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A REVIEW ON : ABELMOSCHUS ESCULENTUS

Nilesh Jain[1]*, Ruchi Jain[1], Vaibhav Jain[1] and Surendra Jain[1]

[1]Sagar Institute of Research and Technology- Pharmacy, SIRT- Campus,
Ayodhya by-pass road, Bhopal, Madhya Pradesh, India.

Abstract

Medicinal plants are the nature's gift to human being to have disease-free healthy life. It plays a vital role to preserve our health. In recent times, the use of herbal products has increased tremendously in the western world as well as developed countries. India is one of the most medico-culturally diverse countries in the world where the medicinal plant sector is part of a time-honored tradition that is respected even today. Medicinal plants are believed to be safer and proved elixir in the treatment of various ailments. Abelmoschus esculentus (Okra) is an important medicinal plant of tropical and subtropical India. Its medicinal usage has been reported in the traditional systems of medicine such as Ayurveda, Siddha and Unani.

Keywords: *Okra, Abelmoschus esculentus, Bhindi*

Introduction

Okra *(Abelmoschus esculentus* (L) Moench) or bhendi also known as ladies finger is an important vegetable crop being native of tropical Africa. Okra Abelmoschus esculentus (L) moench is a tall annual dicotyledonous plant related to cotton and thought to be of African origin. It is still found growing wild along the river Nile in Egypt as well as Ethiopia French colonialist carried okra to the new world soon after 1700. Now it is a widely grown vegetable crop in the tropics and sub tropics and also in the warmer temperate areas [1]. Young pods may be harvested 60-180 days from sowing about 5-10 days after flowering depending on the cultivar grown. Successional harvesting of young pods is generally recommended. The pods are harvested by detaching using a slight twist to break the stalk [2]. The fresh and green tender fruits are used as vegetable. Tender and edible fruit is easily cut by the kitchen knife and set into mucilaginous consistency after cooking [3]. okra mucilage has medicinal applications; when used as a plasma replacement or blood-volume expander. The mucilage of Okra not only binds cholesterol but the bile acid carrying toxins dumped into it by the filtering liver. It also has industrial applications; when added as size to glaze paper and used in confectionary. In Nigeria fresh okra is preferred to dry Okra by the Majority of people and as such consumption is highest in the raining season when production is highest. The site of production of these okra are always very far to the market and where they are been consumed, therefore post-harvest deterioration of fresh okra result in loss of produce due to the poor storage and transport conditions employed by farmers in bringing the produce from the farms in outlying villages to the city markets. In Nigerian Okra are packed and stored in a bag called polypropylene bag when moved from the outlying villages to the city markets which may be up to 520km, and it may get to the city market after 48hours to 72hours due to transportation problem. The aim of this study is to exploit other method that can be use in storing Benin indigenous Okra for utilization and transportation other than polypropylene bag with respect to nutrients, antinutrients and antioxidants [4, 5].

Description

Biological Name:

Hibiscus esculentus, Abelmoschus esculentus.

*For Correspondence :
Nilesh Jain
Sagar Institute of Research and Technology-Pharmacy,
Bypass Road, Bhopal (M.P.) - 462036(India). Tel.: +919425074520
E-mail: nilujain01@Yahoo.co.in

Other Names:

Kacang Bendi, qiu kui, Okra, okura, Okro, Quiabos, Ochro, Quiabo, Okoro, Gumbo, Quimgombo, Bamieh, Bamya, Quingumbo, Bamia, Ladies Fingers, Bendi, Gombo, Bhindi, Kopi Arab

Figure 1: Okra blossom beside a pair of big fuzzy ready-to-harvest pods.

History: Okra was first found in former Abyssinia (present Ethiopia), and was later distributed to the Caribbean, South America, North America, Africa, India, and Eastern Mediterranea. For the present moment, after its long-term glory in southern countries, okra is gaining popularity in the west [6].

Physical Characteristics

Annual growing reaches to 1 meter. It is in flower from July to September. The flowers are hermaphrodite (have both male and female organs) and are pollinated by Bees and insects. The plant prefers light (sandy), medium (loamy) and heavy (clay) soils and requires well-drained soil. The plant prefers acid, neutral and basic (alkaline) soils and can grow in very alkaline soil. It cannot grow in the shade. It requires moist soil.

Habitats

Cultivated Beds;

Cultivation details

Prefers a well-drained humus rich fertile soil in full sun and a pH around 6 to 6.7 but it tolerates a wide range of soil types and pH from 5.5 to 8. It prefers a soil with high potash content. The plant requires a warm sunny position sheltered from winds. It likes plenty of moisture, both in the soil and in the atmosphere. Okra is commonly cultivated in warm temperate and tropical areas for its edible seed pod; there are many named varieties [7, 8]. Most cultivars require about 4 months from sowing before a crop is produced, though some early maturing varieties can produce a crop in 50 days in the tropics. This species is not very hardy in Britain, it sometimes succeeds outdoors in hot summers but is really best grown in a greenhouse since it prefers daytime temperatures of 25°C or more. Plants also dislike low night temperatures. There are some early-maturing varieties that are more tolerant of cooler temperate conditions and these could be tried outdoors. These include 'Clemson's Spineless', 'Emerald Spineless', 'Long Green' and 'Green Velvet'. The flowers are much visited by bees but they may require syringing in order to improve fertilization when plants are grown in a greenhouse. Plants resent being transplanted [9, 10].

Propagation

Seed - sow early spring in a warm greenhouse. The seed germinates in 27 days at 15°C or 6 days at 35°C. When large enough to handle, prick them out into individual pots and plant them out after the last expected frosts [9].

Callus induction

To induce callus, hypocotyl and leaf segments were taken and were cultured in MS medium supplemented with different callus inducing substances and incubated in the light of 25±2°C for 3-6 weeks. MS medium supplemented with different concentrations of 2,4-D (2,4-dichlorophenoxy acetic acid), NAA (Napthalene acetic acid), BAP (Benzyl amino purin), IAA (Indole-3-acetic acid), IBA (Indole-3-butyric acid), and KIN (6-furfural amino purine) were used as sources of carbon (30 gm/l) for massive callus induction. After 21 days of incubation the callus induction frequency was estimated. After callus induction from the explants, the calli were transferred into the fresh medium after every 18-24 days for further proliferation and maintenance. Brown, watery and dead calli were removed during each subculture. Friable, having green roundish callus was considered as putative embryogenic calli. These were selected for plant regeneration [11].

Histological study of callus

Histological studies of organogenic calli were conducted for identifying the nature of shoot formation on sections that obtained with a microtome. Putative organogenic calli were fixed in FAA (5% formalin, 5% acetic acid, 45% alcohol) solution. Dehydration of the fixed materials was accomplished by placing them in a grade series of ethyl alcohol (50%, 60%, 70%, 80%, 90% and 100%) and absolute alcohol with chloroform (2:1 1:1 and 1:2). Then, the dehydrated materials were embedded in paraffin which blocks and sections were prepared serially at 12 ?m thickness using a rotatory microtome. After staining with safranin-orange-G and tannic acid, the sections were mounted on glass slides using Canada balsam. Microphotographs were taken at × 100 magnifications [12].

Plant regeneration

Plantlets were regenerated by transferring the selected calli in MS semisolid medium supplemented with different concentration and combination of growth regulators. The culture was incubated at 25±2^{0}C under white light for 16-8 light dark condition. After 4-6 weeks differentiation, of shoots and roots were observed. The number of calli producing shoots and the total number of shoots were counted for each treatment. The shoot from the selected callus was excised and transferred on MS medium for further growth. The plantlets from each of individual callus were further multiplied by node culture.

Acclimatization

The plantlets having sufficient root and shoot systems were taken out from the culture vessels and were washed under running tap water to remove the agar attached roots. The plantlets were then transferred to small pots containing sterilized ground soil, sand and cow dung manure at the ratio of 1:2:1. After keeping 7-10 days in the growth culture room, the plantlets were moved and adapted to the room temperature for the growth of plantlets. There after, they were transferred to the field condition where eventually developed into mature plants.

Determination of seed moisture

Moisture content of the seed samples was assessed through hot air oven method at low constant temperature. 5 g of powdered samples were separately dried at 103 ± 2^0 C for 17 h. The loss in weight was finally recorded and for each sample based on the average of two replicates the percent seed moisture content was determined.

Evaluation of seeds for mycoflora

400 seeds of each stored samples were separately plated on 3 layers of wet blotters in plastic plates and incubated for a period of one week under alternate cycles of light and darkness. Further each and every seeds were examined under stereomicroscope for the occurrence of mycoflora. The incidence of mycoflora was assessed and the data were tabulated.

Evaluation of seed germination and seedling vigour

Four replicate of 100 seeds each were incubated in wet blotter towels for a period of 21 days in okra seedlings should be considered for germinating test according to ISTA under standard conditions of light, temperature and humidity. On 21st day the incubated towels were unrolled and the root and shoot length of the normal

seedlings were measured. Percentage of seed germination was also recorded. The vigour index of the seedlings was calculated using the formula of Abdul Baki and Anderson [13].

Estimation of carbohydrate, protein, phenol and reducing sugars

Okra samples stored in different bags at different temperatures were drawn at specified period of storage such as 0, 120, 240 and 360 days and were used for the extraction. 1 gram seed of each sample was separately drawn and finely powdered using mini grinder. 10 ml of distilled water was added and ground thoroughly using mortar and pestle. The extract was centrifuged at 2500 rpm and the supernatant was further used for the estimation of total carbohydrates, protein, phenols and reducing sugars. 1 g of each sample was powdered and extracted in 10 ml of distilled water. Carbohydrate estimation was carried out using phenol sulphuric acid method [14]. Aliquots were used for the total sugar content using a calibration curve developed with glucose (0-50 μg) 10-50 μl of the extracts were used for the estimation of protein content based on Lowry's procedure. Bovine serum albumin (10-100 μg) was employed to develop a calibration curve as described by Lowry et al. [15]. Total phenol content of the samples were estimated with Gallic acid as standard (0- 50 μg). Reducing sugar was estimated by Dinitro salicylic acid (DNS) method, against the glucose as standard at the range of 0-50 μg [16].

Chemical Composition

The chemical composition of okra bast fibre (*Abelmoschus esculentus* variety) are 67.5% a-cellulose, 15.4% hemicellulose, 7.1% lignin, 3.4% pectic matter, 3.9% fatty and waxy matter and 2.7% aqueous extract. It is clear that the main constituents of okara bast fibre are a-cellulose, hemicellulose, lignin and the rest or very minor in proportion.

Twenty-two accessions of okra (*Abelmoschus esculentus*), maintained at the Plant Genetic Resources Centre, Bunso, Ghana, were assayed for diversity in esterases, and total and storage proteins. A total of 34 reproducible and easily scorable bands were exposed with the number of bands per accession ranging from one to 21. All but nine of the bands were polymorphic. Storage proteins were the most diverse while esterases revealed the least diversity. Similarity matrices were calculated using the Jaccard coefficient, and input into cluster analysis. The phenogram produced by the UPGMA of the Jaccard similarity matrix from the pooled data of the esterases, and total and storage proteins revealed three major clusters at the 55% level of similarity. Accession 5 collected from Nyinguto was relatively distant from the other main clusters and separated at the 42% level of similarity. The second and third clusters comprised 11 and 10 accessions, respectively. It was observed that 18 out of the 22 accessions were distinct accessions. Similarity indices ranged from 29% to 100%. The wide range of similarity indices, coupled with the clustering of accessions, suggests useful variability in the collection for genetic conservationists and plant breeders [17].

Edible Uses

Edible Parts: Fruit; Leaves; Root; Seed.

Edible Uses: Coffee; Oil; Pectin.

Immature fruit - cooked on their own or added to soups etc. They can be used fresh or dried. Mucilaginous, they are commonly used as a thickening for soups, stews and sauces. The fruits are rich in pectin and are also a fair source of iron and calcium. The fresh fruits contain 740 iu vitamin A. The fruit should be harvested whilst young, older fruits soon become fibrous. The fruit can be up to 20cm long. Seed - cooked or ground into a meal and used in making bread or made into 'tofu' or 'tempeh'. The roasted seed is a coffee substitute. Probably the best of the coffee substitutes. The seed contains up to 22% of an edible oil. The leaves, flower buds, flowers and calyces can be eaten cooked as greens. The leaves can be dried, crushed into a powder and stored for later use. They are also used as flavouring. Root - it is edible but very fibrous. Mucilaginous, without very much flavour [18].

Medicinal Uses

Plants for a future cannot take any responsibility for any adverse effects from the use of plants. Always seek

advice from a professional before using a plant medicinally. Antispasmodic; Demulcent; Diaphoretic; Diuretic; Emollient; Stimulant; Vulnerary. The roots are very rich in mucilage, having a strongly demulcent action. They are said by some to be better than marsh mallow (*Althaea officinalis*). This mucilage can be used as a plasma replacement. An infusion of the roots is used in the treatment of syphilis. The juice of the roots is used externally in Nepal to treat cuts, wounds and boils. The leaves furnish an emollient poultice. A decoction of the immature capsules is demulcent, diuretic and emollient. It is used in the treatment of catarrhal infections, ardor urinae, dysuria and gonorrhoea. The seeds are antispasmodic, cordial and stimulant. An infusion of the roasted seeds has sudorific properties [19, 20].

Other Uses

Fibre; Paper; Size. A fibre obtained from the stems is used as a substitute for jute. It is also used in making paper and textiles. The fibres are about 2.4mm long. When used for paper the stems are harvested in late summer or autumn after the edible seedpods have been harvested, the leaves are removed and the stems are steamed until the fibres can be stripped off. The fibres are cooked for 2 hours with lye and then put in a ball mill for 3 hours. The paper is cream coloured. A decoction of the root or of the seeds is used as a size for paper [21].

Used for: Sylvia Zook, a qualified nutritional specialist, states that okra can favor one's body due to its properties:

1. Okra contains special fiber which takes sugar levels in blood under control, providing sugar quantity, acceptable for the bowels.
2. Mucilage, found in okra, is responsible for washing away toxic substances and bad cholesterol, which loads the liver.
3. Purgative properties okra possesses are beneficial for bowel purification. Due to okra fiber content, sufficient water levels in feces are ensured. Consequently, no discomfort and constipation bothers the patient. Wheat bran, applied for this purpose, can impose certain irritation on the bowels, while okra makes it smooth and all-convenient and safe for the user. Mucilage provides soft effect on the bowels. Stimlating bile movement, okra washes excess cholesterol and harmful substances from the body. This benefits the organism in general, as the toxins and bad cholesterol can induce various health conditions. Okra poses no threat to the organism, causes no addiction; it is completely safe and reliable. Moreover, it contains a bunch of useful nutrients and is cheaper than chemical alternatives.
4. Fiber okra contains is a valuable nutrient for intestine microorganisms. This ensures proper intestine functionality.
5. Okra ensures recovery from psychological and mental conditions, like anxiety, depression and general weakness.
6. Okra is an effective remedy for ulcers and joint healthiness. It is used to counteract the acids, due to its alkaline origin. It also guards the mucous membranes of the digestive system, by covering them with additional layer.
7. Okra is additionally applied for pulmonary inflammations, bowel irritations, and sore throat.
8. According to Indian researches, okra is a complex replacement for human blood plasma.

In order to keep the valuable substances safe, it's necessary to cook okra as shortly as possible, processing it either with steam, or on low heat. Some people even prefer eating it non-prepared at all.

Special Cases of okra application: To regulate constipation and acid reflux, a man, who has been exposed to constipation for almost 20 years and had a recent experience of acid reflux, tried consuming 6 okra pieces daily. There was no chemical drug addition to his therapy. His sugar levels in blood became normal; additionally, his acid reflux and cholesterol cause no more problems.

Okra can be beneficial in treating asthma due to its high vitamin C content. The vitamin acts as a remedy for inflammations, due to which reason it can be applied for asthma. According to a preliminary research on children, suffering from asthma, there is much less stertor in those who consume fruits with high vitamin C concentration. Half a cup of processed okra contains more than 13 mg of this vitamin.

Okra can help fight against atherosclerosis. Fiber-rich diets, which are highly recommended to prevent cholesterol accumulation in the vessels and heart condition development, can be aided by okra to reduce the chance of strokes and heart attacks.

Fiber okra contains is also a valuable component with regard to cancer treatment and prevention, especially when it comes to bowel cancer.

To strengthen the vessel walls, one should consume meals rich in vitamin C and flavonoids, which okra contains in high quantities.

To prevent cataract and make their treatment easier, one should consume meals rich in vitamin A or beta-carotene, also included in okra. Half a cup of processed okra includes vitamin A in a quantity of 460 IU.

Okra is highly popular for stimulating the nervous system, thus, being an aid in depressions, anxiety, and weakness.

Safety: There are no reports concerning this plant's side effects. It's completely safe and applied on a large scale [6].

References

1. Kochhar, S.L., 1986. Okra (Lady's finger) In: Tropical crops, a textbook of economic Botany. Editor S.L., Kochhar, pp: 263-264.
2. Tindall, H.D., 1986. Vegetables in the Tropics A textbook. Editor H.D. Tindall, pp: 328.
3. Sowumi, O. and A. Chukwudebe, 1979. The effect of Ageat harvesting on the chemical composition of okra fruit. Abelmoschus esculentus. Rep. Nig. stored. Prod. Res. Inst. 1979/80 (Issued in 1983), pp: 111-116.
4. Shalau Jeff, 2002. Backyard Gardener. Available at http://ag.arizona.edu /yavapai/anr/hort/byg/.
5. Siemonsma, J.S. and C. Kouame, 2004. Abelmoschus Esculentus. In plant resources of tropical Africa 2 Vegetable. Editors Grubben G.J.H and O.A. Denton, Published by PROTA foundation Netherlands, pp: 21-29.
6. Herbal Online Pharmacy World of Herbal Remedies and Alternative Medicine. Available at http://www.oshims.com/herb-directory/o/okra.
7. Facciola. S. Cornucopia - A Source Book of Edible Plants. Kampong Publications 1990 ISBN 0-9628087-0-9.
8. Huxley. A. The New RHS Dictionary of Gardening. 1992. MacMillan Press 1992 ISBN 0-333-47494-5.
9. Phillips. R. & Rix. M. Vegetables Macmillan Reference Books, London. 1995 ISBN 0 333 62640 0.
10. Rice. G. (Editor) Growing from Seed. Volume 1. Thompson and Morgan. 1987.
11. Murashige, T. and F. Skoog. (1962). A revised medium for rapid growth and Bioassys with tobacco tissue culture. Physiol Plant 15: 473-497.
12. Esau, K. (1965). Plant Anatomy, John Wiley & Sons, New York.
13. Abdul Baki, A.A. and J.P. Anderson, 1973. Vigour determination in Soybean seed by multiple criteria, Crop Sci., 13: 630-3.
14. Dubois, M., K.A. Giltes, J.K. Hamilton, P.A. Rebers and F. Smith, 1956. Carbohydrate estimation by phenol-sulphuric acid method. Annual Chemistry, 26: 350-51.
15. Lowry, O.H, N.J. Rosen Brough, A.L. Farr and R.J. Randall, 1951. Protein measurement with the folin phenol reagent, J. Biol. Chemistry, 193: 265-75.
16. Miller, G.L., 1959. Use of Dinitrosolicylic acid reagent from determination of reducing sugar, Annual Chemistry, 31:426-8.
17. S. K. Torkpo, E. Y. Danquah, S. K. Offei, E. T. Blay. Esterase, total protein and seed storage protein diversity in okra. West Africa journal of applied ecology. vol 9, 2006, 8-18.
18. Hedrick. U. P. Sturtevant's Edible Plants of the World. Dover Publications 1972 ISBN 0-486-20459-6.
19. Grieve. A Modern Herbal. Penguin 1984 ISBN 0-14-046-440-9.
20. Chopra. R. N., Nayar. S. L. and Chopra. I. C. Glossary of Indian Medicinal Plants (Including the Supplement). Council of Scientific and Industrial Research, New Delhi.1986.
21. Bell. L. A. Plant Fibres for Papermaking. Liliaceae Press 1988.