Survey on incidence of gummy stem blight on watermelon (*Citrullus lanatus*) in Karnataka

Abstract:

Watermelon (*Citrullus lanatus)* is an important cucurbitaceous crop cultivated worldwide. The cultivation of watermelon and other species of the family Cucurbitaceae is severely affected by several diseases like anthracnose, *Alternaria* leaf spot, bacterial fruit blotch, powdery mildew and gummy stem blight. Among the diseases, gummy stem blight is an emerging and devastating disease caused by *Didymellabryoniae* producing a serious threat to the economics of production of cucurbits like watermelon. A Rroving survey was carried out in eight districts of Karnataka (Chamarajanagara, Chikkaballapura, Gulburga, Vijayapur, Bengaluru urban, Kolar, Mysuru and Yadgiri.) from 2021 to 2023 to record the incidence of GSB disease on watermelon. The survey data revealed that GSB disease was observed in all areas. The per cent disease index ranged from 51.2 to 29.6 per cent. The maximum mean per cent disease index of (51.2%),) Bengaluru urban district and the lowest was seen in the Mysuru district (29.6%) followed by Chikkaballapura district (31.0%).The pathogen associated with gummy stem blight disease was isolated and proved the pathogenicity of the isolate and fulfilled the Koch's postulates.

Keywords:gummy stem blight, survey, watermelon, per cent disease index

Introduction:

Watermelon [*Citrullaslanatus* (Thumb)] is one of the important cucurbitaceous crops belongs to family *Cucurbitaceae*with chromosome number 2n=2x=22 grown in different parts of the world. It has its origin in the Kalahari Desert of Africa (Paris, 2015; Renner *et al*., 2017) and was domesticated in Egypt and India. It is also known as tarbuj, tarmuj, kalinda, kallangadi and kalindi in different parts of India. gummy stem blight is an emerging and devastating disease caused by *Didymellabryoniae* producing a serious threat to the economics of production of cucurbits like watermelon. GSB is one of the most damaging, due to a lack of resistant cultivars and recently developed fungicide resistanceinsomeisolates(Li*etal*.,2016). The disease was for the first time reported on chow-chow (Sohi and Prakash, 1972) in Mysore and subsequently on other cucurbit crops viz., cucumber (Kumar and Khan, 1984), bitter gourd (Kulwant and Shetty, 1996),

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ash gourd (Pandey and Pandey, 2003), muskmelon (Sudisha *et al*., 2004) and ridge gourd (Bhat *et al.*, 2018). The disease occurs severely during the rabi season with typical symptoms. Sudisha *et al*. (2004) first reported gummy stem blight on muskmelon in India, with 41per cent disease incidence. First report of gummy stem blight by *S. cucurbitacearum* on watermelon in India was reported by Mahapatra *et al*., 2020.*D. bryoniae* is an ascomycota fungus. In spring, asexual fruiting bodies called pycnidia and sexual fruiting bodies called perithecia are formed from previously infected plant debris. Ascospores are readily dispersed and spread by wind after rain or during evening dew periods. *D. bryoniae* survives on or in seeds, surrounding weeds, or organic debris from previously infected cucurbits.

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Materials and methods

A ~~R~~roving field survey was conducted in few watermelon-growing regions of Karnataka. The districts of Karnataka were covered were Chamarajanagara, Chikkaballapura, Gulburga,Vijayapur, Bengaluru urban, Kolar, Mysuru and Yadgiri during 2021-2023 (Plate 1). Visual rating on leaf was scored by using (0-9) scale.

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Disease scale given by (Gusmini*et al.*, 2002)

0	no symptoms
1	yellowing on leaves (suspect of disease only),
2	moderate symptoms (<20 per cent necrosis) on leaves only
3	slight necrosis (21-45 per cent necrosis) on leaves only
4	severe symptoms (>45 per cent necrosis) on leaves only
5	some leaves dead, no symptoms on stem
6	moderate symptoms (<20 per cent necrosis) on leaves, with necrosis also on petioles and stem (<3mm long),
7	slight symptoms (21-45 per cent necrosis) on leaves, with necrosis also on petioles and stem (3-5 mm long),
8	severe symptoms (>45 per cent necrosis) on leaves, with necrosis also on petioles and stem (>5mm long)
9	plant dead

Using the McKinney formula (1923), the percent disease index (PDI) was computed using data on the disease scores of individual seedlings.

$$PDI = \frac{\text{Sum of all numerical ratings}}{\text{Number of observations} \times \text{Maximum disease rating scale}} \times 100$$

Isolation and identification

The infected watermelon plants showing typical symptoms of the disease were collected from field. The infected plant samples were brought immediately to the laboratory and isolated the pathogen on potato dextrose agar media.A standard tissue isolation approach was used for the isolation of *Stagnosporopsiscucurbitacearum* from diseased plant samples having typical symptoms of lesions, necrotic spots and gummy ooze. The samples were sliced into bits of 0.5 to 1.0 cm. The tissue bits were initially surface sterilized with one percent sodium hypochlorite (NaOCl) for one minute and washed with sterile distilled water successively 3 times (30 seconds each time). The pieces were then dried with sterile tissue paper before being put on solidified PDA medium in a sterile ~~P~~petri plate. The plates were then incubated at 26±1°C until the growth started. The standard hyphal tip method was used to purify thecultures. The purified culture were then maintained on potato dextrose agar slants and refrigerated at 4°C for later use.

Plate 1. Different stages of Gummy stem blight of watermelon

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Results and discussion

Survey:

A Rroving survey was carried out in some districts of Karnataka (Chamarajanagara, Chikkaballapura, Gulburga,Vijayapur, Bengaluru urban, Kolar, Mysuru and Yadgiri.) from 2021 to 2023 to record the incidence of GSB disease on watermelon. The details of places surveyed, variety grown, age of the crop and percent disease index (PDI) in the field based on the symptoms are presented in the (Table 1).Meanwhile, diseased stem, leaves, soil and fruits samples were collected from different locations and analysed in the laboratory.

The survey data revealed that GSB disease was observed in all areas. The per cent disease index ranged from 51.2 to 29.6per cent and the data is presented in (Table1). Maximum PDI was observed inHesaraghatta (51.2%), (Bengaluru Urban district and Bengaluru North taluk) followed by 43.65 per cent disease at Vanadurga, Shahapurtaluk &Yadagiri district and Masanapura village of Chamarajanagara district and inkollegal taluk 40.24 per cent disease was observed. The lowest disease incidence of 26.66% was observed at Vadahalli, (Chintamani taluk and Chikkaballapura district) (Table 1). The maximum mean per cent disease index of 51.2%, was noticed in Bengaluru Urban district and the lowest incidence was observed in the Mysuru district (29.6%) followed by Chikkaballapura district 31.0%.Occurrence of GSB disease on cucurbitaceous crops across the world has been reported by several scientists *viz.*, Sudisha *et al.* (2004) on muskmelon in India and sushma*et al* (2021) on ridge gourd in India, Basim *et al*. (2016) on watermelon in Turkey, Ramsoondar*et al*. (2018) on pumpkin in Trinidad and Al-Jubouri and Hussain (2020) on watermelon in Iraq.

Commented [H14]: Remove the average PDI column from table and rephrase the result as authors not mentioned the average PDI in result and mentioned the range of PDI so it is creating confusion.

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Collection, isolation and identification of the pathogen

The isolate of gummy stem blight pathogen was isolated by following standard tissue isolation method. The fungus isolated from the infected tissues was confirmed as *Stagnosporopsiscucurbetacearum*based on their morphological, cultural and mycelial characters as described by (Li *et al.* 2016; Moumni *et al.* 2019 and Mahapatra *et al.* 2020).

Commented [H17]: As Authors mentioned in Abstract gummy stem blight caused by *Didymella bryoniae* and in results section authors stated *stagonosporopsis cucurbitacearum* causes the same disease based on morphological, cultural and mycelial characters. Need evidence in the form of colony and spore photo graph of causal organism

Table 1:Per cent disease indexof watermelon gummy stem disease in different districts of Karnataka

Sl. No.	Name of the place			Per cent disease index (PDI)		Variety	GPS coordinates	Age of the crop(days)	Other diseases/pest
	District	Taluk	Village						
1	Chikkaballapura	Chintamani	Subbarayanapete	35.54	31.0	NS-295	13.3157 77.9539	45	Leaf spots, watermelon mosaic disease, whitefly
			Upparapete	28.65		Melody	12.9745 77.5750	30	Watermelon bud necrosis virus disease (WBNV), serpentine leaf miner, leaf spots
			Vadahalli	26.66		Melody	13.3157 77.9539	60	Anthracnose, leaf spot WBNV
			Konapalli	33.32		Max	13.37405 78.0558	25	Watermelon mosaic, Anthracnose
2	Chamarajanagara	Kollegala	Bandalli	38.56	39.4	Sugar king	12.1641 77.3504	40	Leaf spots, watermelon mosaic disease, whiteflies
			Masanapura	40.24		Sugar queen	11.9869 77.0464	45	Fusarium,leaf spot
3	Kolar	Srinivaspura	Hosahalli	34.25	34.25	Melody	13.3018 77.9703	50	Leaf spots, WBNV
4	Gulburga	Kamalapur	Mahagoan	36.45	36.45	Sugar king	17.3200 76.5500	60	Serpentine leaf miner, leaf spots
5	Mysuru	Nanjangud	Hullahalli	29.65	29.65	Sugar king	12.0976 76.5560	50	Whiteflies, leaf spot
6	Bengaluru urban	Bengaluru north	Hesaraghatta	51.2	51.2	Ns-295	13.1385 77.4778	40	serpentine leaf miner, leaf spots, Thrips
7	Vijayapur	Muddebihal	Mudnal	37.6	33.47	Sugar baby	16.3020 76.1262	30	Leaf spots

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			Bidarkundi	29.35		Sugar queen	16.3396 76.1291	50	Watermelon bud necrosis virus disease,thrips
8	Yadgiri	Shahapur	Vanadurga	43.65	43.65	Black Magic	16.6342 76.6983	45	Whiteflies, aphid

Conclusion:

From the present investigation, it is concluded that the gummy stem blight disease caused by *Stagnosporopsiscucurbitacearum*was prevalent in all surveyed locations ofkaranataka. This disease is causing a potential threat to cucurbitaceous crops.

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