shelf life in the store, the unit cost of spider plant, the distance from suppliers of spider plant, and the problems encountered in marketing the vegetable.

Data analysis. Descriptive statistics were determined using SPSS version 12 (SPSS Inc., 1998). Depending on the type of data, means and/or frequencies were computed.

Results and discussion

Production of traditional vegetables. The types of traditional vegetables grown by the farmers interviewed in Western and Nyanza provinces are shown in Table 1**.** In addition to the traditional vegetables, the farmers also grow cabbage and kale. Spider plant was grown by majority (98%) of the farmers interviewed and was ranked as the most preferred traditional vegetable by 48% of the respondents (Table 1).

The reasons for its preference were that it grows fast and hence gets ready for consumption within a short period of time. According to the respondents, it is highly nutritious, suitable for recuperating patients, it has a pleasant taste and constitutes palatable food for the aged, it is medicinal and adds blood to the body, enhances potency for the men, it is rich in iron, does not require cooking fat, is a healthy food, it brings quick money and is well adapted to the local environment (Table 2).

The two most important reasons for preference of the spider plant was that it is more tasty and nutritious hence a favorite of aged people which resonates with the privileged social position of the aged in the dominant ethnic groups that include the Abagusii, Luo and Luhyia in the study areas. Just like among the Abagusii people where the elderly are revered because they alternately wield curses and blessings (Ontita, 2012), the elderly are equally respected and cared for among the Luo and Luhyia. This partly explains the widespread cultivation of their preferred vegetable, the Spider plant.

Majority (77.8%) of the farmers allocated between 5% - 30 % of their land for the growing of spider plant (Table 3). The production of the spider plant was for both home consumption and sale for 43.3% of the respondents while it was solely for home consumption for 56.7 % of the respondents (Table 3). In many traditional farming methods, indigenous vegetables (IVs) have basically been grown at a subsistence level using or manures that are normally available on-farms, although potential for commercial production exists. Besides, most of these vegetables are grown in mixed cropping systems which have several merits with regard to land productivity, soil fertility, sustainable production and crop diversification (Onyango, 2002).

For those farmers (62%) producing spider plant for sale, it contributed between 15-40% of their total income and more than 50% of the income for 20% of the respondents. As a result, the spider plant is an important income earner for some households. Most of the produce for sale is consumed in Kenya's urban areas and producers incur significant losses due to the perishability of the

Table 1. Traditional vegetables grown by small scale farmers in Kisii, Migori and Kakamega districts (N=90).

Vegetable	% of respondents growing the vegetable	% preference
Basella alba(African spinach)	33.7	1.1
Solanumnigrum (Nightshades)	85.4	31
Vignaunguiculata (Cowpeas)	43.8	4.4
Cleome gynandra (Spider plant)	97.8	47.7
Chorchorusolitorius (Jute mallow)	37.1	10.3
CucurbitaMoschata (Pumpkin leaves)	64.0	4.4
Amaranthusblitum (Vegetable Amaranth)	61.8	3.3
Crotolariabrevidens (Slenderleaf)	33.7	1.1
Cabbage	16.9	-
Brassica carinata (Kales)	37.1	1.1

Table 2. Reasons for *Cleome gynandra's* preference and the percentage of respondents per attribute (N=90).

Attribute	% of respondents
Tasty and nutritious	26.6
Appetizing for recovering patient	11.5
Preferred by aged people	24.8
It's medicinal	11.4
Source of energy	9.2
Rich in iron	1.9
Fast growth rate	6.2
Well adapted to the environment	1.9
Quick returns	5.5
No cooking fat is required	1.0

Table 3. Proportion of land allocated for the growing of spider plant and reasons for growing the vegetable (N=90).

Amount of land allocated and reasons for growing spider plant	No. of farmers (%)
1. Portion of land allocated (%)	
5	6.7
10	27.8
20	21.1
25	11.1
30	11.1
>30	20
2. Reasons for growing	
Home consumption	56.7
Home consumption and for sale	43.3

vegetables and the poor road network (Dijkstra, 2010). Thus; as spider plant production increases, the market institutions and infrastructure should be improved to enable farmers reap maximum benefits from their efforts. Support for the spider plant development can be achieved using the mechanisms that were applied for the smallholder tea production, processing and marketing through Kenya Tea Development Authority (Leonard 1991) and this would elevate returns to farmers. Additionally, it would also aid the trading of the product in the European and American markets where the Kenyan Diaspora would relish it on their supermarket shelves.

Different types of spider plant were grown by the farmers and their characteristics are given in Table 4. Majority (57.8) of the farmers grow these types through rain-fed and organic manure (cow, goat, sheep and chicken manure), while 33% of the farmers grow it using rain-fed methods without use of manure. Only 1% of the respondents use irrigation and a mixture of organic and inorganic fertilisers to grow spider plant. Studies have shown that the use of nitrogen fertilisers at 80 kg ha^{-1} increase the plant height, number of shoots, number of marketable leaves and fresh yield of spider plant (Mauyo, 2008). However, indigenous vegetables often fetch higher prices when marketed as organic produce. This means that there is need for research and extension institutions to give farmers the best combination of organic manure that will deliver the highest spider plant productivity to avoid compromising the sensitive urban niche market largely drawn from a growing middle class based in major Kenyan cities.

The main sources of spider plant seed are old stock (farmers own seed) and buying from the local markets. Some of the farmers obtain the seed from their neighbours (Table 5). About 60 % of the respondents indicated that the seed was not always available from the different sources while 40% indicated that they did not have a problem accessing seed.

The majority of farmers use seeds either saved from a previous crop or obtained from open air markets. These sources tend to have problems of purity, especially the mixing of different varieties and have mean germination rates rarely above 50% (Onim & Mwaniki, 2008). Farmers need pure seed to meet the requirement of the market, but such clean quality seed is lacking in the market. This undermines the quality of vegetables produced by farmers. Effective seed supply system and an assured market for seed is critical in successfully unleashing the potential of IVs such as spider plant to improve food security and livelihoods especially for the most vulnerable populations. For example, when women have an income, they gain more power in household decision making and are likely to devote income to household needs and education investments (FAO, 2001).

Problems encountered when growing spider plant. The farmers identified several problems that they encounter growing spider plant (Table 6). These included insect pests, poor germination, early flowering and lack of seed. The farmers indicated that if the seed is not properly dried, it suffers attack from pests and if stored in polythene bags, they do not germinate. The respondents did not have broad knowledge on seed selection and relevant soil management practices to produce maximum yields. This implies that there is urgent need for agronomic research on spider plant and dissemination of best practices to enhance production. This approach has high potential for success because the spider plant farmers are already hard working, motivated and self-confident; attributes necessary for effectiveness in extension work (Bunch, 1982).

Indigenous knowledge on utilisation of spider plant and postharvest handling of seed

Traditional use of spider plant. The different uses of spider plant and the percent of respondents reporting each purpose are shown in Table 7. Traditionally, the spider plant was used for several purposes. It was used as medicine for recuperating patients, vegetable for expectant mothers to help them deliver easily and to stimulate milk let-down and production, to promote male potency and to provide energy. It was also used to treat eyes and stomachache, it was an important dish for special occasions and it was believed to add blood to the body and was used for people's good health.

Africans have for centuries relied on indigenous vegetables not only for food security, but also for medicinal, social, cultural and income generating purposes. This study found out that spider plant production and

Table 5. Sources of spider plant seed in Nyanza and Western Provinces (N=90).

Source	% of growers obtaining seed from the source
Old stock	28.9
Local market	25.6
Old stock and neighbours	6.7
Neighbours	3.3
Old stock and local market	7.8
Previous season's crop	22.2

Table 4. Characteristics of spider plant types grown by farmers in Nyanza and Western Provinces (N=90).

Type	Characteristics of spider plant grown	Proportion of growers	Reason for preference
1	Purple stems and leaf petioles, and hairy	90	Seed easily available- Tasty-Preferred by most consumers-It is medicinal
2	Green stems and leaf petioles, and hairy	40	The only seed available
3	Purple stems, green leaf petioles and hairy	80	Seed easily available
4	Green stems, purple leaf petioles and hairy	85	Seed available- Preferred by consumers

consumption were declining due inter alia to competition from easy to produce exotic vegetables such as kale and cabbages. The general decline in the consumption of TLVs over the years has been attributed to unavailability and disappearing knowledge particularly among the younger generations (http://www.prota.co.ke).The findings of this study especially on the medicinal value of the spider plant concur with those of Musinguzi *et al*. (2000), which who found out that there was a potential relationship of indigenous vegetables to treat diabetes, gout, hyperlipidemia, gastro-intestinal tract infections, protozoan parasites, amongst others in Kenya and Tanzania. Olembo *et al*. (1995) also states that traditional vegetables have medicinal properties for the management of HIV/AIDS, stomach-related ailments and other diseases. Regular consumption of spider plant is also believed to ease childbirth complications, treat scurvy and marasmus, epileptic fits and recurrent malaria (Mauyo, 2008). This is encouraging for intervention geared towards motivating individuals to increase the consumption and utilisation of indigenous leafy vegetables. However, there is need for further investigation to establish the basis of the above-mentioned perceptions. These claims need to be supported by research data to promote the vegetable fully for medicinal purposes.

Post harvest handling of spider plant vegetable and seed. To ensure availability of spider plant vegetable during the dry season, the plenty vegetables available during the rainy seasons were sun-dried and stored in tightly closed gourds or pots (Table 8). This traditional method of storage was common among the Kisii, Luo and Luhya communities. Spider plant is becoming very popular among members of all ethnic groups in Kenya due to the increased promotion of its nutrition and medicinal value. It is, therefore, a common item in major supermarkets and green grocery stores in Kenya. However, its wide-spread consumption is hindered by its short shelf life. The traditional methods of drying and storing in specialised containers are no longer in use. In addition, the current population lacks the knowledge on preparation and consumption of the preserved vegetables. There is an urgent need for postharvest technologies that preserve the vegetable for the producers to access distant markets. A starting point for post-harvest technology development is the traditional sun-drying practice. This should be improved with a view to reducing the drying time and retaining to the extent possible the original natural flavor and taste. Modern packaging to address current market trends and demands is also necessary.

For the vegetable seed, the seeds were harvested at maturity and stored above the fire place or mixed with ash and stored in gourds or pots (Table 8). The majority of farmers produce and process the seed on-farm, which leads to problems of purity. Depending on seed from such sources also means that farmers have limited access to seed of improved varieties that meet consumer preferred attributes (http://www.asareca.org/sites/default/files/). In addition, there has been an increase in demand for spider plant; however, the potential to meet the growing demand for these vegetables is limited by lack of good quality seeds (http://www.asareca.org/sites/default/files/AIVseedenterpriseASARECA). Effective seed supply system and an assured market for seed is critical in unleashing the potential of spider plant production to improve food and nutrition security as well as the generation of income for the target communities. The influence of seed maturity, seed storage and germination pre-treatments on seed germination of Cleome (*Cleome gynandra* L.) has been reported by Boonsong (2009). It was reported that storing mature seed at 15 °C for 5 months showed that seed dormancy was broken after 3 months and that pre-heating at 40 °C for period of 1–5 days was the most effective method in breaking dormancy in Cleome (Boonsong, 2009). A study on the germplasm collection, evaluation and multiplication of spider plant seeds reported that seed treatment by soaking in water for 24 hours and in 95% acetone had a significant effect on the seedling emergence of spiderplant (Abukutsa-Onyango, 2007).

Table 6. Constraints to spider plant production in Nyanza and Western Provinces (N=90).

Problem encountered	% response
Insect pests	55.6
Early flowering	12.2
Poor germination	5.6
Insect pests, wilting and early flowering	4.4
Lack of seed	20.0
Diseases (wilting)	5.6

Table 7. Indigenous knowledge on the utilization of spider plant by local communities in Kenya(N=90).

Utilisation	% of respondents
Medicinal properties for recuperating patients	12.9
Vegetables of expectant and lactating mothers	40.1
Provides energy	2.2
Promotes male power	15.1
Used for people's good health	10
Good source of strength for aged	12.1
Used to treat eye infection and stomachache	5.5
It was an important dish for special occasions	1.1
Used as animal feed	1.0

Table 8. Postharvest handling of spider plant vegetable and seed (N=90).

Postharvest handling	% of respondents
Vegetables (fresh leaves)	
Vegetables were dried and stored in a pot or a gourd	79.1
Seed	
Drying and storing over the fire place	32.2
Drying the seed and storing in a dry place	26.7
Drying and storing in pots or calabashes	31.1
Drying, mixing with ash and storing	6.7

The income potential of spider plant. There is a growing appreciation of spider plant leafy vegetables by urban consumers, partly because of increasing awareness of the nutritive value of these species. This contributes to the growing potential for commercialisation of this vegetable as a source of income. Out of the 30 outlets surveyed, 23% sold spider plant vegetable (Table 9). Most (86%) of this vegetable was sold at open air markets with less than 10% being sold in supermarkets and green grocer stores.

Spider plant constituted between 10-20% of all the traditional vegetables that were sold in all the outlets surveyed. The types of spider plant that were found in the markets were those with purple stems and leaf petioles as well as those with green stems and green petioles. According to the venders, 80% of the consumers preferred those that had purple stems and leaf petioles. The main source of this vegetable was Nyanza and Western provinces (65%), a small percentage (18%) was from the outskirts of Nairobi and the rest (17%) came from the rift valley. The vegetables are transported in buses, pickups or lorries/trucks from their source of production to the markets mainly in gunny bags or polythene bags. Sometimes for those transported using pickups, they are stacked and covered or carried in crates. In addition, use of bicycles and carts to transport the vegetables especially for those growing them close to the market outlets was also reported.

The vegetables are sold in bundles tied with sisal string or banana fiber with each vending unit weighing between 200g and 500g (majority). This quantity is sold at between Ksh. 15and Ksh. 20 (US dollar 0.19 and 0.25 - 1US dollar = 80 Kenya Shillings) but the price goes much higher (almost doubles) with reduced size of the vending unit during the dry seasons when the vegetables are out of season. Most of the vendors do not store the vegetable before retailing starts i.e. they start selling them immediately they are received. For the major supermarkets, all that is not sold within the day they are received are returned to the supplier while for green grocers and open market; they continue selling in the second day after storage either in refrigerator or spread on a cold floor and sprinkled with water in a well-ventilated room. The longest period of storage in all the outlets was found to be at most 2 day from the day of first display since the supply did not meet the demand in most cases.

For those that stored the vegetable after the first day of display, 50% reported to have incurred losses due to wilting (36%), rotting (32%) and loss of consumer appeal due to lesions from harvesting and transportation (28%). The other problems that were encountered during marketing of the vegetables are shown in Table 10. The study found out that the main problem was low supply of the vegetable (26%). In most cases (61%), the sellers do not meet the demand for the vegetable.

Table 9. African leafy vegetables sold by different outlets in Nairobi and the percentage of outlets selling the vegetables(N=40).

Vegetable type	% outlets selling the vegetables
Nightshades	13.5
Amaranth	9.0
Spider plant	23.4
Pumpkin leaves	6.3
Crotalaria	2.7
Basella alba	5.4
Jute mallow	2.7

Indigenous vegetable (IVs) production such as that of spider plant is constrained mainly by the poor management practices, lack of improved varieties, seasonality of production, poor road network, poor post-harvest handling, high quality standards required by the market, lack of proper marketing strategies and lack of credit facilities particularly for small scale farmers, which need to be addressed.

The growing demand for the indigenous vegetables by people especially in the peri-urban and urban areas and availability of niche markets in major cities and towns provide an opportunity for the promotion of production of these vegetables. In addition, the rise of supermarkets since the late 1990s is transforming the food retail sector. Supplying IVs to supermarkets presents both potentially large opportunities and big challenges for small scale producers of spider plant because of tough quality and safety standards. To meet these requirements, small scale producers have to make investments and adopt new practices so that they are not excluded from dynamic urban markets increasingly dominated by supermarkets (http://www.underutilized-species.org/documents).

A possible way to deal with collection, storage and transportation problems is for spider plant producers to get organised into cooperative societies in order to pool resources to manage the value chain more efficiently. Besides being efficient, cooperatives enable producers to leverage their political bargaining (Bates, 1989). This advantage will in this case facilitate government intervention to improve roads and availability of cheap credit for spider plant production off-season in green houses or on irrigated plots.

Conclusion and recommendation

The study revealed that many spider plant genotypes are grown in Kenya with potential to generate income for the small scale farmers that need to be exploited. Marketing challenges like perishability of the vegetables and poor infrastructure should be considered in the promotion of spider plant for food security and income generation for the rural populations. Spider plant farmers' cooperative societies might leverage their bargaining with the state with regard to improvement of the road network and other relevant services to production and marketing. It was also observed that seed quality and development of production and processing technologies should be given priority to raise the status of spider plant in Kenya. In addition, the study revealed that the communities possess a lot of indigenous knowledge on spider plant in terms of seed production and storage, and the different uses of the vegetable in terms of nutrition and health that has not been documented and/or authenticated. These results suggest that agronomic research on spider plant and

dissemination of best practices to producers would deepen their grasp of plant husbandry to help improve productivity and incomes.

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References

Abukutsa-Onyango, M. 2007. Seed production and support systems for African leafy vegetables in three communities in Western Kenya. African Journal of Food Agriculture Nutrition and Development **7(3),** 1684-5374.

Bates. R. H. 1989. Beyond the Miracle of the Market: The Political Economy of Agrarian Development in Kenya, New Edition 2005. Cambridge: Cambridge University Press.

Boonsong, E. 2009. Effects of seed maturity, seed storage and pre-germination treatments on seed germination of cleome (*Cleome gynandra* L.). Scientia Horticulturae **119 (3),** 236-240.

Bunch, R. 1982. Two Ears of Corn: A Guide to People-Centered Agricultural Improvement. Oklahoma: World Neighbours.

Chadha, M. L., Oluoch, M.O. & Silue, D. 2007. Promoting Indigenous Vegetables for Health, Food Security, and Income Generation in Africa. Acta Hort. (ISHS) **762,** 253-262.

Chweya, J.A. 1985. Identification and nutritional importance of indigenous green leaf vegetables in Kenya. Acta Hort. **153,** 99-108.

Chweya, J.A. & Nameus, A.M. 1997. Cat's whiskers. *Cleome gynandra* L. Promoting the conservation and use of underutilized and neglected crops. 11. Institute of Plant Genetics and Crop Plant Research, Gatersleben/International Plant Genetic Resources Institute, Rome, Italy. ISBN 92-9043-303-5.

Dijkstra, T. 2010. 'Does Trust Travel? Horticulture Trade in Kenya'. In: Bryceson, D.F. (Ed.). How Africa Works: Occupational Change, Identity and Morality. Rugby: Practical Action Publishing Ltd.

FAO. 2001. The state of food and agriculture. Women in agriculture: Closing the gender gap for development. Food and Agriculture Organization of the United Nations, Rome, Italy. http://www.fao.org/docrep/013/i2050e/i2050e.pdf. Accessed on October 26, 2012.

Gomez, M. I. 1981. Carotene content of some green leafy vegetables of Kenya and effects of dehydration and storage on carotene retention. J. Plant Foods **3,** 231-244.

Heever, E. van Den & Venter, S. L. 2007. Nutritional and medicinal properties of *Cleome gynandra*. Acta Horticulturae **752,** 127 -130.

Leonard, D.K. 1991. African Successes: Four Public Managers of Kenyan Rural Development. Berkeley: University of California Press.

Mauyo, L.W., Anjichi, V. E., Wambugu, G. W. & Omunyini, M. E. 2008. Effect of nitrogen fertiliser levels on fresh yield of spider plant (*Cleome gynandra*) in Western Kenya. Scientific Research Essay **3(6),** 240-244.

Mbugua, G.W., Gitonga, L., Ndangu, B., Gatambia, E., Manyeki, L. & Karoga, J. 2011. African indigenous vegetables and farmer-preferences in Central Kenya. Acta Horticulturae **911,** 479.

Musinguzi, E., Kikafunda, J. & Kiremire, B.T. 2000. The status and level of utilisation of indigenous food plants in Uganda: A case study of South West Uganda. Department of Food Science and Technology. Makerere University, Kampala Uganda.

Narendhirakannan, R.T., Kandaswamy, M. & Subramanian, S. 2005. Antinflammatory activity of *Cleome Gynandra* L on hematological and cellular constituents in adjuvant-induced arthritis rats. Journal of Medicinal Food **8(1),** 93-99.

Olembo, N.K., Fedha, S.S. & Ngaire, E.S. 1995. Medical and Agricultural Plants of Ikolomani, Kakamega District, Kenya.

Onim, M. & Mwaniki, P. 2008. Cataloguing and evaluation of available community/ farmers based seed enterprises on African indigenous vegetables (AIVs) in four ECA countries. 95pp.

Ontita, E. 2012. Resources and opportunity: The architecture of livelihoods in rural Kenya. Oxford: Regnum Books International.

Onyango, M.O.A. 2002b. Market survey on African indigenous vegetables in western Kenya. In: Proceedings of the 2nd JKUAT/DAAD workshop on sustainable Horticultural production in the Tropics 6th-9th August 2002. pp. 39-46.

SPSS Inc. (1998). SPSS Base 8.0 for Windows User's Guide. SPSS Inc., Chicago, USA.

Van den Heever, E. & Venter, S.L. 2007. Nutritional and Medicinal Properties of *Cleome Gynandra*. Acta Horticulturae (ISHS) **752,** 127-130