

## SEED-BORNE AND POST-HARVEST DISEASES OF CUCUMBER (*CUCUMIS SATIVUS* L.) AND THEIR MANAGEMENT

**\*Dilip Kumar Sharma**

Vardhaman Mahaveer Open University (VMOU), Kota, Rajasthan, India

\*Author for Correspondence

### ABSTRACT

Cucumber (*Cucumis sativus* L.) is a valuable crop with diverse pharmacological spectrum grown as tropical annual climbers cultivated for its edible young fruits. It is an important multipurpose crop extensively grown in Rajasthan with widely accepted nutrients used in desert areas. Medicinally, it is widely used in Ayurveda, Siddha, Chinese medicine etc. The fruits of cucumber are laxative, astringent, anthelmintic, antipyretic, used in diseases as hepatitis, bronchitis, asthma, dyspepsia, piles, diarrhoea and hair tonic. It has medicinal, pharmacological and ethnobotanical uses. Pharmacologically is as antibacterial, antifungal, antidiabetic, cytotoxic, antacid, carminative activity, hepatoprotective and wound healing activities. The crop is attacked by several diseases that reduced the quality and quantity or market price of the crop. Harvested fruits and vegetables are vulnerable to attack by microorganisms because of their high moisture content and rich nutrients. 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. The plant is attacked by numerous diseases caused by fungi, bacteria, viruses and insects or are of non-parasitic origin.

**Keywords:** *Cucumber, Cucumis Sativus L., Cucurbitaceae, Seed-Borne Diseases, Post-Harvest Diseases*

### INTRODUCTION

The *Cucumis sativus* L. (cucumber) of family Cucurbitaceae is a widely cultivated plant in the entire world especially in Asia, Africa and South America. It contains several bioactivities compounds like glucose and lipid lowering effects, diuretic, demulcent and anti-helminthic actions (Trease, 2002; Han, 2008). In 2002, the world area under *Cucumis sativus* was estimated at about 2 million ha, with a total production of 36 MTs. Asia is the world leader with China alone accounting for over 60% production. In 2002, Africa produced 507,000T on 25,000 ha, accounting for just under 1.5% of production. Egypt is the largest African producer with 360,000T.

*Cucumis sativus* is commonly known as Cucumber, garden cucumber, apple cucumber, gherkin, concomb or cornichon (French), pepino (Spanish and Portuguese), huang gua (pinyin, China), khira (Pakistan) etc. (Reznicek *et al.*, 2011; Anonymous, 2013a; Anonymous, 2013b).

### Nutritional Value

The nutritional composition of cucumber per 100 g edible portion (ends trimmed, not peeled, edible part 97%) is water 96.4 g, energy 42 kJ (10 kcal), protein 0.7 g, fat 0.1 g, carbohydrate 1.5 g, dietary fibre 0.6 g, Calcium 18 mg, Magnesium 8 mg, Phosphorus 49 mg, Iron 0.3 mg, Zinc 0.1 mg, carotene 60 µg, thiamin 0.03 mg, riboflavin 0.01 mg, niacin 0.2 mg, folate 9 µg and ascorbic acid 2 mg (Holland *et al.*, 1991).

### Medicinal and Pharmacological Action

The fruits of cucumber are laxative, astringent, anthelmintic and antipyretic; useful in hepatitis, bronchitis, asthma, dyspepsia, piles, diarrhoea, coughs hoarseness of voice, eye diseases, scorpion-sting and used as a hair tonic. Decoction of the green fruit is used for cough. The pulp of fruit is useful in dysenteric-diarrhoea, dropsy, piles and leprosy. Some times the half ripe fruit is used as purgative.

*Cucumis sativus* is an important medicinal plant with pharmacological activities such as antibacterial, antifungal, antidiabetic, cytotoxic, antacid, carminative activity, hepatoprotective and wound healing activities. The plant is used in the treatment of gastric ulcer, constipation, general debility and piles and provides a significant role in the prevention or treatment of a diseases (Mallik *et al.*, 2013).

### **Review Article**

Ethnobotanical cucumbers are consumed raw or pickled (gherkin). Mature uncooked cucumbers bring relief for individuals suffering from celiac disease or used to promote skin health. Immature cucumbers can be cooked and consumed to treat dysentery. The fruit is also valued in the cosmetic industry used to soften the skin. The seeds can be used to expel parasitic worms. Edible oil can be extracted from the seeds and used for cooking. The juice from the leaves induce vomiting and aid digestion. The seedlings are toxic and should not be consumed. A poultice made from fresh cucumbers can be applied to burns and open sores.

#### **Botanical Feature**

The botanical synonyms of *Cucumis sativus* are *Cucumis esculentus* Salisb., *C. hardwickii* Royle, *C. muricatus* Willd., *C. rumphii* Hassk., *C. setosus* Cogn., *C. sphaerocarpus* Gabaev, *C. vilmorinii* Sprenger (Anonymous, 2013b).

The plant is herbaceous prostrate, angular covered in white pubescence vine stems and unbranched tendrils. Leaves are alternate and simple with 3-7 palmate lobes and serrated margins. It bears yellow pentamerous flowers bearing either female or male organs. The flower is monoecious and its axillary flowers are actinomorphic and rarely bisexual. Both staminate and pistillate flowers have a pubescent 5-parted calyx composed of long white pubescent sepals. The sepals are long narrow and acute, on pistillate flowers the calyx is fused to the ovary and forms a hypanthium. The corolla is yellow fused less than half of its length, campanulate, 5-parted with oblong to lanceolate lobes. Staminate flowers are solitary or 3-7 on pubescent pedicels, bearing 3 stamens, of which two have 2-celled anthers and one a 1-celled anther. Each plant produces up to 25 fruits and fruits are hairless cylindrical fruits warty yellow to green. The fruit is an indehiscent cylindrical berry with many seeds. The white seeds are emarginate and elliptical with pointed ends.

#### **Review of Literature**

The crop is subjected to the attack of many diseases affecting roots, leaves, stems and fruits. The severity of diseases depends on the season and the region in which the crop is grown. The diseases mostly 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.

Richardson (1979), in an annotated list of seed-borne diseases reported the seed borne pathogens as *Alternaria cucumerina* (leaf spot), *Ascochyta* sp., *Cladosporium cucumerinum* (scab, gummosis), *Colletotrichum lagenarium* (anthracnose), *Corynespora cassicola* (cercospora leaf spot), *Didymella bryoniae* (leaf spot, black rot), *Fusarium oxysporum*, *Fusarium oxysporum* f. sp. *cucumerinum*, *Fusarium solani* f.sp. *cucurbitae*, *Myrothecium verrucaria*, *Pythium aphanidermatum* (rotting of seeds), *Pseudomonas syringae* pv. *lachrymans* (angular leaf spot), *Xanthomonas campestris* pv. *cucurbitae* (bacterial leaf spot), Cucumber green mottle mosaic virus, Cucumber leaf spot virus and Cucumber mosaic virus.

Mukherji and Bhasin (1986) also reported the seed-borne diseases namely seed and fruit rot (*Alternaria alternata*), leaf spot (*Cercospora chidamberensis*, *C. citrullina*), anthracnose on fruit and leaf (*Colletotrichum capsici*), anthracnose on leaf, petiole and fruits (*C. lagenarium*), anthracnose of foliage and fruit (*C. orbiculare*), on leaf and seed (*Curvularia lunata*), fruit rot (*C. pallescens*, *Drechslera hawaiiensis*, *Myrothecium roridum*, *Rhizoctonia solani*), leaf spot (*D. rostrata*), powdery mildew (*Erysiphe cichoracearum*), on stored seed (*Fusarium* sp.), charcoal rot (*Macrophomina phaseolina*), downy mildew (*Pseudoperonospora cubensis*), fruit rot and root rot (*Pythium aphanidermatum*), blight and fruit rot (*Sclerotium rolfsii*), leaf, stem and fruit gall (*Synchytrium lagenariae*, *S. trichosanthis*, *Synchytrium wuthii*), fruit and root rot (*Thielaviopsis paradoxa*) and bacterial soft rot (*Erwinia caratovora*). In this article the review has been classify international and national status and types of pathogens.

#### **International Status**

##### **Fungal Diseases**

## Review Article

Downy mildew is an important disease of *Cucumis sativus* caused by *Pseudoperonospora cubensis* (China) (Zhang *et al.*, 2013) and gummy stem blight incited by *Didymella bryoniae* (New York) (Zuniga *et al.*, 1999). Phytophthora blight is caused by *Phytophthora melonis* in cucumber becomes a constraint for sustainable production of the cucumber in China which can be controlled by metalaxyl fungicide (Sheng *et al.*, 2011). *Phytophthora capsici* causes root rot, crown rot, leaf and stem blight and fruit rot of cucumber. Systemic resistance induced by *Trichoderma hamatum* 382 in cucumber against Phytophthora rot, crown rot and leaf blight (Khan *et al.*, 2011).

In another study the minerals also found useful in the treatment of diseases as Silicon significantly inhibited mycelial growth of *Alternaria alternata*, *Fusarium semitectum* and *Trichothecium roseum* that inhibited post-inoculation (Bi *et al.*, 2006). *Aphanomyces euteiches*, *Colletotrichum lindemuthianum*, *Pseudomonas syringae* pv. *lachrymans*, *P. syringae* pv. *syringae* and *Pythium* spp. isolated from *cucumis sativus* in Madison (Stone *et al.*, 2003). In Canada, a formulation of phosphonate (AG3) was tested as a seed treatment for the control of *Pythium* damping-off of cucumber (Abbasi *et al.*, 2006).

### Bacterial Diseases

Plant is effected by several bacterial pathogens and degrade the quality of the crop. *Erwinia tracheiphila* isolated from cucumber plant in Pennsylvania (Mackiewicz *et al.*, 1999).

### Viral Diseases

Diseases caused by aphid-transmitted virus Cucumber mosaic virus (CMV) have increased in the Midwestern United States (Mueller *et al.*, 2013), Zucchini yellow mosaic virus in Brazil (Boiteux *et al.*, 2013). *Serratia marcescens* causes Cucurbit yellow vine disease in cucumber. It causes phloem discoloration, chlorosis and wilting (Bruton *et al.*, 2003).

## National Status

### Fungal Diseases

Downy mildew (*Pseudoperonospora cubensis*), alternaria leaf blight (*Alternaria cucumerina*), belly rot (*Rhizoctonia solani*), cottony leak (*Pythium* spp.), Choanephora fruit rot or wet rot (*Choanephora cucurbitarum*) 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 (Buler, 1968; Neergard, 1977; Mukherji and Bhasin, 1986). The high moisture and warm temperatures favor this disease, characterized by a wet rot of blossoms and later the blossom end of fruit. Fruit damage can be caused by scab (*Cladosporium cucumerinum*), a fungus that also attacks the leaves of susceptible cultivars, by bacterial soft rot (*Erwinia*), phytophthora fruit rot (*Phytophthora capsici*) and belly rot (*Rhizoctonia solani*).

Wounds on fruits are often the starting points of infection. Belly rot is soil-borne and infects the fruits at the place where they touch the soil; preventing contact.

Fungal diseases observed in northern India are *Alternaria* sp., *Cercospora citrullina*, *Choanephora cucurbitarum*, *Myrothecium roridum*, *Oidium tabaci* and *Sclerotium rolfsii*. Wilt is an another important disease in cucumber caused by soil-borne fusarium (*Fusarium oxysporum* f. sp. *cucumerinum*).

Powdery mildew (*Erysiphe cichoracearum* and *Sphaerotheca fuliginea*), anthracnose (*Colletotrichum lagenarium*), target leaf spot (*Corynespora cassiicola*) and gummy stem blight (*Didymella bryoniae*) are another disease which can be controlled by spraying of systemic fungicides such as benomyl (benlate) or metalaxyl (ridomil) that reduce the spread of pathogen.

They can be alternated with broad spectrum fungicides such as copper oxychloride (vitigran Blue) or mancozeb (dithane) (Neergard, 1977; Richardson, 1979; Mukherji and Bhasin, 1986).

### Bacterial Diseases

Angular leaf spot disease is caused by *Pseudomonas lachrymans* is a threat in the production of cucumber. It also produced symptoms on fruits and reduced the production and quality of the crop. Bacterial wilt (*Erwinia tracheiphila*) is important bacterial disease which spread by cucumber beetles in India (Mukherji and Bhasin, 1986).

### Virus Diseases

Commonly found viruses that can cause considerable yield losses in cucumber in the tropics are the aphid-borne cucumber mosaic virus (CMV), zucchini yellow mosaic virus (ZYMV), papaya ringspot

### Review Article

virus (PRSV) and a range of whitefly transmitted viruses that cause yellowing such as cucumber vein yellowing virus (CVYV) and cucumber yellows virus (CYV). Cucumber green mottle mosaic virus (CGMMV) is another important virus highly seed transmitted. Special care must be taken not to grow seeds produced on infected plants; CGMMV can be easily spread mechanically, but it is unknown whether there is an insect or other vector (Verma *et al.*, 2004).

### Conclusion

Cucumber (*Cucumis sativus* L.) of cucurbitaceae is a valuable multipurpose crop extensively grown in Rajasthan with widely accepted nutrients used in desert areas. It is widely used in Ayurveda, Siddha, Chinese medicine etc. But due to attack of several diseases it reduced the quality and quantity or market price of the crop. Various diseases in the field are caused by different microorganism. Besides, the post-harvest diseases are posing a great threat to the fruit and vegetable growers. Further research is required for the better yield and control of various such diseases.

### ACKNOWLEDGEMENT

Author is grateful to Prof. Ashok Sharma, vice-chancellor, VMOU, Kota, Prof. RS Khangrot, Principal, Agrawal P.G. College, Jaipur and faculty members of P.G. Department of Botany for valuable support and academic guidance.

### REFERENCES

- Abbasi PA and Lazarovits G (2006).** Seed treatment with phosphonate (ag3) suppresses *Pythium* damping-off of cucumber seedlings. *APS Journals* **90** 459-464.
- Anonymous (2013a).** *Tropicos.org. Missouri Botanical Garden.* Available: <http://www.tropicos.org/Name/9200572>.
- Anonymous (2013b).** *USDA, NRCS the PLANTS Database* Available: (<http://plants.usda.gov>). (National Plant Data Team, Greensboro, NC 27401-4901 USA).
- Bi Y, Tian SP, Guo YR, Ge YH and Qin GZ (2006).** Sodium silicate reduces post-harvest decay on hami melons: Induced resistance and fungistatic effects. *APS Journals* **90** 279-283.
- Bruton BD, Mitchell F, Fletcher J, Pair SD, Wavandande A, Melcher U, Brady J, Bextine B and Popham TW (2003).** *Serratia marcescens*, a phloem-colonizing, squash bug-transmitted bacterium: Causal agent of cucurbit yellow vine disease. *Plant Disease* **87** 937–944.
- Buler EJ (1968).** *Fungi and Disease in Plants (Revised)*, (Thacker Spink and Co., Culcutta, India) 98.
- Han C, Hui Q and Wang Y (2008).** *Natural Product Research* **22** 1112-1119.
- Holland B, Unwin ID and Buss DH (1991).** *Vegetables, Herbs and Spices. The Fifth Supplement to McCance & Widdowson's The Composition of Foods.* 4th edition, (Royal Society of Chemistry, Cambridge, United Kingdom) 163.
- Khan J, Oaka JJ, Miller SA and Madden LV (2004).** Systemic resistance induced by *Trichoderma hamatum* 382 in cucumber against phytophthora crown rot and leaf blight. *APS Journal* **88**(3) 280-286
- Mackiewicz D, Gildow FE, Blua M, Fleischer SJ and Lukezic FL (1998).** Herbaceous weeds are not ecologically important reservoirs of *Erwinia tracheiphila*. *APS Journal* **82** 521-529.
- Mallik J, Das P and Das S (2013).** Pharmacological activity of *Cucumis sativus* L. a complete overview. *Asian Journal of Pharmaceutical Research and Development* **1**(1) 1-6.
- Mueller EE, Groves RL and Gratton C (2012).** Crop and non-crop plants as potential reservoir hosts of alfalfa mosaic virus and cucumber mosaic virus for spread to commercial snap bean. *APS Journals* **96** 506-514.
- Mukerji KG and Bhasin J (1986).** *Plant Diseases of India*, (Tata Mc Graw-Hill Publication Co. Ltd. New Delhi, India) 468.
- Neergaard P (1977).** *Seed Pathology*, (The MacMillan Press ltd., London, UK) 1187.
- Reznicek AA, Voss EG and Walters BS (2011).** *Michigan Flora Online*, University of Michigan. Available: <http://www.michiganflora.net/species.aspx?id=881>.

**Review Article**

**Richardson MJ (1990).** An annotated list of seed-borne disease (4<sup>th</sup> edition). *Proceeding of the International Seed Testing Association* Zurich, Switzerland.

**Wu Y, Lu S, Huang S, Fu G, Chen L, Xie D, Li Q and Cen Z (2011).** Field resistance of *Phytophthora melonis* to metalaxyl in South China. *Wei Sheng Wu Xue Bao* **51**(8) 1078-1086.

**Stone GA, Vallad GE, Cooperband LR and Rotenberg D (2003).** Effect of organic amendments on soil-borne and foliar diseases in field-grown snap bean and cucumber. *APS Journal* **87** 1037-1042.

**Trease GE and Evans WC (2002).** *Trease and Evans Pharmacognosy*, 15th edition, (UK, London: WB Saunders) 419, 420, 469, 473.

**Verma R and Tomer S (2004).** Zucchini yellow mosaic virus in cucumber in India. *APS Journal* **88**(8) 906.

**Zhang SP, Liu MM and Miao H (2013).** Chromosomal mapping and qtl analysis of resistance to downy mildew in *Cucumis sativus*. *APS Journal* **97** 245-251.

**Zuniga TL, Jantz JP, Zitter TA and Jahn MK (1999).** Monogenic dominant resistance to gummy stem blight in two melon (*Cucumis melo*) accessions. *APS Journal* **83** 1105-1107.