IMPORTANCE OF OKRA (*Abelmoschus esculentus* L.) AND IT'S PROPORTION IN THE WORLD AS A NUTRITIONAL VEGETABLE

ABSTRACT

Okra belong to Malvaceae family, a commercial vegetable crops. It is extensively distributed in tropical, subtropical, and warm temperate parts of the world and is native to Ethiopia. It is essential to human nutrition and a good source of total minerals, vitamins, calcium, potassium, enzymes, and other nutrients that are frequently lacking in developing country diets. Additionally, reports of its medicinal value in treating curingulcers and providing relief from haemorrhoids. Okra has found medical application as a plasma replacement or blood volume expander and also useful in genito-urinary disorders, spermatorrhoea and chronic dysentery. The fruits of okra crop bringing into commercial production have reawakened beneficial interest.

KEY WORDS

Abelmoschus esculentus, Biochemical Composition, Diseases, Insects, Okra, Origin, Production.

INTRODUCTION

Okra is also known as lady's fingers, bhindi in India, krajiab kheaw in Thailand, okra plant, ochro, okoro, quimgombo, quingumbo, gombo, kopi arab, kacang bendi, and bhindi in South East Asia. Okra is also known as *Abelmoschus esculentus* (L.) Moench in many English-speaking nations. However, it is referred to as bamia, bamya, or bamieh in the Middle East and gumbo in the South. Okra is referred to as quiabo in Portuguese and Angola, quimbombo in Cuba, gombo commun, gombo, gumbo in France, mbamia and mbinda in Sweden, and okra in Japan [13], [30]. In Nigerian Igbo, Taiwan is referred to as qiu kui. It belongs to the genus Abelmoschus and family Malvaceae. Okra's geographic origin is contested, with claims that it originated in South Asia, Ethiopia, and West Africa. Around the world, the plant is grown in tropical, subtropical, and warm temperate climates [38]. Although okra may be grown on a variety of soil types, well-drained fertile soils with sufficient organic matter produce a high yield [7]. In the tropics, the crop is extensively grown all year round. Okra is a nutrient-dense vegetable that is crucial in addressing the market's lacklustre demand for vegetables [6]. The world's total area under cultivation in 2009–2010 was 0.43 million hectares, and output totaled 4.54 million tonnes, with India producing 5784 thousand tonnes of okra with a yield of 11.1 tons/hectare [23]. In comparison to other developing countries' yields of 9.7 to 10 tonnes per hectare, the yield is quite low. India contributed largest producer (67.1%), abide by Nigeria (15.4%) and Sudan (9.3 %).

OKRA'S GEOGRAPHIC ORIGIN AND DISTRIBUTION

Previously, the genus Hibiscus, section Abelmoschus of the family Malvaceae, contained the okra plant or lady's finger [32]. It was therefore suggested that the section Abelmoschus be elevated to the status of separate genus. In the taxonomy and modern literature, the widespread use of Abelmoschus was soon approved [22]. The calyx of the Hibiscus genus is

spathulate, has five small teeth, is connate to the corolla, and becomes caducous after flowering [27]. By the 12th century B.C., the ancient Egyptians were cultivating okra, which had its origins somewhere near Ethiopia. Its cultivation became widespread in North Africa and the Middle East [3]. The most comprehensively recorded research of the genus Abelmoschus are those that Borssum and colleagues [11] and Bates [9] conducted on its taxonomic revision. At the International Okra Workshop conducted at the National Bureau of Plant Genetic Resources (NBPGR) in 1990, a modern classification was chosen using van Borssum Waalkes' classification as a starting point. Eight species are the most often accepted, despite the fact that over 50 have been described [24]. Okra is cultivated all throughout the world, although it is more common in nations with tropical and subtropical climates [8]. This crop may be cultivated as a garden crop or on a huge commercial farm. Many nations, including India, Japan, Turkey, Iran, Western Africa, Yugoslavia, Bangladesh, Afghanistan, Pakistan, Myanmar, Malaysia, Thailand, India, Brazil, Ethiopia, Cyprus, and the Southern United States, cultivate okra plants for commercial purposes [10].

STRUCTURE AND PHYSIOLOGY

In tropical and warm temperate areas of the world, *Abelmoschus esculentus* is grown for its fibrous fruits or pods that contain spherical, white seeds. The seeds are soaked the night before sowing in culture, at a depth of 1-2 cm. Between six days (wet seeds) to three weeks, germination takes place. Seedlings need a lot of water. Within a week of the fruit being pollinated, the seed pods must be collected since they quickly turn fibrous and woody. The immature fruits are collected and consumed as vegetables. It is one of the world's most heat- and drought-tolerant vegetable species, and it can grow on thick clay soils and intermittent moisture but frost, can harm the pods.

CYTOGENETIC RELATIONSHIP OF OKRA

The number of chromosomes and ploidy levels of various sepceis of the genus Abelmoschus varied significantly from one another. Within *A. esculentus*, the chromosomal numbers are 2n = 72, 108, 120, 132, and 144, which are in a regular succession of polyploids with n = 12 [15]. *A. angulosus* has the lowest number (2n =56), whereas *A. manihot* var. caillei has the largest number (almost 200) of known chromosomes.

BIOCHEMICALLY RELATIONSHIP

The okra fruit is mostly consumed raw or cooked, and it is a significant source of vitamins A, B, and C, minerals, iron, and iodine, as well as an essential vegetable source of viscous fibre [3, 26, 35]. However, it is also said to be low in salt, saturated fat, and cholesterol. Okra pods contain the following nutrients per 100 g of edible portion: water 88.6 g, energy 144.000 kJ (36 kcal), protein 2.10 g, carbohydrate 8.20 g, fat 0.20 g, fibre 1.70 g, Ca 84.00 mg, P 90.00 mg, Fe 1.20 mg, -carotene 185.00 g, riboflavin 0.08 mg, thiamin 0.04 mg, niacin 0.60 mg, ascorbic acid 47.00 mg. Okra is rich in protein, carbohydrates, and vitamin C [17,21,30] and is an essential part of the human diet [25]. Young, immature okra pods may be eaten in a variety of ways and are crucial to consume as fresh fruits [40]. There have also been reports

of Fe, Zn, Mn, and Ni [36]. Okra is a valuable source of vitamins, calcium, potassium, and other minerals that are frequently missing in the diets of poor nations [24]. The freshest okra pods that are seven days old contain the highest concentration of nutrients [5]. Okra leaves have the following nutritional values per 100 g of edible portion: 81.50 g of water, 235.00 kJ (56.00 kcal) of energy, 4.40 g of protein, and 0.60 g of fat. 11.30 g of carbohydrates, 2.10 g of fibre, 532.0 mg of calcium, 70.00 mg of phosphorus, 0.70 mg of iron, 59.00 mg of ascorbic acid, 385.00 g of -carotene, 0.25 mg of thiamin, 2.80 mg of riboflavin, and 0.20 mg of niacin were found in the study [21]. Mucilage is the primary form of carbohydrates [33], [28]. Additionally edible are the flower and leaf buds [16]. About 20% of the proteins and 20% of the oil in okra seeds are proteins [17], [14]. Potential hypocholesterolemic effects of okra seed oil exist. Okra has a very high potential for widespread planting for both cake and edible oil. Cereal flour might potentially be fortified with okra seed flour [2]. Okra oil was determined to be appropriate for usage as a biofuel in a 2009 research [18]. When making gur or brown sugar from sugarcane juice, the roots and stems of okra are utilized to clarify the juice [13].

One of the main elements in the production of okra is the occurrence of insect pests. Numerous insect pests affect the crop, but the shoot and fruit borer, *Earias vittella* (Fabricius), and *Earias insulana* are the most dangerous since they have the upper hand by directly harming vulnerable fruits. Fruit borer damage ranges from 88 to 100 percent. When compared to healthy okra fruits, the usual number of seeds per fruit was reduced by 16.47 percent, while the number of stained seeds increased by 200 percent and the number of damaged seeds decreased by 18.70 percent [58]. After a rainstorm, the prevalence of fruit borers often occurs in a humid environment. Individual eggs are laid by the female adult on leaves, while flower buds are laid on soft fruits. Before the production of fruits, little brown caterpillars pierce the top stalk and feed there. *Amrasca biguttula biguttula* (Ishida), a leafhopper, and *Earias spp*., a shoot and fruit borer, are serious pests that may wreck havoc and cause significant damage. Leafhopper alone was responsible for 32.06% – 40.84%. Fruit output was reduced by 50% as a result of shoot and fruit borer [12]. Fruit is unsuitable for human consumption when fruit and shoot borer larvae penetrate into shoots during the vegetative development stage and subsequently in blooms and fruits. Insecticide usage has given crops instant respite and appears to have benefitted formers among other suggested pest management methods. The usage of chemicals is rising quickly and will keep doing so unless some trustworthy alternative control techniques are created for the same reason. In Asia, 95% of the population uses pesticides.

DISEASES OF OKRA

Yellow Vein Mosaic Virus (YVMV)

The Yellow Vein Mosaic Virus is the cause causative agent. This is the most significant and harmful viral disease that affects okra crops at all stages of growth. The diseased plants produce fruits that are malformed, tiny, rough, and light yellow to white in colour. If the plants contract the disease within 20 days of germination, there will be a 50–100% loss in production and quality [20].

Cercospora Leaf Spot

Agent responsible for Cercospora Leaf Spot is *Cercospora hibisci, C. malayensis*, and *A. abelmoschi*. Three species of Cercospora in India cause leaf marks in okra. *C. abelmoschi* creates sooty black, angular dots, and *C. malayensis* causes brown, irregular patches. The harmed leaves wilt, roll and then fall. The leaf spots are frequent during wet seasons and severely defoliate the leaves [14] [37].

Fusarium Wilt Causative Agent

Vasinfectum *Fusarium oxysporum* f. sp. Everywhere that okra is actively produced, there is a dangerous disease called *Fursarium* wilt. The fungus colonises the vascular system, invades the roots, and so prevents water from moving through the plant. The illness is transmitted by inter culture operations and is carried in the soil.

Powdery Mildew

Powdery mildew is brought on by *Erysiphe cichoracearum, Sphaerotheca fuliginea*, and these two organisms are also responsible for its cause. While the latter has just been recorded from Bangalore, the former's sickness is most prevalent in okra-growing regions [29].

MEDICAL PROPERTY OF OKRA CROP

Haemorrhoids and ulcers have been treated using its therapeutic benefits, according to reports [1]. Numerous publications related to herbal and traditional medicine make mention to the 1898 claim that unspecified plant components have diuretic qualities [19]. Okra has found use in medicine as a blood volume expander or plasma replacement [34], [31], [4]. It is also an excellent source of iodine, which is helpful in the treatment of uncomplicated goiter, as well as other compounds with medicinal use [35]. It is highly helpful in treating chronic dysentery, spermatorrhoea, and genitourinary diseases [39]. According to experiments carried out in China, an alcohol extract of okra leaves may be able to reduce protein urea, enhance renal function, reduce protein free radicals, and treat renal tubular-interstitial disorders. Numerous texts pertaining to herbal and conventional medicine make mention to the 1898 claim [19] that unspecified plant components have diuretic qualities. Studies focusing on okra extract as a diabetic treatment are currently being research.

CONCLUSION

Okra (*Abelmoschus esculentus* (L.) Moench) is a very important medicinal plant with several pharmacological uses. It has been used as an ingredient in many herbal formulations that are used to treat various illnesses, particularly the regulation of blood pressure, fat, diabetes, chronic dysentery genito-urinary disorders, simple goitre, and ulcer, in addition to having the aforementioned nutritional, medical, and industrial properties.

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