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Fruit and Vine Rot of Pointed Gourd (*Trichosanthes dioica* Roxb.) as Influenced by Planting Systems and Weather Parameters in East Coast Region of India

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Fruit and vine rot of pointed gourd (*Trichosanthes dioica*) caused by *Phytophthora melonis* Katsura is a potential disease that occurs extensively in major pointed gourd growing regions of the country. In order to record the effect of planting systems on the incidence and severity of this disease, a study was conducted under trellis and soil bed system of planting during 2015. The study revealed that crop grown in soil bed system had exhibited the vine and fruit rot to the tune of 34.8 and 39.0 percent, respectively during peak rainy season. In trellis system during the study period, there was no fruit and vine rot incidence, however, leaf blight severity to the tune of 2.8 percent was observed as against 28.8 percent in soil bed system. Only the leaf blight was confined to lower most leaves in trellis system. Disease severity was more in soil bed system in rainy season as against other season. Nearly, 40% mortality was observed in seedlings prepared from cuttings taken from soil bed system. Hence on based this study, it was concluded that pointed gourd crop grown on trellis can potentially reduce the leaf, vine and fruit rot severity especially when cropping period coincides with rainy season.

Keywords: Pointed gourd, *Phytophthora melonis,* leaf blight, fruit rot, vine rot.

Cucurbits constitute about 5.6% of total vegetable production in India. Pointed gourd (*Trichosanthes dioica* Roxb., Cucurbitaceae) is a tropical perennial cucurbit originated in Bengal-Assam area of the Indian subcontinent (Chowdhury, 1996) and it is commercially cultivated in Jharkhand, Bihar, Odisha, Eastern UP and West Bengal. Some of the popular varieties of pointed gourd in these regions are Swarna Alaukik, Arka Neelachal Kirti, Rajendra Parwal and Swarna Rekha. Traditionally the crop is either grown in soil bed or trained on bower/trellis system. Since this vegetable is grown during hot humid climate, it suffers from as many as eleven diseases in different parts of India. During its main growing season, pointed gourd encounters several fungal diseases like downy mildew *(Pseudoperonospora cubensis),* fruit and vine rot (*Phytophthora melonis* (previously referred as *P. cinnamomi*), stem rot *(Sclerotium rolfsii),* anthracnose *(Colletotrichum capsici),* fruit rot *(Pythium aphanidermatum),* net blight *(Rhizoctonia solani)* (Saha *et al*., 2004) and few viral diseases (Jones *et al*., 2000).

Fruit and vine rot of pointed gourd has been reported to cause major loss to the farmers in West Bengal (Khatua and Maiti, 1982) as it appears every year and causes severe damage (Saha *et al*. 2004). Guharoy *et al*. (2006) confirmed the pathogen causing fruit and vine rot of pointed gourd as *Phytophthora melonis* by morphological as well as by molecular tools, based on ITS-RFLP (Restriction Fragment Length Polymorphism of Internal Transcribed Spacer region) and by ITS

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region sequencing. In cucurbit crops, several *Phytophthora* spp. cause seedling damping off, root and crown rot, leaf spots, stem lesions, foliar blight and fruit rot (Chowdappa, 2015). During recent past, occurrence of fruit and vine rot in pointed gourd has also been observed in Odisha in moderate to severe form during southwest monsoon under soil bed system wherein the vines spread on the ground. Since *Phytophthora* sp. is a soil borne pathogen, during favourable weather conditions, pathogen quickly infects the leaves, vines and fruits touching the soil.

Farmers traditionally cultivate pointed gourd either on flat soil bed system or bower system based on their age old experience. Even though the soil bed system does not require any additional initial cost as that of trellis system, it poses difficulty in intercultural and spraying operations. According to Khatua (2004), field sanitation combined with elaborate fungicide schedule is required to manage and restrict the disease spread. The fungicide solution has to reach the lower surface of leaves and fruits touching on the ground beneath the leaves and vines for providing sufficient control. However, due to lack of accessibility, the spray solution seldom reach the target site in soil bed system.

Hence, the present study was carried out to study the influence of planting systems and weather parameter on *Phytophthora* leaf blight, vine rot and fruit rot disease in East coast region of India. Detailed symptom description observed under both planting system has also been documented.

MATERIALS AND METHODS

The present investigation was carried out during 2014-15 at the experimental farm of Central Horticultural Experiment Station, Bhubaneswar, Odisha, situated at a Latitude: 20° 15'N, Longitude : 85° 52' E and an altitude of 25.9 meters above the mean sea level with the normal maximum and minimum temperatures of 32.4°C and 25°C respectively. The region receives an average annual rainfall of 1450 mm, distributed approximately in 69 days. About 80% south-west monsoon rainfall is received in 53-57 days during the months of June to September. The observations were recorded from an existing experiment maintained in two planting system viz., soil bed system and trellis system with cv. Swarna Alaukik where in data was collected following RBD with three replications. The vines raised in soil bed system yield more number of vine cuttings, observations were also taken in nursery for seedling rot due to *Phytophthora* infection. Single line trellis system consists of wooden /iron pole and four tiers of wire or jute thread fastened in vertical manner in a cris-cross way to ensure the support for spreading of vines. Periodical observations were taken on the incidence of leaf blight, fruit and vine rot at different growth stages of the plant in both the system. Visual observation of symptoms on different plant parts were also recorded in both planting systems on three randomly selected quadrates (1x1 m) in the experimental field at fortnightly basis. Diseased and healthy plants/vines/fruits on randomly selected area were counted, averaged and disease incidence was calculated by the following formula.

$$\text{Fruit rot incidence}(\%) = \frac{\text{Number of infected fruits}}{\text{Total number of fruits observed}} \times 100$$

$$\text{Vine rot incidence}(\%) = \frac{\text{Number of infected vines}}{\text{Total number of vines observed}} \times 100$$

The per cent leaf blight severity was calculated according to McKinney (1923). A scale from 0 to 5 was used for estimation of leaf blight severity, wherein, 0 grade; No disease, 1 grade; 1-10 % disease, 2 grade; 11-25% disease, 3 grade; 26-50% disease, 4 grade ;51-75 %, 5 grade >75% disease.

$$\text{Leaf blight severity (\%)} = \frac{\text{Sum of all disease ratings}}{\text{Total number of ratings x maximum disease grade}} \times 100$$

RESULTS AND DISCUSSION

All parts of the vine were vulnerable to the disease and the expression of symptoms depended upon plant part infected and severity of damage. Severity of leaf blight and incidence of fruit and vine rot in pointed gourd was assessed with detailed symptomotology which is described below.

Leaf blight

The infection initiated primarily from petioles/leaf blades/ tip of the leaves. If rain continued for a few consecutive days under warm conditions, the lesions developed with light brown to olive-green borders, expanded rapidly to cover

the entire leaf, and caused extensive blighting and leaf rot (Fig. 2). Under unfavourable conditions, development of leaf blight symptoms ceased.

Fruit rot

Fruit rot symptom was noticed from young immature fruit stage to matured fruit stage. In most cases, fruit rot typically started on the underside of the fruit, which was in contact with the soil. Rotting usually started from the fruit tip. However sometimes when an infected leaf or vine came in contact with a fruit, disease started from middle of the fruit too. Fruit rot typically appeared as a water-soaked lesion and affected area became soft, water soaked and light brown in colour (Fig 3). Infection progressed rapidly and resulted in complete collapse of the fruit. In field, prominent white mycelial growth could be seen on infected fruits under wet condition and abundant sporangia were formed on such growth. However, under dry conditions, the rotten fruits shrivelled, dried and remained attached to the vine. Almost all the cucurbits are reported to be susceptible to *Phytophthora* infection and similar kind of observations were made by Babadoost (2000) in pumpkin infected by *P. capsici.*

Vine rot

The first noticeable symptom of the disease in field condition was drying of vines in isolated individual vines or patches under saturated field condition. Initially, water-soaked lesions developed on the vines of dark olive colour, which later became dark brown in few days. Often plants died within few days of the first appearance of symptoms if the soil was saturated by excessive rain. The vine/stem near the soil line turned light brown and became soft. Lesions girdled the stem, resulting in rapid collapse and death of foliage above the lesion (Fig 4a).

Seedling rot/damping off in nursery

Pointed gourd is vegetatively propagated mainly through the runner shoots and to some extent by tubers. The runner shoots which originated from the base of the vine and crept on the ground under bed system generally have long internodes and are supposed to be amenable for taking more cuttings. Hence, for sourcing cuttings, pointed gourd cultivated on soil bed is preferred due to cost effectiveness and ease of planting material preparation. There is ample opportunity for spread of pathogenic inoculum of *P. melonis* from cuttings to nursery to main field and new areas. During the study period, seedling rot of around 40% was observed in pointed gourd nursery of experimental orchard raised from soil bed system (Fig 4b). Infection in the nursery stage results either in the wilting of the cuttings, *i.e*. the planting material or rotting of the newly emerging leaves. Similar observations were made by Anith

Fig. 1(a) Soil bed system of cultivation (b) trellis system of cultivation

Fig. 2. Leaf blight of pointed gourd on(a) upper surface (b) lower surface of leaf

Fig. 3. Fruit rot infection of pointed gourd

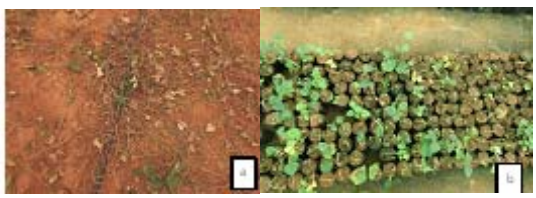

Fig. 4(a) Vine rot of pointed gourd in field (b) seedling rot of pointed gourd in nursery

et al. (2002) in black pepper also wherein, vines were multiplied mainly by vine cuttings and the foot-rot disease incited by *Phytophthora capsici*, was often carried to the main field. However detailed studies are required with regard to pointed gourd cuttings raised from soil bed system as well as trellis system.

Influence of planting system on disease incidence and severity of *Phytopthora* blight

Pointed gourd is grown in soil beds or trained on trellis in addition to bower system of cultivation. Soil bed system is an age-old system of cultivation of pointed gourd as that of other cucurbit crops. But, to achieve higher fruit yield vines of pointed gourd have to be trained on some form of aerial support system (Prasad and Singh, 1987; Yadav *et al*. 1989). Aerial support system includes well-known bower (pandal) system and trellis system viz., single line and double line trellis. During the course of investigation, higher incidence and spread of this disease was noticed in soil bed method as compared to single line trellis system. Data on disease incidence and its severity as influenced by planting system and weather parameter is given in Fig. 5, 6 &7. It was observed that, under ideal free soil moisture conditions the disease appeared aggressively form in soil bed system. Maximum vine rot and fruit rot of 34.8 and 39.0 percent, respectively, was observed during rainy season under soil bed system as against no incidence in single line trellis system. Young vines were found to be more susceptible in the soil bed during rainy season. Similarly, leaf blight severity of 28.8 percent was observed in soil bed during peak rainy season as against 2.0 percent in single line trellis system (Fig 7).

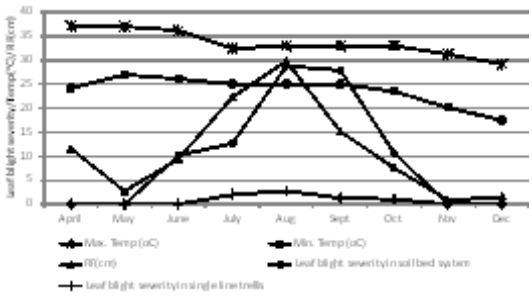

Fig. 5. Leaf blight severity in soil bed and trellis system of cultivation of pointed gourd in relation to temperature and rainfall (2015)

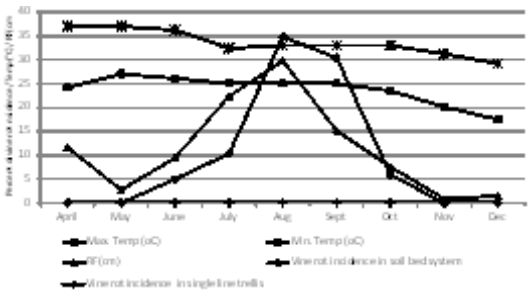

Fig. 6. Vine rot incidence of pointed gourd in soil bed and trellis system of cultivation in relation to temperature and rainfall (2015)

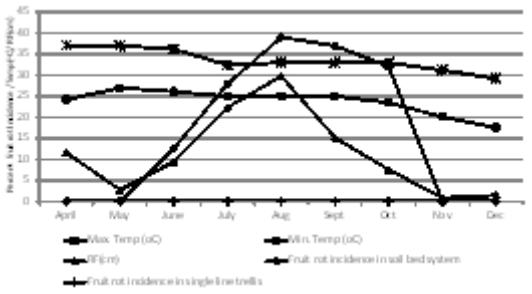

Fig.7. Fruit rot incidence of pointed gourd in soil bed and trellis system of cultivation in relation to temperature and rainfall (2015)

Soil bed system acerbated the infection and resulted in quick disease spread under congenial conditions. Though leaf blight/rot was very common in soil bed system, but in trellis system, also symptoms appeared only under favourable conditions only on lower leaves of vines. Leaves on upper portion of vines were almost free from infection. In trellis system, there was 2-3 feet gap between soil and leaves of growing vines. Due to lack of direct contact of soil with aerial plant, It appears that disease incidence remained confined to lower leaves as marginal blight probably due to splashing of raindrops carrying the pathogen to lower most leaves. However, the disease did not spread to the upper canopy of the vines, fruit and vine. further in the soil bed system, during the later stages, the fruits were in direct contact with soil containing inoculum which led to fruit rot at the contact point with soil, in trellis, plant grows vertically and there were no runner shoots, hence, were less exposed to predisposing condition. Observations in nursery indicated that, vine cuttings taken from soil bed system led to 40% seedling mortality in nursery.

In soil bed system, the infection appeared

first in low lying areas of the fields where soil remained wet for longer time. During the period of continuous rain, infection initiated on leaves near the point of attachment of leaf lamina with petiole, causing leaf blight, fruit rot and vine rot. These observations are in agreement with Khatua (2004) who explained that spread of the disease was very fast during frequent rains and cloudy weather conditions along with the warm temperature in the range of 28°C and above for few consecutive days (6 days or more).

In soil bed system as the vines were crowded and retained leaf wetness for longer period due to poor air passage, presence of free water in and around diseased tissue under such condition especially during rainy days could probably helped in production and release of spores. However, in case of single line trellis, immediately after rain the leaf wetness could quickly disappear due to free air movement and circulation in between the vines which made the host plant unfavourable for pathogen infection and multiplication.

Inadequate disease management by pesticide spraying happens in soil bed due to poor pesticide coverage on lower unexposed portion of leaf and vines in contact with soil. However, in trellis system, spraying is easy and uniform coverage leads to efficient pest and disease management (Singh *et al*., 2007). Further, cuttings taken from soil bed system were more likely to carry the soil borne inoculum to the nursery and to other new places but it is assumed that the cuttings from trellis will less likely to carry contamination to nursery since vines will not be in direct contact with soil. However to prove this statement detailed studies are needed. In bitter gourd, the studies carried out by Singh *et al*. (2007) clearly revealed the efficiency of single line trellis over other methods of planting system in managing fruit borer and downy mildew infection. Moreover single trellis system reduced the drudgery in irrigation, fertilizer application, pesticide application, pest monitoring and weeding over the other methods of cultivation and greater benefit in terms of pesticide application as the target area could be fully accessed compared to other pandal system of pointed gourd cultivation (Singh et al., 2007).

Phytophthora blight has been reported as a major yield-limiting factor in pointed gourd cultivation causing severe yield losses and crop damage (Khatua *et al*., 1981). Under natural epiphytotic conditions, significantly lower *Phytophthora* blight was found in trellis system among the two commonly adapted planting systems of pointed gourd. Further, pointed gourd is propagated mainly by stem cuttings, disease free stem cuttings should be used for planting and as preventive measure, vines should be treated with suitable fungicide before planting the cuttings in poly bags for propagation. Hence, cultivating pointed gourd raised from disease free cuttings in single line trellis system is one of the good management option available to prevent the occurrence of *Phytophthora* blight in pointed gourd in east coastal region of India.

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