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Incidence of pomegranate wilt in Karnataka

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Abstract

Pomegranate (*Punica granatum* L.) is an ancient fruit, belongs to the family Lythraceae. Pomegranate is native to Iran, where it was first cultivated in about 2000 BC and spread to the Mediterranean countries. India is the world's leading country in pomegranate production. Fixed plot survey for incidence of pomegranate wilt was taken up during 2014-15 and 2015-16 in major pomegranate growing districts of Karnataka viz., Vijayapura, Bagalkot, Koppal, Yadgir, Raichur, Ballari, Chitradurga, Tumakura and Hassan. In each district, two taluks were selected, in each taluk five orchards were selected for disease incidence. Talukwise data on mean incidence of wilt over two seasons indicated that the highest incidence (33.34%) was recorded in Sira taluk of Tumakur district followed by Bagalkot taluk of Bagalkot district (31.41%) and Hassan taluk of Hassan district (30.70%). The least incidence of 11.54 per cent was recorded in Shorapur taluk of Yadgir district. Among districts, the data over two seasons indicated that, Tumakur showed highest mean wilt incidence (30.62%) followed by Bagalkot (29.02%) and Hassan (28.75%). However, the lowest mean incidence over two seasons was observed in Yadagiri (14.81%) followed by Raichur (17.38%) and Koppal (20.5%). Further, it is clear from the survey data that Karnataka state recorded overall mean wilt incidence of 24.13 per cent. The incidence of wilt varied from 11.54 per cent (Shorapur) to 33.34 per cent (Sira).

Keywords: *Ceratocystis fimbriata*, *Hastbahar*, Soil borne, Wilt, incident

1. Introduction

Pomegranate (*Punica granatum* L.) is an ancient fruit, belongs to the family Punicaceae. Pomegranate is native to Iran, where it was first cultivated in about 2000 BC and spread to the Mediterranean countries. It is cultivated in India, Iran, China, Turkey, USA, Spain, Azerbaijan, Armenia, Afghanistan, Uzbekistan, the Middle East, Pakistan, Tunisia, Israel, dry regions of Southeast Asia, Peninsular Malaysia, the East Indies and tropical Africa. India is the world's leading country in pomegranate production. The statistical on acreage and production of pomegranate are not available with Food and Agriculture Organization at global level, however, estimated global cultivated area under pomegranate is around 3 lakh ha and production 3.0 million tons (NRCP Technical Bulletin, 2014). The fruit is very much preferred for its cool and refreshing juice. The arils of the fully matured fruit is consumed as such and also in processed form like juice, syrup and jelly. Seeds with fleshy portions of sour pomegranate are dried and marketed as 'Anardana', which is being used as a condiment and for souring curries. Pomegranate is a good source of carbohydrates and minerals such as iron, calcium and sulphur. It is a rich source of vitamin C. Citric acid is the most predominant organic acid present in pomegranate (Malhotra *et al.*, 1983) [2]. Glucose (5.46%) and fructose (6.14%) are the main sugars and no sucrose in fruits. The fruits of pomegranate are known for pharmaceutical and therapeutic values. Sweet varieties are mildly laxative, sour types are good for curing inflammation of stomach and heart ache, therefore pomegranate is called as the "Fruit of Paradise". In India, there is a common slogan 'Ek anar sau bimbar' meaning one fruit cures hundred diseases. The flower buds are very useful in ayurveda for managing bronchitis. The bark of the stem, root and rind of the fruit is used for slimming, control of diarrhea and for killing tape worms.

In Karnataka, the crop has spread across different districts viz., Vijayapura, Bagalkot, Koppal, Yadgir, Raichur, Ballari, Chitradurga, Tumakura and Hassan. The most popular varieties suitable for processing and table use are Ganesh, Mridula, Arakta, Bhagwa (Kesar), G-137 and Khandar. Area under pomegranate is increasing worldwide because of its hardy nature, wider adaptability, drought tolerance, higher yield levels with excellent keeping quality and remunerative prices in domestic as well as export market. It thrives well in dry tropics and subtropics and comes up very well in soils of low fertility status as well as on saline soils. Successful cultivation of pomegranate in recent years has met with different traumas such as pest and diseases.

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Bacterial blight, wilt, anthracnose, leaf spot and root knot nematode are important diseases. Among them, wilt caused by *Ceratocystis fimbriata* Ell. and Halst. is a major threat. At present the crop is severely affected by wilt pathogen and day by day the wilting severity is increasing at faster rate. It was first noticed in some areas of Vijayapur districts of India during 1990. By 1993, rapid spread of this disease was observed in entire Vijayapura district. The cause was not identified until 1995; however in 1996 the fungus *C. fimbriata* was isolated from discolored stem, root and branch tissues on wilting plants. Disease is characterized by initial symptoms of yellowing and wilting of leaves on one to several branches leading to death of affected plants in a few weeks. Cross sections of diseased plants revealed brown discoloration in the outer xylem from roots to the main trunk (Somasekhara and Walli, 1999) [3].

The disease is prevalent in parts of Maharashtra, Karnataka, Telangana, Gujarat and Tamil Nadu states (Jadhav and Sharma, 2009) [9]. Despite many factors conducive for the high severity, seedlings selection for planting, soil borne nature and also association with shot hole borer and plant parasitic nematodes is noticed. This might be the reason for the current rampant spread of the disease in south Indian states. Several agents are known to cause wilt in pomegranate, but *C. fimbriata* is the major cause (Sharma, 2009 and Sharma *et al.*, 2010) [4, 5], hence, emphasis will be on *C. fimbriata*.

In Karnataka, systematic work on important aspects of the pomegranate wilt and its pathogen has not been done. Realizing the potentiality of wilt causing huge economic losses, it was thought necessary to initiate systematic studies on different aspects of the disease as well as pathogen. It is necessary to conduct the survey of the disease, so that its distribution and extent of its spread can be understood and "hot spots" can be located.

Considering the importance and the severe loss caused by *Ceratocystis fimbriata* Ell. and Halst., it is thought necessary to initiate systematic studies on emerging and destructive wilt disease problem occurring in different parts of Karnataka. Keeping these points in view, thorough study of different aspects of pathogen and disease are planned with following objectives. Survey for the incidence of pomegranate wilt in Karnataka.

Material and methods

Fixed plot survey for incidence of pomegranate wilt was taken up during 2014-15 and 2015-16 in major pomegranate growing districts of Karnataka viz., Vijayapura, Bagalkot, Koppal, Yadgir, Raichur, Ballari, Chitradurga, Tumakura and Hassan. In each district, two taluks were selected, in each taluk five orchards were selected for disease incidence. Observations on total number of plants in the orchard and number of plants wilted, either partially or completely in each orchard were recorded during the survey and the disease incidence (%) was calculated by using the following formula.

$$\text{Disease incidence (\%)} = \frac{\text{Number of plants wilted in the orchard}}{\text{Total number of plants observed in the orchard}} \times 100$$

Results and Discussion

An intensive fixed plot survey was carried out during *Hastbahar* 2014 and 2015 in different pomegranate growing areas of Vijayapura, Bagalkot, Koppal, Yadgir, Raichur, Ballari, Chitradurga, Tumakura and Hassan districts to assess the status of pomegranate wilt. Plots were visited during the

month of November at flowering stage and observations required to calculate the disease incidence were recorded. The results obtained during fixed plot survey are presented in Table 1. Vijayapura district recorded the mean pomegranate wilt incidence of 22.50 per cent (Table 1). In the district, highest pomegranate wilt (37.60%) was recorded in Babaleshwar village of Vijayapura taluk followed by Hittanahalli (27.7%) and Devara hippargi-2 (25.40%) of Sindgi taluk and lowest incidence of 8.05 per cent was recorded in Devara hippargi-1 of Sindgi taluk during 2014 (Table 1). During 2015, the highest incidence of pomegranate wilt (42.60%) was observed in Babaleshwar village of Vijayapura taluk followed by Hittanahalli (32.7%) and Kanolli-2 of Sindgi taluk (26.04%) and lowest (13.08%) was recorded in Devara hippargi-1 of Sindgi taluk (Table 1).

Survey conducted in Bagalkot district indicated that, mean incidence of pomegranate wilt was 29.02 per cent over two years (Table 1). During 2014, highest incidence of pomegranate wilt (38.45%) was observed in Govindkoppa village of Bagalkot taluk followed by Mudhol (rural) of Mudhol taluk (33.83%) and Kaladgi-3 of Bagalkot taluk (29.64%). While, Lokapur-2 of Bagalkot taluk recorded least pomegranate wilt of 9.5 per cent (Table 1). Results also indicated that Govindkoppa village of Bagalkot taluk recorded highest pomegranate wilt (45.45%) followed by Mudhol (rural) (39.83%) of Mudhol taluk and Kaladgi-3 of Bagalkot taluk (36.64%) and least incidence of 15.5 per cent in Lokapur-2 of Bagalkot taluk (Table 1).

With respect to Koppal district, results revealed that, highest pomegranate wilt (31.33%) was found in Lebgera village of Koppal taluk followed by Maladgati-1 of Kushtagi taluk (30.41%) and Irakalagunda village of Koppal taluk (26.16%) and least pomegranate wilt (1.69%) was recorded in Yelamgera village of Koppal taluk during 2014 (Table 1). During 2015, Maladgati-1 of Kushtagi taluk recorded highest pomegranate wilt (35.41%) followed by Lebgera village of Koppal taluk (33.33%) and Herebannigola village of Kushtagi taluk (28.63%). However, the least incidence was in (2.3%) Yelamgera village of Koppal taluk (Table 3). The mean incidence in Koppal district for pomegranate wilt was 20.5 per cent (Table 2).

Among six villages in Yadgir district, Wadgera-2 of Shahapur taluk recorded highest pomegranate wilt (31.4%) followed by Tumkur (25.45%) village of Shahapu taluk and least pomegranate wilt (0.71%) was recorded in Heggandodi-1 of Shorapur taluk during 2014 (Table 1). Whereas during 2015, Wadgera-2 of Shahapur taluk recorded maximum pomegranate wilt (36.45%) followed by Tumkur (29.17%) village of Shahapur taluk and least (1.82%) was observed in Heggandodi-1 of Shorapur taluk (Table 1). The district mean incidence of pomegranate wilt was 14.81 per cent for two years (Table 2).

In Raichur district, the average incidence was 17.38 per cent (Table 2) and survey was covered in eight villages of the district during 2014. Ganjhalli-1 of Raichur taluk recorded highest incidence of pomegranate wilt (25.63%) followed by Yatgal of Devadurga taluk (23.95%) whereas least incidence of pomegranate wilt (7.4%) was observed in Arker-2 village of Devadurga taluk (Table 1). During 2015, highest pomegranate wilt (27.23%) was found in Ganjhalli-1 of Raichur taluk. The least incidence of pomegranate wilt (9.56%) was in Arker-2 of Devadurga taluk (Table 1).

The average disease incidence over two years in Ballari district was 26.69 per cent (Table 2). Maximum incidence (41.11%) was observed in Khondanhalli-2 of HB Halli taluk

followed by Kallukamba-2 of Ballari taluk (31.75%). Least incidence was in Basarkodu village of HB Halli taluk (10.24%) during 2014 (Table 1). During 2015, Khondanhalli village of HB Halli taluk recorded wilt incidence of 46.11 per cent followed by Kallukamba-2 village of Ballari taluk (36.57%) and Bachigondanhalli village of HB Halli taluk (35.32%) and the lowest (15.24%) was found in Basarkodu village of HB Halli taluk (Table 1).

Chitradurga district is well known for pomegranate cultivation and highest pomegranate wilt of 33.52 per cent incidence was recorded in Shriranager village of Hiriyur taluk followed by Siranahatti-2 of Hosadurga taluk (28.08%) and least was in Seerana katta-1 of Hiriyur taluk (13.2%) during 2014 (Table 1). Whereas survey conducted during 2015 revealed that highest pomegranate wilt (37.52%) was found in Shriranager village of Hiriyur taluk followed by Siranahatti-2 of Hosadurga taluk (33.08%) and Nagayana hatti-1 (32.08%) of Hosadurga taluk and lowest (17.2%) was in Seerana katta-1 of Hiriyur taluk (Table 1). However, an average incidence for the district for two years survey is 26.99 per cent (Table 2).

In Tumakur district, highest pomegranate wilt of 41.23 per cent was recorded in Madanakunte-1 of Pavagada taluk followed by Thogargunte-2 of Sira taluk (38.5%) and least was in Chikkahalikunte-1 of Sira taluk (19.07%) during 2014 (Table 1). Whereas survey conducted during 2015 revealed that highest pomegranate wilt incidence (45.23%) was found in Madanakunte-1 of Pavagada taluk followed by Thogargunte-2 of Sira taluk (42.5%) and lowest (23.07%) was in Chikkahalikunte-1 of Sira taluk (Table 1). However, an average incidence for the district for two years survey is 30.62 per cent (Table 2).

With respect to incidence in Hassan district, the average incidence of pomegranate wilt was 28.75 per cent (Table 2). Survey covered in five villages of the district during 2014 indicated that Harnahalli-1 of Arsikere taluk recorded highest incidence of pomegranate wilt (41.75%) followed by Mylanahalli-1 of Hassan taluk (40.66%) whereas least incidences of pomegranate wilt (10.85%) was observed in Gorankoppal-1 of Arsikere taluk (Table 1). During 2015, highest pomegranate wilt (51.17%) was found in Gorankoppal-2 of Arsikere taluk. The least incidence of pomegranate wilt (14.5%) was in Gorankoppal-1 of Arsikere taluk (Table 2).

Talukwise data (Table 2) on mean incidence of wilt over two seasons indicated that the highest incidence (33.34%) was recorded in Sira taluk of Tumakur district followed Bagalkot taluk of Bagalkot district (31.41%) and Hassan taluk of Hassan district (30.70%). The least incidence of 11.54 per cent was recorded in Shorapur taluk of Yadgir district.

Among districts, the data over two seasons indicated that, Tumakur showed highest mean wilt incidence (30.62%) followed by Bagalkot (29.02%) and Hassan (28.75%). However, the lowest mean incidence over two seasons was observed in Yadagiri (14.81%) followed by Raichur (17.38%) and Koppal (20.5%). Further, it is clear from the survey data that Karnataka state recorded overall mean wilt incidence of 24.13 per cent (Table 2).

Survey carried out during 2014, in 88 orchards, of which three orchards had wilt in severe form (> 40.0% incidence), 76 orchards had wilt of moderate incidence (10.1-40%) and nine orchards had mild (up to 10%) wilt incidence (Table 2). During 2015, in 88 orchards, of which 10 orchards had wilt in severe form (> 40.0% incidence), 72 orchards had wilt moderate incidence (10.1-40%) and 6 orchards had mild (up to 10%) wilt incidence (Table 2).

The first hand knowledge about distribution of disease and the extent of prevalence will guide to take up immediate control measures. In addition, the survey also gives indication about the occurrence and distribution of disease in a region. In the present study, an intensive fixed plot survey for wilt of pomegranate was carried out during *Hastbahar* 2014 and 2015 in major pomegranate growing areas of Karnataka to get precise information on the distribution and intensity of the disease. The data on survey revealed that, the wilt incidence varied from locality to locality, type of cropping pattern and environmental condition. The overall mean incidence of pomegranate wilt was slightly more and it ranged from 21.87-26.4 per cent during *Hastbahar* 2014 and 2015 on different cultivars such as Kesar, Ganesh, Arkata and Sindhoori grown in Karnataka state. This may be due to build up of inoculum in the soil prevailed due to continuous cultivation of the crop year after year at different locations. Sharma *et al.* (2010)^[5] surveyed major pomegranate areas in India during 2005-09 and reported higher disease incidences in Maharashtra (49.2%), Karnataka (61.11%) and Andhra Pradesh (8.69%).

With respect to incidence in surveyed districts, the highest pomegranate wilt (30.62%) was recorded in Tumakur district followed by Bagalkot recorded wilt incidence of 29.02 per cent and least incidence of wilt (14.81%) was recorded in Yadgir district during 2014 and 2015. Further, five to six year old orchards showed a higher disease compared to younger orchards during the recent study. It was also noticed that wherever shot hole borer association was noticed, the wilt incidence was higher. Similar kind of observations were noticed by Sonyal (2010)^[8] who reported that wilt incidence ranged from 22.3 to 45.2 per cent in different surveyed locations of six northern districts. Among the orchards, 4-5 year old orchards showed a higher disease than the plants aged three years or less and orchards showing higher wilt incidence also showed an association with the borer. Sharma *et al.* (2010)^[5] reported that in Maharashtra wilt prevalence was more in the districts of Satara (91.66%), Pune (90.0%), Nashik (66.66%), Solapur (47.05%) and Ahmednagar (50.0%). In Karnataka 61.11 per cent prevalence was recorded in Koppal, Bagalkot and Bijapur districts whereas, in Anantapur district of Andhra Pradesh wilt was observed only in 8.69 per cent of the orchards. Further, the higher incidence of pomegranate wilt disease in Tumkur and Bagalkot districts is due to the major crop in Tumkur district where pomegranate is grown in large area as a sole crop and it was noticed during survey that, the farmers of these districts are not practicing any type of cropping pattern and more build up of inoculum.

Further, the highest mean incidence of wilt (33.34%) was recorded in Sira taluk of Tumakur district followed by Bagalkot (31.41%) of Bagalkot district and Hassan taluk of Hassan district (30.7%) among the taluks. The least incidence of pomegranate wilt (11.54%) was recorded in Shorapur taluk of Yadgir district. Eighty eight orchards, of which three orchards had wilt in severe form (> 40.0% incidence), 76 orchards had wilt moderate incidence (10.1-40%) and nine orchards had mild (up to 10%) wilt incidence during 2014. During 2015, in 88 orchards, of which 10 orchards had wilt in severe form (> 40.0% incidence), 72 orchards had wilt moderate incidence (10.1-40%) and 6 orchards had mild (up to 10%) wilt incidence. The incidence of wilt varied from 11.54 per cent (Shorapur) to 33.34 per cent (Sira) and all taluks recorded moderately severe infection (10.1-40%) of wilt. None of the taluks recorded mild (0-10%) and severe (>40%) indicating the moderate incidence of wilt disease in

Karnataka state. Similar studies were carried out in Karnataka, Andhra Pradesh and Maharashtra wherein wilt was prevalent in 47.57 per cent of orchards, of which only 5.82 per cent had severe wilt infections, 10.03 per cent moderate and 31.71 per cent mild wilt infections and the disease was prevalent on all important cultivars. These results are in conformity with the results of Somasekhara (1999) [6], a survey of 44 locations in Maharashtra in India from 1995 to 1998 showed 7.5 per cent crop losses. In Karnataka wilt incidence was reported from Bagalkot, Bijapur, Bilagi, Kanamadi, Tikota, Sindagi, Indi, Talikoti and Tajpur locations (Somasekhara *et al.*, 2000) [7]. The higher disease incidence in Tumkur, Bagalkot and Hassan in the present study may be attributed to the use of cuttings from infected fields. The mono cropping also aggravated the disease situation and there is no resistance variety available. Practicing improper management practices by farmers in the initial period of the crop also made it difficult to manage the wilt. As per the present

recommendation, on observing first symptoms of wilt in the orchard immediately drench soil with chemicals/bio-agents also drench at least 2-3 healthy plants on all the four sides around the infected plant/s, repeat the drenching 3-4 times at 15-20 days interval. But this is not happening in the farmers fields because the cultivation of pomegranate is labour intensive and costly. Moreover, infected plants are not removed timely from field and are not burnt by farmers. To these reasons pathogens survive in the field and cause the disease in higher proportions. The prophylactic management practices were also not followed by farmers to manage the fungal wilt disease of pomegranate in almost all the locations surveyed. The selection of pre infected cuttings with *C. fimbriata* lead to the increased wilt incidence in the areas surveyed. This is in agreement with Sonyal (2010) [8] who reported that the pomegranate wilt was most severe in districts such as Bellary, Koppal, Gadag, Bijapur, Bagalkot and Raichur in Karnataka.

Table 1: Incidence of wilt in major pomegranate growing districts of Karnataka during 2014-2015

Sl. No	Name of the place			2014, Average Wilt incidence (%)			2015, Average Wilt incidence (%)			
	District	Taluk	Village	Village	Taluk	District	Village	Taluk	District	
1	Vijayapura	Vijayapura	Kumatagi	Kesar	12.30	21.61	20.14	17.30	26.71	24.89
			Hadagali	Ganesh	18.30			23.83		
			Babaleshwar	Ganesh	37.60			42.60		
			Hittinahalli	Ganesh	27.70			32.70		
			Jumnal	Arkata	12.15			17.15		
		Sindgi	Kannolli-1	Sinduri	20.22	18.68	23.01	25.22		
			Kannolli-2	Sinduri	21.04			26.04		
			Devara hippargi-1	Kesar	08.08			13.08		
			Devara hippargi-2	Sinduri	25.40			30.40		
			Bandal	Kesar	15.69			20.63		
2	Bagalkot	Bagalkot	Devanal	Sinduri	19.11	27.91	25.76	26.11	34.91	32.26
			Govindkopp	Kesar	38.45			45.45		
			Kaladgi-1	Sinduri	25.00			32.00		
			Kaladgi-2	Ganesh	27.37			34.37		
			Kaladgi-3	Sinduri	29.64			36.64		
		Mudhol	Lokapur-1	Kesar	24.06	23.62	29.62	30.06		
			Lokapur-2	Ganesh	09.50			15.50		
			Mahalingapur-1	Kesar	26.22			32.22		
			Mahalingapur-2	Ganesh	24.50			30.50		
			Mudhol (rural)	Kesar	33.83			39.83		
3	Koppal	Koppal	Kalkbandi	Kesar	03.40	16.56	18.80	03.40	18.37	22.20
			Kamanur	Kesar	20.22			22.22		
			Lebgera	Kesar	31.33			33.33		
			Yelamgera	Kesar	01.69			02.30		
			Irakalagunda	Ganesh	26.16			28.16		
		Kushtagi	Here bannigola	Kesar	23.63	21.04	26.04	28.63		
			Kodkera	Kesar	11.65			16.65		
			Kustgi	Ganesh	16.65			21.65		
			Maladgati-1	Kesar	30.41			35.41		
			Maladgati-2	Ganesh	22.90			27.90		
4	Yadgir	Shahapur	Gogi K	Kesar	03.00	16.41	13.22	05.14	19.74	16.29
			Wandurg-1	Kesar	05.80			08.23		
			Wadgera-2	Kesar	31.40			36.45		
			Tumkur	Kesar	25.45			29.17		
		Shorapur	Heggandoddi-1	Kesar	00.71	10.23	12.85	01.82		
			Heggandoddi-2	Kesar	8.75			10.11		
			Chincholi-1	Kesar	19.25			22.52		
			Chincholi-2	Kesar	12.22			16.96		
5	Raichur	Raichur	Karekal	Kesar	20.50	18.46	16.05	23.45	21.23	18.69
			Ganjhalli-1	Kesar	25.63			27.23		

				Ganjhalli-2	Kesar	10.50	13.68		13.98	16.15		
				Chandrabanda	Kesar	18.40			21.35			
				Yapaldinni	Kesar	17.05			20.16			
				Yatgal	Kesar	23.95			26.21			
				Arkera-1	Kesar	11.70			15.45			
				Arkera-2	Kesar	07.40			09.56			
				Benkal	Kesar	12.03			15.24			
				Kurkihalli	Kesar	13.33			14.33			
6	Ballari	Ballari		Kampli	Kesar	15.53	22.88	24.19	20.53	27.88	29.19	
				Kurugodu	Kesar	29.27			34.27			
				Lakshmipura	Kesar	19.38			24.38			
				Kallukamba-1	Kesar	18.65			23.65			
				Kallukamba-2	Kesar	31.57			36.57			
	HB Halli				Khondanhalli-1	Kesar	18.64	25.50		23.64	30.50	
					Khondanhalli-2	Kesar	41.11			46.11		
					Thambrahalli	Kesar	27.21			32.21		
					Bachigondanahalli	Kesar	30.32			35.32		
					Basarkodu	Kesar	10.24			15.24		
7	Chitradurga	Hosadurga		Siranahatti-1	Arkata	26.93	26.04	24.73	31.93	31.04	29.23	
				Siranahatti-2	Mrudula	28.08			33.08			
				Ramajjanahalli	Kesar	21.55			26.55			
				Nagayana hatti-1	Kesar	27.08			32.08			
				Nagayana hatti-2	Ganesh	26.56			31.56			
	Hiriyur				Maskal-1	Kesar	27.60	23.43		31.60	27.43	
					Maskal-2	Mrudula	19.86			23.86		
					Seerana katte-1	Kesar	13.20			17.20		
					Seerana katte-2	Mrudula	23.00			27.00		
					Shrirananager	Kesar	33.52			37.52		
8	Tumakuru	Pavagada		Madanakunte-1	Mrudula	41.23	25.90	28.62	45.23	29.90	32.62	
				Madanakunte-2	Mrudula	19.62			23.62			
				Karekyatana halli-1	Kesar	19.66			23.66			
				Karekyatana halli-2	Kesar	24.85			28.85			
				Karekyatana halli-3	Sinduri	24.15			28.15			
	Sira				Chikka halikunte-1	Kesar	19.07	31.34		23.07	35.34	
					Chikka halikunte-2	Kesar	38.22			42.22		
					Thogargunte-1	Kesar	32.00			36.00		
					Thogargunte-2	Ganesh	38.50			42.50		
					Hosahalli	Kesar	28.95			32.95		
9	Hassan	Hassan		Mylanahalli-1	Arakta	40.66	27.20	25.23	47.66	34.20	32.28	
				Mylanahalli-2	Arakta	12.92			19.92			
				Nadakhalli	Kesar	13.74			20.74			
				Chikabidane-1	Kesar	36.55			43.55			
				Chikabidane-2	Kesar	32.13			39.13			
	Arsikere				Harnahalli-1	Kesar	41.75	23.27		48.50	30.36	
					Harnahalli-2	Kesar	13.28			18.28		
					Harnahalli-3	Kesar	14.37			19.37		
					Gorankoppal-1	Sinduri	10.85			14.50		
					Gorankoppal-2	Ganesh	36.11			51.17		

Table 2: District and talukwise pomegranate wilt incidence in parts of Karnataka during 2014 -15

Districts	Taluk	Wilt incidence (%)		Mean
		2014	2015	
Vijayapura	Vijayapura	21.61	26.71	24.16
	Sindgi	18.68	23.01	20.85
	Mean	20.14	24.89	22.50
Bagalkot	Bagalkot	27.91	34.91	31.41
	Mudhol	23.62	29.62	26.62
	Mean	25.77	32.26	29.02
Koppal	Koppal	16.56	18.37	17.46
	Kushtagi	21.04	26.04	23.54
	Mean	18.80	22.20	20.50
Yadgir	Shahapur	16.41	19.74	18.08
	Shorapur	10.23	12.85	11.54
	Mean	13.32	16.29	14.81
Raichur	Raichur	18.46	21.23	19.845
	Devadurga	13.68	16.15	14.915
	Mean	16.07	18.69	17.38
Ballari	Ballari	22.88	27.88	25.38

	HB halli	25.50	30.50	28.00
	Mean	24.19	29.19	26.69
Chitradurga	Hosadurga	26.04	31.04	28.54
	Hiriyur	23.43	27.43	25.43
	Mean	24.73	29.23	26.99
Tumakur	Pavagada	25.90	29.90	27.90
	Sira	31.34	35.34	33.34
	Mean	28.62	32.62	30.62
Hassan	Hassan	27.20	34.20	30.70
	Arsikere	23.27	30.36	26.81
	Mean	25.23	32.28	28.75
Grand mean		21.87	26.40	24.13

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