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Status of *Phytophthora* diseases in Nagpur mandarin orchards of Vidarbha region

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DOI: <https://doi.org/10.22271/chemi.2020.v8.i4aj.10102>**Abstract**

In central India the major cause of citrus decline is supposed to be because of *Phytophthora* causing diseases in citrus. The pathogen attack citrus plants right from nursery causing damping off of seedlings, decay of fibrous roots, crown rot, collar rot, foot rot and gummosis in mature orchards. Nagpur mandarins face short life span and low productivity because of these three species of *Phytophthora* viz. *P. parasitica*, *P. citrophthora* and *P. palmivora*. An intensive rapid roving survey of selected mandarin orchards was conducted during the year 2016 and 2017 to access incidence and intensity of *Phytophthora* diseases (root rot and gummosis). Total 83 orchards were surveyed during peak period of diseases (August to November) by using modified disease rating scale (0-9). According to rapid roving survey of root rot in selected orchards, pooled data indicate similar disease progress with root rot incidence in the range of 10.42 to 62.50% and intensity from 1.62 up to 23.48%. In case of gummosis pooled data indicate similar trend of disease development with gummosis incidence in the range of 14.58 to 64.58% and intensity in between 2.08 to 19.91%.

Keywords: *Phytophthora*, survey, mandarin, root rot, gummosis**Introduction**

Nagpur mandarin (*Citrus reticulata*) is the most common among citrus fruits in India and is occupying a premier position among Indian mandarins. A large number of fungal diseases affect the crop (Meena and Shah 2005) [7]. Citrus plants are prone to attack of more than 150 diseases and disorders caused by fungal, viral and few bacterial pathogens right from nursery level to bearing stage resulting in incalculable losses (Lakshmi *et al.*, 2014) [6]. In central India the major cause of citrus decline is supposed to be because of *Phytophthora* causing diseases in citrus. *Phytophthora* disease has been identified as one of the major causes of decline in citrus. It causes the most serious and economically important soil borne diseases to citrus crops. Three species of *Phytophthora* viz. *P. parasitica*, *P. citrophthora* and *P. palmivora* found associated to cause damping off, collar rot and root rot in citrus (Naqvi, 1988; Gade, 2012) [8, 3]. The pathogen attack citrus plants right from nursery causing damping off of seedlings, decay of fibrous roots, crown rot, collar rot, foot rot and gummosis in mature orchards. Nagpur mandarins face short life span and low productivity because of these three species of *Phytophthora* (Das *et al.*, 2011) [1]. The pathogen caused severe losses in Nagpur mandarin from nursery to orchard. The 24% mortality occur in nursery beds and 5-15% in transplanted seedlings/ grafts due to this pathogen (Naqvi, 2006) [11]. *Phytophthora* spp. cause the most serious and economically important soil borne diseases of citrus.

In Madhya Pradesh adjoining to Vidarbha region of Maharashtra, 20-50% Nagpur mandarin plants were found to be affected resulting in severe decline due to *P. parasitica*, *P. citrophthora* along with *P. palmivora*. In Nagpur district 10-60%, in Amravati 20-100%, Akola 10-70%, Yavatmal 20-100%, Aurangabad 20-100%, while, in Jalna 10-30% plants of sweet orange cv. Mosambi, Nagpur mandarin and acid lime were infected with *Phytophthora* spp. (Naqvi, 1993 and Naqvi, 1999) [9, 10]. In recent time, gummosis incidence was recorded in between 14.00% to 50.50% whereas, gummosis intensity was in the range of 8.50% to 28.00%. Similarly, root rot incidence was observed in the range of 18.00% to 40.00% while, intensity was recorded from 6.70% to 24.55% (Wagh *et al.*, 2018) [13].

An intensive rapid roving survey of orchards in contributes to assess the present status, distribution of plant pathogens prevalent in particular areas. Such surveys are helpful to

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characterize local isolates of pathogen. Epidemics of *Phytophthora* on heavy black cotton soils play an important role in citrus rootstock failure. Survey have been undertaken to see the association of *Phytophthora* spp. & diseases caused by this pathogen in Vidarbha region where nearly 80L grafts are being raised for sale every year (Gade, 2012) [3]. *Phytophthora* diseases affecting above-ground plant parts like leaves, stems or fruit are easily detected and diagnosed, root diseases below-ground may less visible and may detected after many years of infection (Tsao, 1990) [12]. Such surveys collect data at a single point in time; it is difficult to measure changes in the plant population unless two or more surveys are done at different points in time. Such repetition is often expensive and time-consuming, making frequent periodic surveys impractical.

Materials and methods

Amravati district is one of the major mandarin growing area in Vidarbha region. A rapid roving field survey was conducted to assess the incidence and intensity of gummosis and root rot diseases in Nagpur mandarin orchards of Amravati district of Maharashtra. Total 83 Nagpur mandarin orchards were surveyed during peak period of diseases (July to November) in the year 2016 and 2017 by using modified disease rating scale (0-9). To calculate disease severity or intensity of root rot and gummosis of citrus numerical rating scale was developed by modifying the scale of Gade *et al.* (2006) [4] and Gade and Koche (2012) [2]. The similar scale was also used by Wagh *et al.* (2018) [13] in their survey.

Disease rating scale for root rot: The intensity of root rot of citrus was recorded on the basis yellowing of leaves and

drying of branches. The modified disease rating scale was used for recording observations by modifying scale of Gade *et al.* (2006) [4]. The 0-9 scale was used for root rot measurement as follows, 0- no yellowing, 1- yellowing of leaves and leaf fall (1-10%), 3- yellowing of leaves and leaf fall (11-25%), 5- yellowing of leaves and leaf fall (26-50%), 7- above 50% yellowing of leaves and leaf fall and 9- drying of branches.

Disease rating scale for gummosis: The trees showing oozing of gum at bud joint and one meter above the ground level on the trunk were observed for calculating disease intensity of citrus gummosis. Observations on gumming were recorded on the basis of gradation as follows, 0 – healthy, 1- oozing and lesion developed up to 1 cm² area, 3- oozing lesion developed above 1 cm² up to 2.5 cm² area, 5- oozing lesion developed above 2.5 cm² up to 5 cm² area, 7- oozing lesion developed above 5 cm² and 9- splitting of bark.

The disease intensity of both diseases was recorded by selecting twenty four plants from each plot. Per cent disease intensity (PDI) and percent disease incidence of the diseases were calculated by the formula used by Jagtap *et al.* (2012) [5].

Results and discussion

An intensive rapid roving survey of selected mandarin orchards was conducted during the year 2016 and 2017 to access incidence and intensity of *Phytophthora* diseases (root rot and gummosis). Total 83 orchards were surveyed during peak period of diseases (August to November) by using modified disease rating scale (0-9). Survey indicated the presence of *Phytophthora* diseases in all selected mandarin orchards of Amravati district.

Table 1: Survey for incidence and intensity of root rot and gummosis in Nagpur mandarin orchards of Amravati (Pooled)

S. No.	Location	GPS (Latitude / Longitude)	Root rot		Gummosis	
			Incidence (%)	Intensity (%)	Incidence (%)	Intensity (%)
1	Jarud	21.463509/78.215042	62.50	23.48	60.42	19.91
2	Bahada	21.480949/78.204926	35.42	9.72	25.00	8.79
3	Gavhan kund	21.511707/78.198654	41.67	14.81	35.42	14.11
4	Warud mahapur	21.485443/78.251587	39.58	13.42	33.33	11.34
5	Warud	21.496702/78.266396	31.25	10.88	42.17	7.40
6	Tivsa ghat	21.505159/78.270630	16.67	2.77	20.83	3.24
7	Pimpalshevada	21.532314/78.252853	58.33	16.66	54.17	14.12
8	Zatamziri A	21.537823/78.241547	18.75	2.54	20.83	2.54
9	Zatamziri B	21.535418/78.272522	35.42	6.71	33.33	5.32
10	Rawala	21.553238/78.275665	37.50	9.26	43.75	6.71
11	Shendurjana ghat	21.518757/78.296188	33.33	7.40	25.00	6.94
12	Pusala	21.501884/78.358276	52.08	14.35	39.58	12.96
13	Sawangi	21.479252/78.378899	39.58	14.58	33.33	10.18
14	Udapur	21.437040/78.339600	58.33	18.51	64.58	19.67
15	Kathi	21.366669/78.257408	27.08	3.93	35.42	5.32
16	Loni	21.378971/78.180305	47.92	10.88	35.42	12.73
17	Khadki	21.440512/78.123169	50.00	14.35	45.83	18.05
18	Hiwarkhed	21.396545/78.068939	18.75	3.01	22.92	3.00
19	Narayanpur	21.036819/77.839081	41.63	15.27	45.83	12.50
20	Dapori	21.386913/78.058708	50.00	17.82	47.92	17.59
21	Morshi	21.351351/78.026848	27.08	5.32	29.17	6.48
22	Khanapur	21.313564/77.944221	56.25	11.80	39.58	9.03
23	Khed	21.286816/77.868927	54.17	12.26	43.75	11.34
24	Kolevihi	21.273340/77.842461	27.08	6.71	29.17	4.62
25	Riddhapur	21.243561/77.817818	10.42	1.77	14.58	3.01
26	Dhamangaon	21.222244/77.897881	20.83	3.70	18.75	3.47
27	Lehgaon	21.198622/77.952744	35.42	4.86	31.25	6.71
28	Nerpinglai	21.178944/78.025307	22.92	4.39	37.50	6.71
29	Satargaon	21.129595/78.073072	29.17	6.94	27.08	5.78
30	Tivsa	21.080996/78.059776	27.08	7.17	22.92	6.71
31	Shendurjana Bazar A	21.071243/78.036125	31.25	3.93	22.92	5.32
32	Shendurjana Bazar B	21.040308/78.054565	43.75	11.34	54.17	9.49

33	Kawadgavhan	21.005722/78.056297	33.33	7.87	37.50	9.25
34	Kurha	20.941765/78.057526	39.58	9.49	22.92	6.94
35	Anjanwati	20.905460/78.140945	20.83	3.70	18.75	3.00
36	Dhakulgaon	20.900702/78.129700	43.75	14.12	39.58	12.26
37	Gunji	20.859447/78.126190	25.00	5.09	14.58	2.08
38	Dhamangaon	20.755804/78.143257	39.58	11.80	39.58	9.49
39	Jalka patache	20.713381/78.152710	16.67	2.31	33.33	4.62
40	Devgaon	20.681091/78.138123	31.25	10.88	43.75	9.26
41	Shendurjana	20.725727/78.059837	10.42	1.62	22.92	3.00
42	Jawara	20.712641/78.026985	47.92	11.34	43.75	14.12
43	Satephal	20.754368/78.007439	25.00	3.24	22.92	4.39
44	Kalamgaon	20.764721/77.986305	25.00	3.24	14.58	2.54
45	Songaon	20.795628/77.981483	54.17	18.05	45.83	15.28
46	Govt. Farm CR	20.816608/77.980843	50.00	11.11	45.83	10.18
47	Chirodi road	20.827375/77.949455	37.50	8.33	29.17	6.01
48	Chirodi	20.871901/77.920975	33.33	6.48	37.50	6.71
49	Wadgaon mahure	20.964720/77.823738	16.67	2.31	25.00	2.77
50	Shewati	20.980495/77.857025	41.67	8.33	35.42	6.71
51	Pimpalviher	21.028675/77.914795	47.92	11.34	39.58	10.18
52	Mahuli jahangir A	21.053570/77.881485	17.59	4.86	31.25	3.47
53	Mahuli jahangir B	21.054468/77.875603	16.67	2.31	25.00	3.23
54	Wagholi	21.088282/77.889664	43.75	11.10	52.08	11.80
55	Dawargaon	21.104092/77.881348	45.83	7.40	37.50	5.32
56	Narsingpur	21.107113/77.825760	39.58	14.58	39.58	11.34
57	Dewari	21.094004/77.812752	22.92	4.39	25.00	5.09
58	Dabha	20.826481/77.733650	18.75	2.08	27.08	3.47
59	Jalu	20.789574/77.744354	43.75	6.25	33.33	5.55
60	Javara	20.779692/77.748238	43.75	9.95	35.42	10.41
61	Dhanora	20.701618/77.744415	20.83	3.24	35.42	4.39
62	Siddhnathpur	20.698893/77.725929	43.75	11.34	43.75	8.56
63	Dhanera fasi	20.720860/77.686241	12.50	1.85	25.00	4.39
64	Ghawalsari	20.768379/77.699270	35.42	5.32	25.00	4.62
65	Loni takali	20.783119/77.668846	33.33	5.09	25.00	5.09
66	Murha	21.105963/77.302162	37.50	11.11	37.50	8.79
67	Takarkheda	21.155949/77.314034	35.42	6.71	35.42	6.71
68	Dhanegaon	21.148237/77.358475	25.00	3.70	22.92	2.54
69	Anjangaon	21.169685/77.293846	25.00	3.70	22.92	3.47
70	Sategaon	21.161844/77.221146	35.42	7.17	37.50	8.79
71	Takala	21.149736/77.423096	31.25	5.78	25.00	6.48
72	Isegaon	21.180529/77.559967	33.33	5.09	29.17	5.55
73	Khanapur B	21.222572/77.496910	39.58	8.10	29.17	4.16
74	Paratwada	21.295736/77.528702	52.08	10.41	25.00	5.55
75	Dhamangaon	21.295909/77.481285	37.50	6.48	35.42	7.17
76	Parasapur	21.255491/77.412094	22.92	4.39	37.50	6.01
77	Pathrot	21.205725/77.355133	39.58	9.02	25.00	4.63
78	Tondgaon	21.248672/77.564194	41.67	13.42	43.75	11.34
79	Pimpri	21.240486/77.644196	37.50	6.48	37.50	6.94
80	Haidatpur	21.232422/77.706490	33.33	4.62	27.08	4.86
81	Kondwardha	21.252337/77.628304	22.92	3.00	27.08	4.39
82	Kurha	21.297943/77.632507	41.67	12.96	31.25	5.32
83	Kharpi	21.330448/77.583687	31.25	4.86	37.50	6.48

Maximum root rot incidence was recorded in orchards of Jarud, Pimpleshevda, Udupur, and Khanapur during 2016 (54.16%), whereas minimum root rot incidence was recorded in orchards of Zatamziri (A), Riddhapur, Shendurjana and Dhanera fasi villages (8.33%). Maximum root rot intensity of 18.72% was recorded in Jarud and least disease intensity (0.92%) was observed at Riddhapur, Shendurjana and Dhanera fasi. In 2017, maximum disease incidence (70.83%) and intensity (28.24%) of root rot was recorded in orchard of village Jarud. Minimum incidence of root rot (12.50%) was recorded in orchards of Tivsa ghat, Riddhapur, Shendurjana villages, whereas, minimum disease intensity was recorded in Riddhapur (2.30%).

Maximum gummosis incidence (62.50%) was observed in orchards of village Udupur and the minimum disease incidence (12.50%) was observed in village Gunji, Kalamgaon and Dhanegaon. The gummosis intensity was found maximum in Udupur and Dapori *i.e.* 18.05% however,

minimum disease intensity (1.38%) was observed in Gunji and Dhanegaon in 2016. In case study of gummosis during the year 2017, minimum disease incidence of 12.50% was observed in village Riddhapur but minimum disease intensity of 2.77% was recorded in orchards of location Zatamziri (A), Hiwarkhed, Dhamangaon, Anjanwati, Gunji and Kalamgaon. In both the years study, similar trend was observed hence here pooled data of that two years (2016 and 2017) study is presented. According to rapid roving survey of root rot in selected orchards, pooled data indicate similar disease progress with root rot incidence in the range of 10.42 to 62.50% and intensity from 1.62 up to 23.48%. In case of gummosis pooled data indicate similar trend of disease development with gummosis incidence in the range of 14.58 to 64.58% and intensity in between 2.08 to 19.91% (Table 1). The mandarin orchards surveyed in Amravati district were severely affected with *Phytophthora* diseases. Heavy rainfall during July up to November was the peak season to establish

the disease in orchards, high humidity and optimum temperature range 18°C – 35°C was found to conducive for the disease growth. Wagh *et al.* (2018)^[13] recorded incidence and intensity of root rot in the range of 18 to 40% and intensity 6.70 to 24.55%. In their study gummosis incidence was found in the range of 14 to 50.50% and intensity in the range of 8.50 to 28% in Nagpur mandarin in Warud and Morshi tahsils of Central India. Survey for damping off of seedling, root rot, collar rot, foot rot, brown rot and gummosis of citrus were undertaken in citrus growing belts of India by Naqvi (2006)^[11] and observed 10 to 100% citrus decline with 5 to 12 propagules/cc soil in Amravati district in Central India. Naqvi (1999)^[10] reported 20 to 100% plants of citrus affected with decline in Amravati district. The results of the present findings are in accordance to Jagtap *et al.* (2012)^[5] who carried out roving survey of 103 sweet orange orchards to assess the disease incidence and severity of citrus gummosis and noticed disease incidence in the range of 10 - 63.38% in Marathwada region. The result shows the seriousness of the issue need to be tackled to take corrective measures in time.

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