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MEDICINAL VALUE OF *PRAECITRULLUS FISTULOSUS* : AN OVERVIEW

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ABSTRACT

Cucurbitaceae family is major source of medicinal agents since ancient time. Various plants parts including fruits of this family have been established for their pharmacological potential. In the series of *Cucurbitaceae* plants, *Praecitrullus fistulosus* is one of the excellent plants, gifted by the nature having composition of all the essential constituents that are required for normal and good human health. Genus *Praecitrullus fistulosus* is very similar to Citrullus in its morphological characters, but differs in the stratification of pollen grains, haploid chromosome number and to some extent in leaf morphology. . This study is an attempt to compile an up-to-date and comprehensive review of *Praecitrullus fistulosus* that covers its traditional and folk medicinal uses, phytochemistry and pharmacology profile.

Keywords: *Praecitrullus fistulosus, Cucurbitaceae,* Citrullus.

INTRODUCTION

Cucurbits belong to family *Cucurbitaceae*, *Cucurbitaceae* family is commonly known as gourd, melon and pumpkin family. This family is composed of includes about 118 genera and 825 species. In India, a number of major and minor cucurbits are cultivated, which share about 5.6 % of the total vegetable production (Rai *et al*., 2004). In the series of *Cucurbitaceae* plants, *Praecitrullus fistulosus* is one of the excellent plants, gifted by the nature having composition of all the essential constituents that are required for normal and good human health. *Praecitrullus fistulosus* is commonly known as Tendu in Punjabi, Tinda kaaya in Telugu, Kovaikkaai in Tamil and Indian round gourd in English (Kirtikar & Basu., 1998). It is a diffuse annual, creeping or climbing herb with stout stem and rounded fruits of the size of a small turnip, pale or dark green in colour with blackish seeds. The fruits are used as a vegetable (Wealth of India., 1950). *Praecitrullus fistulosus* is cultivated as a vegetable in India, Pakistan and Afghanistan. The origin is probably northwestern India, where wild types may still be found in the wild. In Punjab, Uttar Pradesh, Mumbai and Rajasthan it is quite important as a cultivated market vegetable. The Hindi name 'tinda' is commonly used in other parts of the world. In Africa it is cultivated locally, mainly in East Africa, as a vegetable for the Asian population. In Ghana and Kenya it is grown as an export commodity for the United Kingdom market. It is also grown on a small scale in the United States (Schippers, 2004). It is sometimes grown on the edges of gardens or in river beds. Two types of tinda are usually grown, one with green fruits and the other with pale green fruits (Wealth of India., 1950). Tinda is mainly cultivated in the lowlands from sea-level up to approximately 1000 m altitude. It likes warm, sunny conditions of 25–30°C at daytime and 18°C or more during the night and performs less well in cooler and humid areas. In India it is either grown in the dry season (February to end of April) or in the rainy season (mid-June to end of July). Tinda prefers light or sandy soils where its

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roots can penetrate easily. Moderately fertile to fertile soil is required for early closure of the vegetative cover (Gautam *et al*., 2011). In case of prolonged drought, irrigation is required before ploughing. Fertilizer applications depend on the nutrient status of the soil. In general a fertilizer application at a rate of 50 kg N, 20 kg P and 20 kg K per ha is needed. Watering 2–3 times per week is recommended during the dry season. One or two weedings are required before the stems cover the soil, attained in 6–8 weeks after sowing. From this stage movement in the crop should be reduced to a minimum to avoid damaging the plants.

Seeds are sown directly on ridges or on flat land after the soil have been prepared either manually or mechanically by ploughing, harrowing or ridging. Tinda is primarily grown as a sole crop. Three or four seeds are sown per hill at a depth of 2–3 cm, spaced at approximately 90 cm × 150 cm. The seedlings are thinned to one or two per hill at 3–4 weeks after sowing when they have 2–4 true leaves. This leaves a plant population of about 10,000 plants per ha.

The range of diseases that can be seen in tinda corresponds closely with that of watermelon. The most serious fungal diseases are downy mildew (*Pseudoperonospora cubensis*) and to a lesser extent powdery mildew (*Erysiphe cichoracearum* and *Sphaerotheca fuliginea*), which can be controlled by spraying a carbamate fungicide. *Choanephora cucurbitarum* causes wet rot of the fruit and another major disease of the fruit is anthracnose caused by C*olletotrichum gloeosporioides*. These diseases may be controlled chemically, e.g. by a weekly spraying with fungicides such as benomyl for 3–4 weeks. There are also several virus diseases that can cause severe fruit abortion, defoliation and fruit distortion. These viruses are usually transmitted by aphids (*Aphis* spp.), thrips and white flies (*Bemisia tabaci*). Virus infections can be reduced by spraying appropriate insecticides and by early planting before the heavy rains. The most serious pests are melon fruit fly (*Dacus* spp.) and leaf beetles (*Epilachna chrysomelina*), which can be controlled with insecticides. Tinda is harvested at the nearly mature green stage when the fruit has a diameter of 10–12 cm and the seed is still soft. Harvesting can take place about two weeks from fruit set, depending on prevailing moisture and temperature conditions. The fruit stalk is cut short to avoid damage to neighboring fruits. Up to 4 fruits of about 500 g each can be harvested per plant. In India, an average yield of 10 t/ha is reported (Schippers., 2004). Tinda is also affected by several insect pests. In the seedling stage, roots are damage by red pumpkin beetle (*Raphidopalpa foevicollis*).The foliage is attacked by sap-sucking insects, viz. aphids, jassids and mites, although in milder forms. The tender fruits are punctured and damaged by the fruit fly (*Bacus cucurbitae*). Control of downy mildew, insects and vectors of viruses of tinda is obtained through a package involving spray of sevin (0.2) about 15-20 days after sowing and thereafter mixed spray of Dithane M-45 and Rogor or Thiodon. Downy mildew can be controlled by seed treatment with Bassivol or Vitavax (2 g/kg seed); Karathane (0.05%) is effective against powdery mildew. The control of red pumpkin beetle may also check the spread of powdery mildew as the beetle is a source of secondary infection (Wealth of India, 1950). Praecitrullus fistulosus may be a useful source of resistance to whiteflies for the improvement of watermelons (Levi *et al*., 2005). Synonyms of different species of tinda are Citrullus fistulosus (Stocks), *Praecitrullus fistulosus* (Stocks), Citrullus lanatus, Citrullus vulgaris var fistulosus (Stocks), Colocynthis citrullus var. fistulosus (Stocks) (Gautam *et al*., 2011).

TOXONOMICAL CLASSIFICATION

Kingdom	*Plantae* – Plants
Order	*Cucurbitales*
Family	*Cucurbitaceae*
Subfamily	*Cucurbitoideae*
Genus	*Praecitrullus*
Species	*Fistulosus*

CHARACTERSTIC OF PRAECITRULLUS FISTULOSUS

Leaves are alternate and usually palmately 5-lobed or divided, stipules are absent. Leaves are sparingly pinnatifid, lamina sparsely hispid all over, densely hispid on veins and veinlets of under surface, margin minutely denticulate, apparently entire, young leaves villous to densely hispid. Probract spathulate are 0.8 cm long. Flowers are actinomorphic and nearly always unisexual. The perianth has a short to prolonged epigynous zone that bears a calyx of 3-6 lobes and 3-6 petals or more frequently a 3-6 lobed sympetalous corollas. The androecium is highly variable, consisting of basically 5 distinct to completely connate stamens that frequently are twisted, folded or reduced in number. The gynoecium consists of a single compound pistil of 2-5 carpels, generally with one style and as many style branches or major stigma lobes as carpels, and an inferior ovary with one locule and usually numerous ovules on 2-5 parietal placentae or 3 locules with numerous ovules on axile placentae. The fruit is a type of berry called a pepo by Gerald Carr**.** The fruit is approximately spherical, and 5–8 cm in diameter. Fruit is about the size of a small turnip, depressed at each end, hispid when young afterwards glabrous (Gautam *et al*., 2011).

REPORTED TAXONOMIC POSITION

Praecitrullus fistulosus having a chromosome number of x=12. This taxon was earlier considered as a botanical variety of watermelon, *Citrullus lanatus* (x=11). Pangalo, however, identified distinct morphological and cytological differences between *C. vulgaris* var. *fistulosus* (tinda) and *C. lanatus* (syn. *C. vulgaris*). There is now general agreement among botanists and cytologists in that round melon requires a separate taxonomic status from watermelon and suggested a separate species status for round melon in the genus *Citrullus*. However, many other scientists are of the opinion that round melon should be put in a different genus, separate from *Citrullus*. It was the opinion that round melon with x=12 should be placed in the genus *Cucumis*, along with *C. melo* whose chromosome number is also 12. However, histological studies and analysis of leaf phenolics brought out distinct differences between the two taxa. Tinda is not crossable with either watermelon or muskmelon, but isozymes provided additional evidence for comparison of the two species. Round melon was compared with watermelon and muskmelon for two enzyme systems, peroxidase (PRX) and glutamate oxaloacetate transaminase (GOT). Polyacrylamide gel electrophoresis was carried out at 5°C, using vertical slab gels and a constant current of 40 mA per slab. The gel buffer for all analyses was pH 9.0 tris-chloride, and the electrode buffer was pH 8.3 tris-glycine. Bromophenol blue (0.2%) in imidazole buffer (pH 7.0) was used as a tracer dye, and relative mobility (Rm) was calculated. Peroxidase analyses were made on roots and hypocotyls of 4-5 week old seedlings, with gel concentration of 7% acrylamide and staining. Glutamate oxaloacetate transaminase analyses were made on 3-4 day old seedlings, with 9.5 acrylamide gel concentration and staining technique. Seven peroxidase isozymes were found at Rm 0.01, 0.04, 0.11, 0.15, 0.44, 0.47, 0.76), different in electrophoretic mobility from the six isozymes found in *Citrullus lanatus* (Rm=0.07, 0.12, 0.19, 0.43, 0.54, 0.57) and the eight isozymes of *Cucumis melo* (Rm=0.05, 0.15, 0.443, 0.48, 0.52, 0.56, 0.61, 0.73). In the GOT zymogram, the three isozymes of *Praecitrullus* (Rm=0.13, 0.26, 0.30) were different from the two found in *Citrullus lanatus* (Rm=0.22, 0.25) and the four isozymes found in *Cucumis melo* (Rm=0.17, 0.23, 0.34, 0.38). Thus, it was found that there was no similarity of *Praecitrullus* with *Citrullus lanatus* or *Cucumis melo* for PRX or GOT,similarity between *C. lanatus* and *C. colocynthis* for GOT and PRX zymograms. Comparing *Praecitrullus* with *Cucumis melo*, it was found that the two species did not have any PRX or GOT isozymes in common. The isozyme at GOT_4 which was present in the 12 *Cucumis* species analyzed was absent in *Praecitrullus*. Thus, round melon should be placed in the genus *Cucumis*. The indian round melon or 'tinda' is unrelated to and different from muskmelon and watermelon (Sujhata & Seshadri, 1989).

REPORTED PHYTOCONSTITUENTS

The composition of tinda fruits per 100 g edible portion is: water 93.5 g, energy 89 kJ (21 kcal), protein 1.4 g, fat 0.2 g, carbohydrate 3.6 g, fibre 1.6 g, Ca 25 mg, Fe 0.9 mg, P 24 mg, carotene 13 μg, thiamin 0.04 mg, riboflavin 0.08 mg, niacin 0.3 mg, ascorbic acid 18 mg (Holland *et al*., 1991). Thiamin 0.04mg, Riboflavin 0.08mg, Niacin 0.3mg, Copper 11ppm, Nikel <0.006ppm, Lead <0.015ppm , Zinc 34ppm, Cobalt <0.009ppm, Cadmium <0.0008ppm, Cromium <0.003ppm, Sodium 4ppm (Javid *et al*., 2010). Seeds and kernels contain 52.8 and 37.8%,respectively of a fatty oil with the following Characterstics:$[\alpha]_D$,-1.4758; saponification value,192.5;and iodine value,126.5.The fatty acid composition of oil is:myristic,1.74;plmitic, 11.85;stearic,10.70;oleic,21.23;and linoleic,50.80%, The oil free-kernel has been found to contain protein I n the range of 60 to 70% (Wealth of India., 1950).

REPORTED PHARMACOLOGICAL ACTIVITY

Mondal *et al*., (2012); fruit rot disease (FRD), an emerging problem of tinda (*Praecitrullus fistulosus*) in India. FRD epidemics begin during rainy and warm weather and often spoil marketable produce. Symptoms appear as numerous, pale brown-to-dark brown, deeply penetrating circular soft rot lesions on fleshy fruit tissues. Noneffervescent bacterial exudates occasionally form on lesions. Repeated isolations from FRD-affected tinda fruits consistently yielded the same bacterial species. Inoculation of the isolated bacterium into asymptomatic tinda fruits produced identical soft rot symptoms. Fruits were inoculated with the isolate ITCC B0030 (0.1 OD) by removing a 2.0-cm deep tissue plug with a sterile cork borer (5 mm in diameter) and injecting the inoculum with a syringe in the cylindrical cavity. After inoculation, the plug (upper 5 mm) was reinserted, sealed with sterile paraffin, and covered with a small piece of wet absorbent cotton to prevent dehydration. High humidity (>90%) and 30 to 33°C temperature was maintained after inoculation in a glasshouse. After 4 to 10 days, fruits showed FRD symptoms. The reisolated bacterium from artificially inoculated symptomatic fruits was identical with the original inoculated bacterium. Identity of the bacterial pathogen for FRD was confirmed by phenotypic and genotypic methods. The causal bacterium was a gramnegative, non-sporing motile rod with a single polar flagellum. The bacterium produced yellowish green and blue-green diffusible pigments on King's B (KB) medium. On yeast dextrose calcium carbonate agar at 30°C, the colonies produced abundant, blue, diffusible pigment within 48 h. The bacterium grew at temperatures up to 42°C but not at 4°C. Excellent growth occurred on Salmonella-Shigella agar and MaConkey's medium, as reported also for *Pseudomonas aeruginosa* strain P8. The bacterium produced ammonia, hydrogen sulfide, arginine dihydrolase, urease, lipase, catalase, gelatinase, and casinase but not amylase, indole, or acetyl methyl carbinol. The bacterium was identified as *P. aeruginosa* using Biolog based Bacterial Identification System version 4.2 (Biolog Inc., Hayward, CA). The bacterium did not utilize cellobiose, dulcitol, maltose, sorbitol, sucrose, arabinose, and starch. Upon infiltration on tobacco leaves (*Nicotiana tabacum* cv. Xanthi) at 10^7 or more cells ml^{-1}, the bacterium gave a strong hypersensitive reaction within 24 h. Transmission electron micrographs (TEM, KYKY 1000B, Japan) of the causal bacterium revealed a single, polar flagellum. Identity was further confirmed as *P. aeruginosa* based on 16S rRNA sequence (1,491 nt) analysis with universal primers F1 (5′-GAGTTTGATCCTGGCTCAG-3′) and R13 (5′-AGAAAGGAGGTGATCCAGCC-3′). A blastN search of GenBank revealed a >99% nt identity with *P. aeruginosa* strain TAUC 7 (HQ914782). The 16S rRNA gene sequence (1,491 nt) was deposited in Bankit GenBank (JF797204). To our knowledge, this is the first report of fruit rot of tinda caused by *P. aeruginosa* in India (ITCC B0030) and a new record of bacterial rot of *Praecitrullus fistulosus* induced by a fluorescent and blue-green pigment producing *P. aeruginosa*. To date, *P. syringae* pv. *lachrymans* and a nonfluorescent *P. pseudoalcaligenes* subsp. *citrulli* were reported to infect *Citrullus lanata* and *Praecitrullus fistulosus* respectively.

Gautam *et al*., (2011); evaluated the petroleum ether and methanolic extract of *Praecitrullus fistulosus* for anthelmintic activity against Pheretima posthuma. Two concentrations (50 and 100 mg/ml) of each extract were assessed, using determination of time of paralysis and time of death of the worms. Distilled water and Albendazole were used as control and standard respectively and proved that the tested extracts of the *Praecitrullus fistulosus* exhibited significant anthelmintic activity at highest concentration of 100 mg/ml.

Gautam *et al*., (2011); evaluated the antioxidant effect of petroleum ether and methanolic extract of Praecitrullus fistulosus against free radical damage by standard method as DPPH (1,1- diphenyl-2-picrylhydrazyl) free radical model and proved that the fruits possess varying degree of antioxidant activity when compared with the standard ascorbic acid. The IC50 of pet-ether extract is 18µg/ml and ethanol extract is 20µg/ml.

Perveen *et al*., (2011); evaluated the Pollen germination of *Praecitrullus fistulosus* L. in fresh and stored pollen upto 48 weeks at different temperatures i.e., -30°C refrigerator (+4°C), freezer (-20° C, -30°C) and freeze drier (-60°C) and proved that Pollen stored at low temperature showed better germination percentage as compared to pollen stored at +4°C and fresh. Pollen stored at -30°C (freezer) showed the highest germination percentage.

Hussain *et al*., (2010); evaluated the eight vegetable species viz., *Solanum melongena, Trianthema portulacastrum, Abelmoschus esculentus, Spinacia oleracea, Praecitrullus fistulosus, Luffa acutangula, Cucurbita moschata* and *Cucumis sativus* for their nutritional values using standard techniques for proximate, macro and micronutrient analysis. In proximate analysis, ash, carbohydrate, proteins, fiber, fats and moisture (both dry and wet) were assayed while Cu, Ni, Zn, Pb, Co, Cd, Fe, Cr, Ca and Na were evaluated in micronutrients analysis using AOAC methods and atomic absorption spectrometric techniques. The species showed variable results in proximate analysis, however, *Cucurbita moschata* have revealed higher percentage of carbohydrates, fibers, and energy values. The results showed that *Trianthema portulacastrum* (a wild vegetable) had the highest concentrations of the micronutrients like Cu, Zn, and Fe compared to the other seven species while it had highest concentration of Ca. Proximate and nutrient analysis of such wild and cultivated vegetables can help us to determine the health benefits achieved from their use in marginal communities.

Dixit *et al*., (2010); evaluated the glucose regulating role of three vegetable peels from cucurbitaceae family. In a preliminary study, effects of ethanolic extracts of Cucurbita pepo, Cucumis sativus and Praecitrullus fistulosus peels were studied at 250 and 500mgkg(-1)d(-1) for 15days in the alterations in serum glucose and in hepatic lipid peroxidation (LPO) in male mice. In the pilot experiment, the effective and safe concentration of each peel was administered (p.o.) for 10 consecutive days and then on 11th and 12th days alloxan was administered along with peel extracts. The treatment was continued up to 15th day. At the end, alterations in serum glucose, insulin, triiodothyronine, thyroxine, total cholesterol, triglyceride, high density lipoprotein, low density lipoprotein, very low density lipoprotein, hepatic lipid peroxidation, superoxide dismutase and catalase were studied. All the three peel extracts nearly reversed most of these changes induced by alloxan suggesting their possible role in ameliorating diabetes mellitus and related changes in serum lipids. However, Cucurbita pepo peel was found to be the most effective. Total polyphenols, flavonoids and ascorbic acid contents of the test peels were also estimated, which appear to be associated with the observed antidiabetic and antioxidative potentials.

Levi *et al*., (2010); evaluated that the taxonomic classification of *P. fistulosus* is incomplete and for many years it has been considered a close relative of watermelon and was previously classified as *Citrullus lanatus* subsp. *fistulosus* (Stocks). Here, we used two sets of DNA markers to assess the genetic similarity of *P. fistulosus* in relation to *Citrullus* spp. {including *Citrullus lanatus* subsp. *vulgaris*, *C. lanatus* subsp. *lanatus*, *Citroides* group [also known as *C. lanatus* (Thunb.) *citroides* (Bailey) and *C. colocynthis* (L.) Schrad.}, *Cucumis* spp. (including *C. melo*, *C. sativus*, *C. anguria*, *C. meeusei* and *C. zeyheri*), *Benincasa hispida* (Thunb.) Cogn., *Lagenaria siceraria* (Mol.) Standl and *Cucurbita* spp. (including *C. moschata* Duchesne and the winter squash *C. maxima* Duchesne). The first marker set comprised 501 markers that were produced by 38 primer pairs derived from watermelon expressed sequenced tags (ESTs) containing simple sequence repeat (SSR) motifs (designated as EST-SSR primers; produced 311 markers), and by 18 primer pairs derived from ESTs that do not contain SSR motives (designated here as EST-PCR primers; produced 190 markers). The second marker set comprised 628 markers that were produced by 18 sequence related amplified polymorphism (SRAP) primer pairs. The phylogenetic data indicated that among these cucurbit species, the wax gourd *B. hispida* is the closest to the *P. fistulosus*. Pollen observations, using light microscopy, indicated that each of the cucurbit genera examined here has unique pollen morphology. The *Cucurbita* spp. have globular pollen grains with a stigmatic surface. The *L. siceraria* has polygonal pollen grains with symmetrical boundaries, while the *Citrullus* spp. and *Cucumis* spp. have ovular (conical) and triangular shaped pollen grains (respectively). The *B. hispida* and *P. fistulosus* have spherical or semispherical pollen grains. These pollen features appear to be in agreement with the phylogenetic relationships of these two species based on DNA markers. Analysis with 12 SRAP primer pairs revealed low genetic diversity among 18 United States Plant Introductions (PIs) of *P. fistulosus*, indicating the need to expand the germplasm collection of this cucurbit crop.

Singh *et al*., (2010); evaluated the variation among 17 accessions of *Citrullus lanatus* from different geographic regions and interspecific relationships of six taxa of *Citrullus* and *Praecitrullus* using electrophoretic patterns of their seed storage proteins. Globulins, the salt soluble proteins, represented the major fraction with their proportion varying between 56.6% and 67.0%. These were followed by albumins (16.6–20.8%) and glutelins (13.5–18.5%) with prolamins as the lowest (2.2–4.1%) of the four fractions. Two-dimensional gel electrophoresis under nonreducing conditions in the first dimension and reducing conditions in the second revealed disulphide-bonded subunit pairs of molecular weight 53, 52, 50 and 41 kDa, unlike the single subunit pair generally reported in different cucurbits, each consisting of a large and a small subunit. In the UPGMA dendrogram based on polypeptide patterns, the occurrence of *C. lanatus* var. *lanatus*, *C. lanatus* var. *citroides* and *C. lanatus* accession PI 482318 in one subcluster suggested that phylogenetically *C. lanatus* var. *citroides* and *C. lanatus* var. *lanatus* are closely related. The recently described annual wild species, *Citrullus rehmii*, occurred independently nearest to the subcluster of these cultivated and wild taxa. *Citrullus colocynthis*, the perennial wild species occurred farther from this cluster showing relatively more genetic distance from the watermelons. *Praecitrullus fistulosus* was outclustered and appeared genetically distant from all the *Citrullus* taxa; this supported its placement in a separate genus unlike its nomenclature as a botanical variety of watermelon or as a separate species of *Citrullus* proposed in certain earlier studies.

Levi *et al*., (2005); evaluated that *Praecitrullus fistulosus* is mild resistance to whiteflies (Bemisia tabaci). However, our attempts to cross various US plant introductions (PIs) of P. fistulosus with watermelon or other Citrullus PIs have not been successful. Thus, to determine genetic relatedness among those species, phylogenetic analysis [based on simple sequence repeat (SSR)-anchored (also termed ISSR), and randomly amplified polymorphic DNA (RAPD) markers] was conducted among PIs of *P. fistulosus*, *Citrullus lanatus* var. lanatus (watermelon), *C. lanatus* var. citroides and the wild *Citrullus colocynthis*. Phylogenetic relationships were also examined with *Cucumis melo* (melon), *Cucumis sativus* (cucumber) and wild *Cucumis* species including *C. africanus*, *C. metuliferus*, *C. anguria*, *C. meeusei* and *C. zeyheri*. Wide genetic distance exists between Citrullus and Cucumis groups (8% genetic similarity). Phylogenetic relationships among Citrullus species and subspecies are closer (25–55% genetic similarity) as compared with those among most Cucumis species (14–68% genetic similarity). P. fistulosus appeared to be distant from both Cucumis and Citrullus species (genetic similarity between *P. fistulosus* and Cucumis or Citrullus groups is less than 3%). Although wide genetic differences and reproductive barriers exist among cucurbit species examined in this study, they are still considered as potential germplasm source for enhancing watermelon and melon crops using traditional breeding and biotechnology procedures.

Dane *et al*., (2004); evaluated the sequencing analysis of one coding and four noncoding cpDNA regions was conducted to infer biogeographic and evolutionary relationships in the genus *Citrullus*. Eighteen taxa from diverse geographical areas were included. A low number of parsimony informative characters (1.1%) were observed at the 4 kb section of cpDNA. Variability within *Citrullus* was detected primarily at noncoding regions of high A 1 T content. Substitution rates varied from 0–0.48% for *ndh*F with A 1 T content of 68.4% to 0.39– 1.69% for the intergenic region of *atp*A with A 1 T content of 82.8%, mainly resulting in indels and transversions. Indels at several regions acted as valuable parsimony informative markers. *Citrullus lanatus* var. *lanatus*, the cultivated watermelon and *C. ecirrhosus* and *C. rehmii* from Namibia, lacked molecular variability. The genus *Citrullus* is supported monophyletically and shows two main clades, one of which contains *C. colocynthis*. In the other clade, *C. rehmii* is sister to a clade containing *C. ecirrhosus* and *C. lanatus*. Two clades were recovered within *C. lanatus*, consisting of domesticated watermelon and wild citron, var. *citroides*. Five haplotypes within *C. colocynthis* were used to deduce colonization routes of the species. Biogeographic patterns point to separate colonization events into Africa and the Far East.

TRADITIONAL USES

Praecitrullus fistulosus may be a useful source of resistancebto whiteflies for the improvement of watermelons. Tinda is an immature fruits are used in rayata or vegetable curries**.** The seeds of tinda are roasted and consumed in the same way as watermelon or egusi seeds. In India tinda is used as fodder and in medicine. The entire immature fruit is used asa cooked vegetable. In India the fruits are also pickled and candied (Holland *et al*., 1991), (Javid *et al*., 2010).

MEDICINAL USES

Praecitrullus fistulosus is used for anthelmintic (Gautam *et al*., 2011) and antioxidant activity (Gautam & Shivhare, 2011). The glucose regulating role of three vegetable of *Cucurbita pepo*, *Cucumis sativus* and *Praecitrullus fistulosus* peels is also study (Hussain *et al*., 2010).

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