

## **Seed-borne, Post-harvest Diseases of Round Gourd (*Citrullus vulgaris* var. *fistulosus*) and its Nutritive Value**

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### **ABSTRACT**

Cucurbits, the largest group of summer vegetables are grown all over the tropical countries including India. Watermelon, cucumber, snack squash, pumpkin, snake melon, bottle gourd, sponge gourd, Round Gourd, bitter melon, squirting cucumber are the main cucurbits grown in Rajasthan. Round Gourd (*Citrullus vulgaris* var. *fistulosus*), main vegetable of summer are of great economic importance plant and as excellent source of vitamins, minerals and carbohydrates. It is attacked by several diseases like fungi, bacteria and viral that lowered the nutritive and market value of the crop.

**Key words:** Seed-borne, round gourd, post-harvest diseases, *Citrullus vulgaris* var. *fistulosus*

### **INTRODUCTION**

Cucurbits are the largest group of summer vegetables grown all over the tropical countries. In India, including Rajasthan, the main cucurbits grown are watermelon, cucumber, snack squash, pumpkin, snake melon, bottle gourd, sponge gourd, Round Gourd, bitter melon, squirting cucumber etc. Cucumber and round gourd are of Indian origin. In Rajasthan, the round gourd is main edible vegetable in summer. It is attacked by several diseases that lower the nutritive and market value of the crop. Cucurbits are of great economic importance plants and as excellent source of vitamins, minerals and carbohydrates. Many of them form the staple food, both in fresh and preserved form. *Citrullus vulgaris* var. *fistulosus* (syn. *Praecitrullus fistulosus* (Stocks) Pangalo Protologue, *Citrullus fistulosus* Stocks, *Citrullus lanatus* (Thunb) Matsum and Nakai var. *fistulosus* (Stocks) Chakrav) commonly known as squash melon, round melon (English) and tinda (Hindi and commonly used in other parts of the world) is one of the most popular summer vegetable crop in north India, especially in Punjab western Uttar Pradesh and Rajasthan. It is cultivated as a vegetable in India, Pakistan and Afghanistan. The origin of Round Gourd is probably north-western India, where wild types may still be found in the wild. In Africa it is cultivated locally, mainly in East Africa, as a vegetable for the Asian population. It is usually grown in small plots for the market and only rarely for home consumption. There is some limited export, mainly from Kenya and more recently also from Ghana, to the United Kingdom. It is also grown on a small scale in the United States. The fruits are harvested and cooked alone or mixed with other vegetables or pulses when the seeds are still soft. The demand is primarily from people of Indian origin. In Punjab,

Uttar Pradesh, Mumbai and Rajasthan, it is quite important as a cultivated market vegetable. In India, the entire immature fruit is used as a cooked vegetable also used as Pickle Candy and sometimes used as fodder and in medicine. The seeds are roasted and consumed in the same way as watermelon or egusi seeds (Choudhury, 1977; Hopkins and Thompson, 2002).

### **NUTRITIVE VALUE**

Squash melon has higher nutritive value than most of the other cucurbits. It contains 100 g<sup>-1</sup> of edible portion approximately: Moisture, 93.5%; protein, 1.4%; fats 0.2%; carbohydrates, 3.4%; fiber, 1.0%; calcium 21-25 mg, magnesium 14 mg, phosphorous 24 mg iron 0.9 mg, sodium 35 mg, potassium 24 mg copper 0.12, vitamin A 23 I.U., thiamine 0.04 mg, chlorine 44 mg, riboflavin 0.08 mg, nicotinic acid 0.3 mg, vitamin C 18 mg, oxalic acid 2 mg, energy 89 kJ (21 kcal), carotene 13 µg, niacin 0.3 mg (Holland *et al.*, 1991; Choudhury, 1977; Antonious and Kochhar, 2009). These values makes it also better than other vegetables.

### **BOTANICAL ASPECTS**

Botanically, it is annual, climbing or trailing herb, with robust, villous hairy stem, tendriller and slender. Leaves are alternate, simple, stipules absent; long petiol, hirsute; lamina ovate in outline, shallowly pinnatifid, cordate at base, margin finely dentate, hispid and hairy. The plant is monoecious, flowers usually solitary in leaf axils, comparatively small, regular, pentamerous, calyx campanulate, petals connate, yellow, hairy; male flowers with three stamens, female flowers with inferior, globose and hairy ovary. The fruit is a globose or depressed-globose berry (hispid when immature), pale to dark green outside and creamy white to pale green inside with many-seeded. Seeds are ovate-oblong, compressed, long, with ridged margin, smooth with black seed coat (CSIR, 1950; Whitaker and Davis, 1962).

### **AGRICULTURAL PRACTICES**

Round Guard is mainly cultivated in the lowlands, from sea-level up to approximately 1000 m altitude. It requires 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 grown either in the dry season (February to end of April) or in the rainy season (mid-June to end of July). Round Gourd prefers light or sandy soils but moderately fertile soil is required for early closure of the vegetative cover. It is pollinated predominantly by bees. The fruits are ready to harvest in 13-15 weeks from sowing, depending on temperature and growing conditions.

Irrigation is required before ploughing (in case of prolonged drought) and fertilizer applications depend on the nutrient status of the soil. One or two weedings are required before the stems cover the soil. The fruits of Round Gourd are harvested at the nearly mature green stage the seed is still soft and harvesting depending on prevailing moisture and temperature conditions. In India, an average yield of 10 t ha<sup>-1</sup> has been reported. The plant breeding work focuses on earliness, tenderness of the fruit, fruit size and yield. 'Arka' and 'Dilpas' are cultivars introduced from India to Kenya (Chadha and Lal, 1993).

Seeds of Round Gourd infected with the various microorganisms such as fungi, bacteria and viruses are responsible for the lower market and nutritive value of the vegetable and planting value of seeds.

**Diseases status:** The commonly occurring diseases of cucurbits, are: Alternaria leaf spot (*Alternaria cucumerina*, *A. alternata*), leaf spot (*Cladosporium herbarium*, *Cercospora citrullina*, *Colletotrichum capsaci*, *Phyllosticta citrullina*), downy mildew (*Pseudoperonospora cubensis*), powdery mildew (*Podosphaera xanthi*), anthracnose (*Colletotrichum orbiculare*), scab or gummosis (*Cladosporium cucumerinum*), septoria leaf spot (*Septoria cucurbitacearum*), gummy stem blight (*Didymella bryoniae*), charcoal rot (*Macrophomina phaseolina*), damping-off of seedlings and fungal root rots (species of *Pythium*, *Rhizoctonia*, *Fusarium*), angular leaf spot (*Pseudomonas syringae* pv. *lachrymans*), bacterial leaf spot (*Xanthomonas campestris* pv. *cucurbitae*), mosaic viruses (Watermelon mosaic virus Type 1 and 2), papaya ringspot virus and zucchini yellow mosaic virus (Neergard, 1977; Richardson, 1990; Singh, 2005; Watson and Napler, 2009).

Mukerji and Bhasin (1986) reported following species on the *Citrullus* spp.: Alternaria leaf spot (*Alternaria cucumerina*, *A. alternata*), leaf spot (*Cladosporium herbarium*, *Cercospora citrullina*, *Colletotrichum capsaci*, *Phyllosticta citrullina*, *Myrothecium roridum*, *Gleosporium* sp.), fruit rot (*Curvularia lunata*, *Fusarium equiseti*, *F. oxysporium*, *Geotrichum candidum*, *Pythium aphanidermatum*, *Trichothecium roseum*), rust (*Puccinia citrulli*), white rot (*Sclerotium rolfsi*), leaf, stem and fruit gall (*Synchitrium legendariae*), leaf gall (*Synchitrium trichosanthis*), powdery mildew (*Erysiphe cichoracearum*), anthracnose (*Colletotrichum capsaci*), wilt (*Fusarium oxysporium* f. sp. *niveum*), charcoal rot (*Macrophomina phaseolina*), soft rot (*Erwinia caratovora*), Mosaic viruses (Watermelon mosaic virus Type 1 and 2), papaya ringspot virus and zucchini yellow mosaic virus.

The range of diseases and pests that can be seen in Round Gourd corresponds closely with that of Watermelon. The most serious fungal diseases are downey mildew (*Pseudoperonospora cubensis*) and to a lesser extent powdery mildew (*Erysiphe cichoracearum* and *Sphaerotheca fuliginea*) and wet rot of fruit (*Choanephora cucurbitarum*). Another major disease of the fruit is anthracnose caused by *Colletotrichum gloeosporioides*. 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 (Schippers, 2004).

**Post-harvest diseases:** Fruit rot or cottony leak of cucurbits is a common disease of cucurbits in India. It occurs in almost every locality during the summer months when there is excess moisture during the rainy season. The disease has been reported on sponge gourd (*Luffa* spp.), snake gourd (*Trichosanthes anguina*), parwal (*Lodiocia* sp.), kheera (*Cucumis sativus*), bottlegourd (*Lagenaria siceraria*) and bittergourd (*Momordica indica*) and also other cucurbits. It is not only a field disease but market and transit disease also. Fruits may rot during transit and storage. The disease appears as a luxuriant woolly mycelial growth on the affected fruits. It is caused by *Pythium butleri* Subram and *Pythium aphanidermatum* (Eds.) Fitz. that causes cucurbit fruit rot. However, other species of *Pythium*, *Fusarium*, *Rhizoctonia* and *Phytophthora* may also be involved. Frequently, *Sclerotium rolfsi* has been found growing on fruits affected with cottony leak (Singh, 2005; Mehrotra and Aggrawal, 2005).

Alternaria blight and fruit rot of cucurbits is caused by several species of *Alternaria* that can attack the foliage of cucurbits causing spots on leaves and blight. Some species of *Alternaria* attack the fruits of muskmelon usually causing a dry rot. *Alternaria cucumerina* (Ellis and Everhart)

Elliott is one species that causes leaf spots. The species of *Alternaria* rarely attack young, vigorously growing plants. They live from one season to the next in diseased crop debris and cucurbit weed hosts. The feeding by the leaf minor, *Liriomyza trifolii* helps the pathogen in parasitizing the host.

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#### **REFERENCES**

- Antonious, G.F. and T.S. Kochhar, 2009. Mobility of heavy metals from soil into hot pepper fruits: A field study. *Bull. Environ. Contam. Toxicol.*, 82: 59-63.
- Chadha, M.L. and T. Lal, 1993. Improvement of Cucurbits. In: *Advances in Horticulture: Vegetable Crops*, Chadha, K.L. and G. Kalloo (Eds.). Vol. 5, Malhotra Publishing House, New Delhi, India, pp: 137-179.
- Choudhury, B., 1977. *Vegetables: India, the Land and the People*. 5th Edn., National Book Trust, New Delhi, India, Pages: 214.
- CSIR, 1950. *The Wealth of India: A Dictionary of Indian Raw Materials and Industrial Products*. Vol. 2, Council of Scientific and Industrial Research (CSIR), New Delhi, India, Pages: 427.
- Holland, B., E.M. Widdowson, I.D. Unwin and D.H. Bu, 1991. *Vegetables, Herbs and Spices: Fifth Supplement to McCance and Widdowson's the Composition of Foods*. 4th Edn., Royal Society of Chemistry, Cambridge, ISBN: 9780851863764, Pages: 163.
- Hopkins, D.L. and C.M. Thompson, 2002. Evaluation of *Citrullus* sp. germ plasm for resistance to *Acidovorax avenae* subsp. *citrulli*. *Plant Dis.*, 86: 61-64.
- Mehrotra, R.S. and A. Agrawal, 2005. *Plant Pathology*. 2nd Edn., Oxford and IBH Publishing Co. Ltd., New Delhi, Pages: 846.
- Mukerji, K.G. and J. Bhasin, 1986. *Plant Diseases of India*. Tata Mc Graw-Hill Publication Co. Ltd., New Delhi, Pages: 468.
- Neergard, P., 1977. *Seed Pathology*. Vol. 1-2, The Macmillan Press Ltd., London, UK., Pages: 1187.
- Richardson, M.J., 1990. *An Annotated List of Seed-Borne Diseases*. 4th Edn., International Seed Testing Association, Zurich, Switzerland, ISBN-13: 9783906549187, Pages: 345.
- Schippers, R.R., 2004. *Praecitrullus Fistulosus (Stocks) Pangalo*. In: *PROTA 2: Vegetables/Legumes [CD-Rom]*, Grubben, G.J.H. and O.A. Denton (Eds.). ROTA, Wageningen, Netherlands.
- Singh, R.S., 2005. *Plant Diseases*. Oxford and IBH Publishing Co. Ltd, New Delhi, Pages: 720.
- Watson, A. and T. Napler, 2009. *Diseases of cucurbit vegetables*. Primefact 832. [http://www.dpi.nsw.gov.au/\\_data/assets/pdf\\_file/0003/290244/diseases-of-cucurbit-vegetables.pdf](http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0003/290244/diseases-of-cucurbit-vegetables.pdf).
- Whitaker, T.W. and G.N. Davis, 1962. *Cucurbits: Botany, Cultivation and Utilization*. Leonard Hill Ltd., London, Pages: 250.