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***Review Article***

# SEED-BORNE AND POST-HARVEST DISEASES OF SPONGE GOURD (*LUFFA CYLINDRICA* (L.) ROX.) AND THEIR MANAGEMENT

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## ABSTRACT
Sponge gourd (*Luffa cylindrical* (L.) Rox.) or loofah is a valuable crop grown as tropical annual climbers cultivated for its edible young fruits. It is an important multipurpose vine crop extensively grown in Rajasthan. It has widely accepted nutrients used in desert areas. It suffers from a number of diseases. Fruit losses are greater during wet weather especially flowering stage relatively dry weather conditions. The plant is attacked by several diseases in the field. Besides the various diseases in the field caused by different microorganism, the post-harvest diseases are posing a great threat to the fruit and vegetable growers in the country. Harvested fruits and vegetables are vulnerable to attack by microorganisms because of their high moisture content and rich nutrients. Due to harvesting, packing and transportation, injuries of various kinds are caused which facilitate the entry of certain pathogens. The numerous diseases, which occur in transit and storage, result mainly from the activity of fungi and bacteria or are of non-parasitic origin.

***Keywords:*** *Sponge Gourd (Luffa Cylindrical (L.) Rox.), Cucurbitaceae, Loofah, Chemical Constitutions, Seed-Borne Diseases, Post-Harvest Diseases*

## INTRODUCTION
Crops belonging to the family Cucurbitaceae are generally known as cucurbits or gourds comprises of about 117 genera and 825 species in warmer parts. In India, Chakarvarthy (1982) estimated 36 genera and 100 species of cucumbers. These cucurbitaceous vegetable crops are widely grown and are consumed in various forms, e.g. salad (cucumber, gherkins, and long melon), pickles (gherkins), and deserts (melons) are also used for culinary purposes.
Among all the cucurbitaceous vegetables grown in India, various gourd vegetables occupy an area of 73273 ha with an annual production of 685224 tonnes.
In India, it is largely grown in Karnataka, Andhra Pradesh, Kerala, Tamil Nadu, Uttar Pradesh, Madhya Pradesh and Maharashtra states.
In Rajasthan, it produced in Dungerpur, Banswara, Ranakpur, Sirohi, Sagwada, Kherwada, Udaipur, Jaisamand, Rajsamand, Malvi, Falna, Pindwada, Jhalawad and Gogunda (Anonymous, 2004, Kumar *et al.*, 2013).
The synonyms of *Luffa cylindrica* (L.) Rox. are *Luffa fluminensis* M.J. Roem.; *Cucumis acutangulus* L.; *Cucurbita acutangula* (L.) Blume; *Luffa foetida* Cav.; Luffa *plukenetiana* Ser.; *Luffa hermaphrodita* Singh & Bandhari; *Momordica luffa* Vell) of cucurbitaceae, commonly known as sponge gourd originated in India (Stephens, 2003).
The plant is cultivated in many countries, including Brazil, Africa and Indo-Burma (Mazali and Alves, 2005) areas but commercially it is produced in countries like China, Korea, India, Japan and Central America (Bal *et al.*, 2004; Oboh and Aluyor, 2009).
In the different parts of India it is also known as torai in hindi and urdu, bhol in assamese, jhinga in bengali, janhi in oriya, gisoda in gujarati, pirkanga in tamil, beerakaya in telugu, heeray kayi in kannada, peechinga in malayalam, patola in tagalog, kabatiti in ilocano, gambas or oyong in Indonesian and wetakolu in sinhala in various languages.
The active principles of medicinal plants are commonly concentrated in storage organs as leaves, roots and seeds (Kochhar, 1981). The seed of *L. cylindrica* contains polypeptides (Pal, 2011, Pratap *et al.*,

2012). The seeds were characterized with respect to their proximate mineral and energy using standard analytical technique. The range values of the proximate analysis for raw and defatted samples were; crude protein (42.17-70.65%), moisture (5.69-6.42%), fat content (1.53-33.64%), ash content (3.87-3.92%), crude fibre (1.95-2.80%), carbohydrate (12.68-14.68%) and the available energy range (1507.53-2177.13KJ). The minerals determined and their range values in mg/100g for raw and defatted samples were; K (910-960), Na (28-31), Zn (0.86-1.50), Mg (16-18), Fe (4.67-6.23), P (680-660), Ca (40.24-43.44), Mn (4.20-4.47) and Cu (1.10-1.24). The results revealed that crude protein was higher in defatted sample (Abitogun *et al.*, 2010).

***Review of Literature***

In sponge gourd disease spread widely in rainy season. The rain splash may play an important role in the rapid spread and aerial infection of the pathogen. Plants produce many substances for self-defence against microbial infection and deterioration. These photochemical possess potential significant therapeutic applications against human pathogens such as bacteria and fungi (Perez, 2003).

***International Status***

*Fungal Diseases*

There are reports of a few diseases of sponge gourd e.g. Powdery mildew, downy mildew, fruit rot, anthracnose, roots rot (Kamal and Moghal, 1968; Maholay, 1989; Zitter *et al.*, 1996).

Some of the fungal species reported from seeds of sponge gourd are *Altenaria alternata, Aspergillus flavus, A. niger, Botryodiplodia theobromae, Chaetomium sp., Curvularia lunata, Drechslera tetramera, Fusarium equiseti, F. moniliforme, F. solani, Macrophomina phaseolina, Myrothecium roridum, Rizoctonia solani, Sclerotium rolfsii and Trichoderma sp.* The important diseases are Alternaria rot (*Alternaria alternata*), belly rot (*Rhizoctonia solani*), cottony leak (*Phythium sp.*), Rhizopus soft rot (*Rhizopus stolonifer*), Botryodiplodia rot (*Botryidiplodia theobromae*), Fusarium rot (*Fusarium sp.*), and waxy rot (*Geotrichum candidum*) (Manthachitra, 1971; Richardson, 1979; Maholay, 1989; Shakir and Mirza, 1992; Annonynous, 2004; Naureen *et al.*, 2009).

Fruit Rot (*Stagonosporiopsis cucurbitacearum*) disease observed in Brazil (Silva *et al.*, 2013) and powdery mildew (*Podosphaera xanthii*) has been reported in Kentucky (Holiday and Puithelingham, 1972).

Downy mildew is an important disease caused by *Pseudopernospora cubensis*. This fungus is common cucurbit pathogen worldwide and also reported in Brazil (Soares *et al.*, 2005).

In 2004 and 2005, Phytophthora rot caused by *Phytophthora nicotianae* on *L. cylindrica* has been reported in Korea (Kwon and Hyeong, 2006); gray mold disease (*Botrytis cinerea*) reported in Taiwan. Symptoms appear as small, brown spots on the flower petals and cause blossom (Ko *et al.*, 2007), anthracnose disease (*Glomerella magna* and *Colletotrichum orbiculare*) from Taiwan (Tsay *et al.*, 2010) and foliar blight disease (*Didymella bryoniae*) (Keinath, 2014). The most progress for disease management is to use sources of resistant varieties for most of the major pathogens (Robinson and Decker-Walters, 1999).

There are numerous reports of potentially valuable biological control microorganisms. Various species of *Trichoderma* has been widely used as antagonistic fungal agents against several pests as well as plant growth enhancers. Anti-microbial metabolites and physiological conformation are key factors which chiefly contribute to antagonism of these fungi (Verma *et al.*, 2006). There are few reports where fungicides have been used for the control of disease caused by *L. theobromace* under laboratory condition.

*Bacterial Diseases*

Leaf spot disease is an important bacterial disease of bottle gourd and attack on leaves. The disease is caused by *Pseudomonas cichorii* and *Pseudomonas syringae.* White colour colonies identified on the seedlings of *L. cylindrica* and confirm bacterium was *Pseudomonas syringae pv. lachrymans* (Shila *et al.*, 2013). The bacterium was consistently isolated from diseased leaf tissues (Li *et al.*, 2014) in China.

These seed-borne bacteria impaired germination and emergence of seedlings and reduce yield and quality of cucurbits are of major concerns for cucurbit production throughout the world.

*Viral Disease*

Cucurbit Yellow Vine Disease (CYVD) is caused by *Serratia marcescens* causes phloem discoloration, chlorosis and wilting in USA (Bruton *et al.,* 2003). Cotton leaf curl Burewala virus and cognate Cotton leaf curl reported on *L. cylindrica* in Pakistan (Mansoor *et al.,* 2006; Rehman *et al.,* 2013). Zucchini yellow mosaic virus attacks on *sponge* gourd and infect it easily. *Fevillea trilobata* is a natural host in Brazil (Boiteux *et al.,* 2013).

***National Status***

*Fungal Disease*

Sponge gourd infected by several diseases as fruit rot (*Fusarium oxysporum, Aspergillus niger, Alternaria alternata, Fusarium semitectum* and *Geotrichum candimum*) (Mukherji and Bhasin, 1986), downy mildew (*Pseudoperonospora cubensis*) reported from north India (Buler, 1968) on more than 20 cucurbits (Fugro, Rajput and Mandokhot, 1997), Alternaria leaf blight (*Alternaria cucumerina*), belly rot (*Rhizoctonia solani*) (Mukherji and Bhasin, 1986), cottony leak (*Pythium* spp.) characterized by a soft, wet rot and the presence of profuse, fuzzy (cottony) growth of mycelium, or fungal threads, covering part or all of infected fruit (Neergard, 1977) and Choanephora fruit rot (wet rot) (*Choanephora cucurbitarum*). The high moisture and warm temperatures favour this disease, characterized by a wet rot of blossoms and later the blossom end of fruit.

*Bacterial Diseases*

Angular leaf spot (*Pseudomonas syringae* pv. *lachrymus*) disease is appears on leaves and stems location along the vascular system which extends to the seeds. The Pathogeni city test revealed that the bacterium was able to cause leaf spot symptom on the seedlings of *Luffa cylinderica* (Neergard, 1977; Singh, 1999). Bacterial wilt is caused by *Erwinia tracheiphila*, appears initially as a sudden wilt of the vines in small sections, progressing later to large-scale collapse of vines (Mukherji and Bhasin, 1986).

*Virus Diseases*

*Luffa cylindrica* is affected by Tomato Leaf Curl Virus (Varma and Giri, 1998) causing yellow spots on newly emerged leaves, mosaic, mild leaf (Sohrab *et al.,* 2003; Tiwari *et al.,* 2012) in Delhi. Leaf samples with and without symptoms of Yellow mosaic disease of chayote in India was tested for possible virus infection (Mandal *et al.,* 2004).

In Pune (India), the symptoms confirmed of Papaya ring spot virus using enzyme-linked immunosorbent assay (ELISA) (Verma *et al.,* 2006). This virus was easily transmitted by whitefly (*Bemisia tabaci*) (Castillo *et al.,* 2011). The screening of *L. cylindrica* against ToLCNDV has been reported (Islam *et al.,* 2010).

*Post-Harvest Diseases*

Most severe post-harvest diseases in smooth gourd fruits cause heavy losses to the nutrients of the fruits. Infection spreads in internal tissues of fruits, while cottony fungal growth completely covers the luffa fruits. It suffers from a number of disease, but in present study heavy losses in fruits were recorded by the infection of Anthracnose (*Colletotrichum orbiculare*), Belly rot (*Rhizoctonia solani*), Phytophthora fruit rot (*Phytophthora capsici*), Choanephora fruit rot (*Choanephora cucurbitarum*) and cottony leak (*Pythium* sps) from Kota district of Rajasthan.

Fruit losses are greater during wet weather especially flowering stage relatively dry weather conditions (Varma *et al.,* 2015).

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