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Journal homepage: www.Sjournals.com**Original article****Symptomatology, survey and surveillance of citrus gummosis disease caused by *Phytophthora* spp.****G.P. Jagtap^a, M.C. Dhavale^a, U. Dey^{a,*}**^aDepartment of Plant Pathology, Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India^{*}Corresponding author; Department of Plant Pathology, Marathwada Krishi Vidyapeeth, Parbhani, 431 402 (MS), India

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ABSTRACT

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An extensive roving survey was conducted in different districts of Marathwada region of Maharashtra state to isolate the pathogen associated with the gummosis of sweet orange. In all 103 sweet orange orchards surveyed the average disease incidence of 38.83 per cent had been observed. Highest disease incidence and severity noticed in Nanded district (63.38%) followed by Jalna (58%), Parbhani (50.66%), Hingoli (46.66%), Aurangabad (39.11%) and Latur (14%). The lowest disease incidence noticed in Osmanabad district (10%). Peak period of disease expression was August-September that was concomitant with heavy rainfall, high humidity percentage and temperature range of 18 °C – 35 °C. The harvest of disease free fruits was increased in adopted orchards.

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1. Introduction

Sweet orange belongs to genus *Citrus* of family *Rutaceae*. *Citrus sinensis* is a highly polyembryonic species of Chinese origin. The species is of great economic importance for its excellent quality as well as for its rootstock value to limited extent. Whereas, mosambi and Necullar (Maharashtra), Sathgudi (Andhra Pradesh) and Malta and Jaffa (Punjab) are the sweet orange cultivars traditionally grown in India.

Sweet oranges are grown in India on 288 thousand ha area, with production 2953.6 thousand tonnes and productivity 10.3 t/ha (Anonymous, 2009), while in Maharashtra it is grown in 81000 ha area with a production of 6.23 lakh tonnes and productivity of 7.7 tonnes/ha. In Marathwada, sweet oranges are grown in 51,000 ha area with production 4.59 lakh/ha and productivity 8-10 tonnes/ha (Anonymous, 2006). But still the average

productivity of sweet orange in Marathwada region of Maharashtra is far below the national average of sweet orange as 10.7 tonne/ha (Anonymous, 2005). Presently citrus has become an important fruit crop in world trade for fresh fruits and its processed products with 77.50 million tonnes of total production (Singh, 2000).

Although, large number of diseases due to fungi and virus have been reported on citrus. The root rot, collar rot, fruit (brown) rot and gummosis caused by *Phytophthora* spp. is most important. *Phytophthora* infects roots, leaves and fruit, Fruit rot caused by *Phytophthora citrophthora* (Smith and Smith). Leonian, *P. nicotianae* (Breda de Haan) (=parasitica) and *P. pluvialis* (E.J. Butler) is an endemic disease in India and is reported to pose a serious problem grown on large scale. In Maharashtra, citrus suffers from severe infection of this disease. The weather conditions appears to be favourable during monsoon months from July to August.

Losses due to this disease vary in kind and quality from place to place and time to time or season to season; resulting in increased cost of production and reduced yield of citrus fruits very drastically. More than 20 per cent plants die due to this pathogen in citrus nurseries of central India where 7-8 million citrus plants are being propagated every year. Rest of the apparently healthy plants from such infected nurseries become the primary source of spread of this pathogen to new areas (Das, 2009).

2. Materials and methods

A survey was undertaken in villages of Parbhani, Hingoli, Osmanabad, Aurangabad, Latur, Jalna and Nanded districts to record the incidence of gummosis of sweet orange in nurseries and orchards in 2009-10. The weather data was recorded from Agrometeorology observatory and Dept. of Agril. Meteorology, M.K.V., Parbhani and correlated disease development was also recorded. The incidence of gummosis and brown rot was recorded and detailed discussions were made with several progressive cultivators to understand the problem and history of the disease and orchard health management schedule was suggested to farmers to increase the fruit productivity by M.K.V., Parbhani. Along with survey diseased samples of leaves, stem, root, fruit and soil were collected in polythene bags from different location separately.

Incidence of gummosis disease of sweet orange was examined as severe, moderate, trace and free on the basis of percentage of severity of disease. Similarly, the per cent disease incidence of gummosis disease was calculated by using formula.

$$\text{Per cent disease incidence} = \frac{\text{Number of plant infected}}{\text{Total number of plant examined}} \times 100$$

$$\text{Per cent disease intensity (PDI)} = \frac{\text{Sum of all disease rating}}{\text{Number of rating} \times \text{Maximum disease grade}} \times 100$$

3. Results and discussion

3.1. Symptomatology

Plants affected in nursery beds developed chlorotic symptoms, stunted in growth and with poorly developed root system. In severe infection, stem at ground level showed rotting. *Phytophthora* caused foot rot, root rot, crown rot, gummosis, leaf fall and brown rot diseases in well grown orchards (Plate 1 & 2). Foot rot lesions developed as high as 60 cm from the ground level on the trunk and extended below the soil on crown roots as crown rot. On scraping the dead bark of the lesion, a brown discolored, slippery area was observed. Such active lesions started oozing gum which observed on the trunk as brownish black oozing known as gummosis (Plate 3). In dry season, the dead bark becomes firm, broke away from healthy bark, curled and split. In severe cases, when foot and significant portion of root system was damaged, the large branches of the same side of the affected plants were killed due to the rot of conducting tissues near the bark. Usually the disease was confined to feeder roots and remains unnoticed by the growers. Dull chlorotic foliage is the first symptoms of such affected plants

where mid rib, main lateral veins and bands of leaf tissue bordering them became yellow leaved rest of the leaf normal in colour. Such veinal chlorosis was often confused with nitrogen deficiency by the growers. The diseased plants thus had comparatively fewer fibrous roots than healthy plants. In severe cases, where regeneration of feeder root did not cope with the rate of destruction, the affected plant shown, starvation, less canopy volume with naked braches, die back and slow decline symptoms. In continuously wet weather conditions about 24 hrs or more, *Phytophthora* splashed along with rain drops to low hanging fruits and caused a typical brown rot of fruits and leaf fall. Foot and root rot caused severe moisture stress in the plants and resulted either in erratic bearing and yield loss or such plants bear heavily collapsed when fruits were still on the plant.

Table 1

Status of gummosis of sweet orange in Marathwada region in 2009-10

Sr. No.	Districts	Talukas	No. of orchard	Per cent orchards affected with gummosis of sweet orange			
				Severe (Incidence >40%)	Moderate (Incidence > 10 to 40%)	Traces (Incidence upto 10%)	Gummosis free
1	Nanded	6	25	26.65	14.45	25.38	33.52
2	Jalna	4	18	17.65	17.65	22.99	41.71
3	Hingoli	3	15	11.55	4.71	19.29	64.45
4	Parbhani	4	20	8.45	13.68	25.00	52.87
5	Aurangabad	5	16	0	9.78	26.86	63.36
6	Osmanabad	2	5	0	0	10	90
7	Latur	2	4	0	7.20	8.5	84.30
	Total		103				

Table 2

Percent disease incidence of gummosis of sweet orange in different district of Marathwada region

Sr. No.	Districts	Number covered			Area (acres) /variety	Total No. of examined	Infected plants with gummosis	Per cent disease incidence (%)
		Talukas	Villages	Orchards				
1	Nanded	6	16	25	285/Nucellar, local, sathgudi	650	412	63.38
2	Jalna	4	10	18	102.7/local	500	290	58
3	Hingoli	3	7	15	142.5/local	450	210	46.66
4	Parbhani	4	12	20	90.70/Nucellar, local	600	304	50.66
5	Aurangabad	5	9	16	137.5/Nucellar, local	450	176	39.11
6	Osmanabad	2	4	5	20.9/local	250	25	10
7	Latur	2	4	4	50/local	200	28	14
Average								38.83

Severe : > 40%, Moderate : > 10% to < 40%, Trace < 10%.

3.2. Identification

The test pathogen was isolated from the rotten seedling of Rangapur lime and fruits of sweet orange with brown rot spots on *Pythium* Selective Medium (PSM) and Potato Dextrose Agar (PDA) medium. The colonies of the fungus developed on PSM and PDA were cream to whitish cream, snow white in colour with thin mat of mycelium having little or no aerial growth. A piece of sporulating mycelium of different species was mounted in methyl cotton blue and observed under the light microscope (Plate 4).

3.3. Occurrence of gummosis of sweet orange severity in different districts

The surveys were aimed at assessing the disease scenario in Marathwada region, with special emphasis on gummosis of sweet orange. Gummosis was the most prevalent disease and had its presence in mild to severe form in Marathwada. Hence, an extensive survey was conducted during the year 2009 to 2010 in Parbhani, Hingoli, Nanded, Jalna, Aurangabad, Latur and Osmanabad districts of Marathwada region. Total one hundred and three sweet orange orchards were observed out of which 25, 18, 15, 20, 16, 5 and 4 were observed in Nanded, Jalna, Hingoli, Parbhani, Aurangabad, Osmanabad and Latur districts, respectively.

Results (Table 1 and Fig. 1) showed that the severity of disease was maximum in Nanded district followed by Jalna, Parbhani, Hingoli, Aurangabad, Latur and Osmanabad district. In Nanded during 2009-10 about 66 per cent of surveyed orchards were affected by gummosis. Severe attack of gummosis was recorded in less than 20% orchards of Latur and Osmanabad districts. The disease severity was moderate or in traces in Aurangabad district orchards. Jalna, Hingoli, Parbhani and Nanded were found affected with gummosis in varying intensities. The diseases severity was minimum in Osmanabad district.

3.4. Occurrence of gummosis of sweet orange incidence in different districts of Marathwada region

Results (Table 2 and Fig. 2) clearly revealed that the maximum per cent disease incidence in Nanded district (63.38 %) followed by Jalna (58%), Parbhani (50.66%), Hingoli (46.66%), and Aurangabad (39.11%). The minimum per cent disease incidence of gummosis of sweet orange found in Latur (14%) and Osmanabad (10%).

The data (Table 3) clearly revealed that the district wise maximum per cent severity in Limbgaon village in Nanded district (34.5 %) followed by Bahiregaon Jalna district (33.2%), Changefal, Parbhani (29.8 %), Dandegaon, Hingoli (18.9%). In Aurangabad district the per cent severity of gummosis disease was 8.9 per cent in Rajapimpri village. While in Osmanabad district minimum per cent severity was found in village Ambe Jawalga (6.5%). In Nanded district local variety was more susceptible to attacks of *Phytophthora* spp. had 34.5 per cent severity followed by Nuellar (37.7%) and Sathgudi (24.00%).

Similar survey for damping off of seedling, root rot, collar rot, foot rot, brown rot and gummosis of citrus were undertaken in Marathwada region by Naqvi (2006). Similar work was undertaken for north east hills by Naqvi (2004) and Singh (2002). For central India region by Naqvi (1999). Lele and Kapoor (1982) was carried out survey in central and peninsular India for *Phytophthora* rot in citrus. Zeng HuiCai *et al.* (2009) was also done survey in Hainan island of South China and they found fourteen species of *Phytophthora* caused foot rot, collar rot.

Peak period of disease expression was August-September that was concomitant with heavy rainfall, high humidity percentage and optimum temperature range 18 °C – 35 °C. Similar, results was obtained by Das (2009) and Sigh (2002).

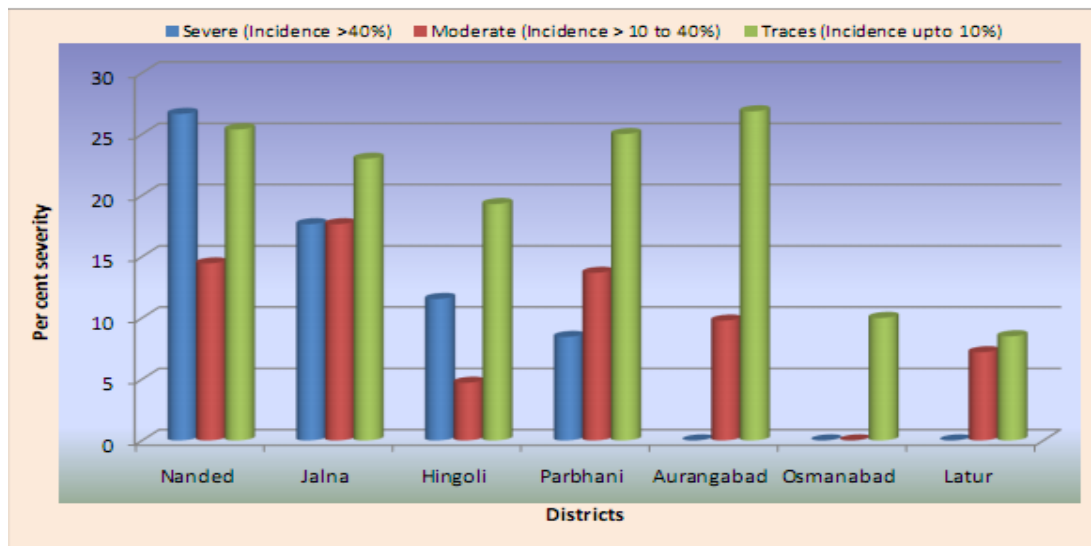


Fig. 1. Percent disease severity of sweet orange in different districts Marathwada region.



Plate.1: Veinal chlorosis

Plate. 2: Survey and surveillance of *Phytophthora* infested Sweet orange nurseries and orchards



Plate. 3: Deposition of gum

Plate. 4: Chlamydospores of *P. nicotianae*, *P. citrophthora* and *P. palmivora*

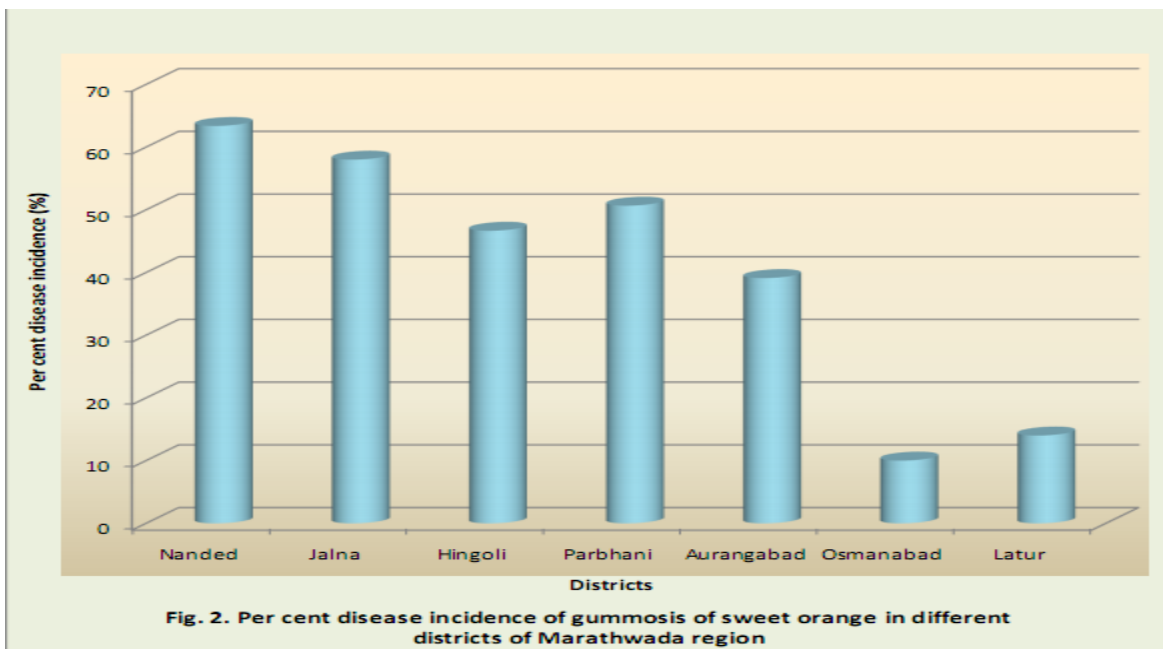


Table 3

Incidence of severity of gummosis disease of sweet orange in adopted orchards of Marathwada region (2009-10)

Sr. No.	Farmer name	Village	District	Area in acre	Age (yrs)	Variety	Incidence			Severity			% severity
							Leaf	Stem	Fruit	Leaf	Stem	Fruit	
1	Bhimrao D. Kadam	Limbgaon	Nanded	2.5	15	Local	80.0	55.7	57.0	40.5	28.3	35.4	34.5
2	Tukaram R. Hilalpur	Waghi	Nanded	6	10	Sathgudi	68.5	65.8	40.0	31.3	18.3	24.3	24.0
3	Kashinath T. Nardile	Waghi	Nanded	1.5	14	Nucellar	78.0	61.5	72.5	40.3	26.5	30.6	30.7
4	Kailas B. Solanke	Dandegaon	Hingoli	1.5	20	Local	61.7	61.8	43.7	30.5	26.2	20.5	10.3
5	Sunil B. Solanke	Dandegaon	Hingoli	8	8	Local	59.7	79.5	51.9	18.4	20.6	25.3	18.9
6	Dnyaneshwar P. Dongre	Sawargaon Haddap	Jalna	3	9	Local	38.5	79.5	42.7	11.3	21.8	22.4	8.3
7	Bhagwan S. Kadam	Dawalwadi	Jalna	2.5	9	Local	61.7	61.8	48.5	37.4	22.5	14.2	18.9
8	Ganesg A. Bandal	Bahiregaon	Jalna	4	10	Local	69.5	79.5	90.5	20.7	29.5	36.1	33.2
9	Subhash N. Jarad	Ambadgoan	Jalna	6	18	Local	36.5	56.00	45.4	9.1	13.5	23.5	8.2
10	Suresh R. Gadgil	Changefal	Parbhani	4	10	Local	73.5	66.0	68.4	88.2	26.3	29.6	29.8
11	Dnyaneshwar B. Pawar	Rajpimpri	Aurangabad	5	10	Local	45.5	10.5	49.5	16.3	8.4	13.2	6.9
12	Kapil P. Pawar	Rajpimpri	Aurangabad	4	14	Local	57.5	71.5	43.5	22.7	26.7	14.2	8.9
13	Bhike K. Sarde	Ambe Jawalga	Osmanabad	4	10	Local	32.0	20.5	38.5	15.5	5.7	12.3	6.5

References

- Anonymous, 2005. Area, production and productivity of major citrus growing states of India. National Horticulture Board.
- Anonymous, 2006. Districtwise Agricultural statistical Information of Maharashtra State. Epitome of Agriculture in Maharashtra, (Part-II), 161-164.
- Anonymous, 2009. www.nabard.org/modelbankprojects/plant-citrus.asp.
- Das, A.K., 2009. Fungal disease in citrus and its management. Integrated orchard management in citrus. NRCC, Nagpur, 53-57.
- Lele, V.C., Kapoor, J.N., 1982. Phytophthora on citrus in central and peninsular India. Indian Phytopath. 35, 407-410.
- Naqvi, S.A.M.H., 1999. Phytophthora diseases – The major cause of citrus decline in central India. Prof. Nat. Symp. Citriculture, Indian Soc. of Citriculture, Nagpur, 430-435.
- Naqvi, S.A.M.H., 2004. A new report on Phytophthora capsici L. causing root rot of Mandarin in North-East Hills. J. Mycol. Pl. Pathol. (In press).
- Naqvi, S.A.M.H. 2006. Distribution of citrus Phytophthora spp. and mating types pathogenic to citrus in central India. J. Mycol. Pl. Pathol. 36(1).
- Singh, S., 2000. Citrus in India, Hi Tech Citrus Management, 278-303.
- Singh, S., 2002. Fungal diseases of citrus Diagnosis and management. NRCC. Technical Bulletin, 1, 59.
- Zeng H.C., H.H. Ho, Fuy-Cong Z., 2009. A survey of Phytophthora spp. on Hainan Island of south China. J. Phytopathol. 157(1), 33-39.