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Original Research Article

Assessment of Severity and Distribution of Ring Spot and Brown Spot Diseases in Major Sugarcane Growing Districts of Northern Karnataka

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Benefit: Disease severity, Ring spot, Brown spot, Per cent disease index

A B S T R A C T

An extensive survey was carried out to assess the severity and distribution of ring spot and brown spot diseases in four districts of northern Karnataka *viz.*, Dharwad, Belagavi, Bagalkote and Uttar Kannada districts during, *Kharif* season. The severity of ring spot varied from 0.00 to 85.80 PDI and brown spot ranged from 0.00 to 85.18 PDI). In general the highest severity of ring spot (85.18 PDI) was noticed at Bandal village of Kumta taluk at 11th month cropping stage of main crop and Hegadegatta and Janmane villages village of Sirsi taluk at 10th and 11th month cropping stage of main crop, respectively. The least PDI of ring spot was observed in Budhihal village (7.40 PDI) of Bilagi taluk at 11th month cropping stage of ratoon crop and there was no disease in all other surveyed villages of Bagalkote district and Kagawad, Katral, Khanapur, Konnur and Mole villages of Belagavi district. In general the highest severity of brown spot was observed at Kagawad village (85.18 PDI) of Athani taluk at 11th month cropping stage of ratoon crop and Mandhanakere village (85.18 PDI) of Sirsi taluk. There was no disease in Konnur and Mole villages of Belagavi district and all the surveyed villages of Bagalkote district except in Budhihal and Honnihal villages and all the village of Uttar Kannada district except Madhanakere and Mareguddi villages.

Introduction

Sugarcane (*Saccharum officinarum* L) is an important cash crop and it is grown in tropical and subtropical regions of the world. This crop was introduced by the Arabs in the eighth century A. D. to the Mediterranean, Mesopotamia, Egypt, North Africa and Andalusia. By the 10th century, sugarcane cultivation was well established. In some countries, such as Brazil, part of the sugarcane biomass is also used for the production of bioethanol. The crop is cultivated in more than 90 countries all over the world, the largest area being in Brazil followed by India.

Globally, sugarcane is cultivated over an area of 23.80 million hectare with a production of 1794.35 million tonnes with a productivity of 70.54 tonnes per hectare (Anon., 2018a).

Sugarcane is an important cash and industrial crop of India. In India, it is cultivated in an area of 5.35 million hectares with a production of 355 million tonnes and productivity of 66.36 tonnes per hectare (Anon., 2018a). The principal sugarcane growing states are Andhra Pradesh, Gujarat, Karnataka, Maharashtra, Tamil Nadu and Uttar Pradesh. In Karnataka, sugarcane is being cultivated in an area of 4.25 lakh hectares with a cane production of 35.91 million tonnes and a productivity of 85.5 tonnes per hectare which is well above the national and also world average (Anon., 2018b). However, there is still scope to increase the productivity. Important districts which cultivate sugarcane are Bagalkote, Belagavi, Bidar, Mandya, Mysore and Vijayapur.

Sugarcane is considered as long durated and lazyman's crop and its production is affected by different pest problems. Sugarcane suffers from many diseases caused by fungi, bacteria, viruses, nematodes and also abiotic stresses. Because of increased area of cultivation and continuous spread of same crop causing losses both qualitatively and quantitatively. Hither to minor diseases have reached the proportion of causing severity in larger area. Thus, ring spot and brown spot diseases which were sporadically earlier have become frequently occurring diseases in some parts of northern Karnataka.

This has made to draw attention of sugarcane scientists in general and plant pathologist in parsial to initiate some work. Survey of literature suggested that there is no much systematic work carried out on various aspects of these two diseases *i.e.,* ring spot and brown spot except reporting of the diseases and description of symptoms.

In the present study Survey to assess the severity and distribution of ring spot and brown spot diseases in major sugarcane growing districts of northern Karnataka.

Materials and Methods

An intensive roving survey was conducted to know the severity and distribution of two foliar diseases (ring spot and brown spot) of sugarcane in major sugarcane growing districts of northern Karnataka *viz.*, Belagavi, Bagalkote, Dharwad and Uttar Kannada districts during *Kharif*, season, 2018-2019.Observations recorded based on extent of area covered in sugarcane crop in different taluks in each district. One village per taluk and in each village five sugarcane fields were randomly selected. At each field, five plants were selected for collecting information. Observations were collected on type of symptoms, genotypes used, GPS reading.

As disease rating scale was not available for these two diseases, the one developed for sugarcane rust (0-9) was used with some modifications for recording disease based on the extent of area covered and disease rating scale viz.,0 - No visible Symptoms, 1- Minute specks on lower one or two leaves covering approximately 1% leaf area, 2- Specks increase in their size with light coloured center and red to brown margin on lower one or two leaves covering around 5% leaf area, 3- Specks enlarge into lesions, irregularly shaped may coalesce observed on lower three to four leaves covering around 6 - 15 per cent leaf area, 4- Enlarged lesions on lower three to four leaves covering around 16 -25 per cent leaf area with sporulation noticed, 5- Lesions enlarged covering large area on each leaf and observed on mid leaves covering around 26%-30% leaf area with sporulation observed, 6- Lesions enlarged covering large area on each leaf and observed on mid leaves covering around 26%-30% leaf area with sporulation observed and also up to 66 per cent of PDI range showing susceptible

(MS), 7- Lesions enlarged and lower three to four leaves drying covering around 41%-45% leaf area with high sporulation and also up to 77 per cent of PDI range showing similar susceptible (S), 8- Lesions of different sizes observed on all the leaves and middle leaves drying covering around 46%-50% leaf area with high sporulation and also up to 88 per cent of PDI range showing similar susceptible(S),, 9- All the leaves showing enlarged lesions covering more than 50% of leaf area with heavy sporulation and all the leaves drying and also up to 99 per cent of PDI range showing Highly susceptible (HS) (Modified from sugarcane rust, Mayee and Datar, 1988).

Per cent disease index (PDI) was calculated by using formula (Wheeler, 1969) as indicated below.

$$PDI = \frac{\text{Sum of individual ratings}}{\text{No. of leaves assessed x Maximum disease grade}} \times 100$$

Results and Discussion

Roving survey was undertaken during *Kharif,* season to assess the severity of foliar diseases sugarcane (Ring spot caused by *L. sacchari* and brown spot caused by *C. longipes*) in major sugarcane growing districts of northern Karnataka *viz.*, Dharwad, Belagavi, Bagalkote and Uttar Kannada by taking 5 fields in each village of different taluks as explained in the "Material and Methods" and results are presented in Table 1.

The data on survey revealed that the disease severity varied from locality to locality. The severity of ring spot varied from 0.00 to 85.80 PDI and brown spot ranged from 0.00 to 85.18 PDI.

Maximum mean severity of ring spot was observed in Uttar Kannada district (76.11 PDI) followed by Dharwad district (46.44 PDI) and Belagavi district (22.23 PDI), while the minimum mean severity was noticed in Bagalkote district (2.03 PDI). In general the highest PDI of 85.18 was noticed at Bandal village of Kumta taluk at 11th month cropping stage of main crop and Hegadegatta and Janmane villages village of Sirsi taluk at 10th and 11th month cropping stage of main crop, respectively followed by PDI of 77.77 was noticed at Kanakoppe, Madhanakere, Mareguddi villages of Sirsi taluk at 10 to 11th month cropping stage of main crop and Devanahally and Hebbail villages of Kumta taluk at 10th month cropping stage of main crop. The least PDI of ring spot was observed in Budhihal village (7.40 PDI) of Bilagi taluk at 11th month cropping stage of ratoon crop and there was no disease in all other surveyed villages of Bagalkote district and Kagawad, Katral, Khanapur, Konnur and Mole villages of Belagavi district. Among four districts surveyed, Uttar Kannada district recorded highest disease severity, which may be due to favourable environmental conditions *viz.*, maximum mean temperature (27.96^{0}C), minimum mean temperature (20.26 ^{0}C), relative humidity (92.27%) and rain fall (3540 mm/year) that must have favoured the buildup of inoculum in the earlier period, thus showing increase in disease severity. Similar observations were made in survey for *Leptosphaeria* species complex in other crops (Irana *et al*., 2012).

Maximum mean severity of brown spot was observed in Dharwad district (60.75 PDI) followed by Belagavi district (31.66 PDI) and Uttar Kannada district (5.92 PDI), while the minimum mean severity was noticed in Bagalkote district (0.92 PDI). In general the highest severity was observed at Kagawad village (85.18 PDI) of Athani taluk at 11th month cropping stage of ratoon crop and Mandhanakere village (85.18 PDI) of Sirsi taluk and followed by Kelageri (74.04 PDI) village of Dharwad taluk. There was no disease in Konnur and Mole villages of

Belagavi district and all the surveyed villages of Bagalkote district except in Budhihal and Honnihal villages and all the village of Uttar Kannada district except Madhanakere and Mareguddi villages. Among four districts surveyed, Dharwad district recorded highest disease severity, which may be due to favourable environmental conditions *viz.*, maximum mean temperature (31.10^{o} C),minimum mean temperature (20.37 ^{o} C) relative humidity (82.67%), rain fall (962.20 mm) and rainy days (69 days) that must have favoured the buildup of inoculum in the earlier period thus showing increase in disease severity. Similar observations were made in survey for *Cercospora* leaf spot of greengram by Kavyashree (2014). Varied incidence of early and late leaf spot of groundnut in different locations in Raichur taluk was attributed to cultivars grown, environmental conditions and pathogenic populations (Khadar, 1999).

The data on survey revealed that the disease severity of ring spot varied from main crop to ratoon crop and results are presented in Table 1. Maximum mean severity of ring spot was observed in Uttar Kannada district in main crop (78.46 PDI) followed by Belagavi District in ratoon crop (53.70 PDI) and Dharwad district in ratoon crop (52.85 PDI). Minimum mean severity of ring spot was observed in Bagalkote district in ratoon crop (2.96 PDI) and there was no disease recorded in Bagalkote district in main crop.

Maximum mean severity of brown spot was observed in Dharwad district (62.95 PDI) in main crop followed by Belagavi district (53.70 PDI) in ratoon crop which was closer with main crop of Dharwad district (60.64 PDA) and followed by Belagavi district (48.14 PDI).

Minimum mean severity of brown spot was observed in Bagalkote district (3.70 PDI) in ratoon crop and there was no disease recorded in Bagalkote district in main crop.

It is commonly observed that ratoon crop of sugarcane suffers more from the disease. In the present study the disease severity of ring spot in main crop of Uttar Kannada was higher which may be due to change of genotypes planted in Uttar Kannada as compared to other districts. This needs conformation by taking observations for some more years.

Summary and conclusions are as follows:

Sugarcane crop suffers from many diseases caused by fungi, bacteria, viruses, nematodes and also abiotic stresses. Recently, some of minor foliar diseases *viz.*, ring spot and brown spot have started occurring regularly in some parts of Karnataka. Thus a study is initiated on these two diseases and the results of the investigation are summarized here under.

Sugarcane (*Saccharum officinarum* L) Sugarcane is an important cash and industrial crop of India. The crop is affected by fungal diseases such as ring spot and brown spot. The severity of ring spot and brown spot ranged from 0.00 to 85.80 PDI and 0.00 to 85.18 PDI, respectively. The hot spot identified for ring spot are Hegadegatta, Bandal and Janmane (Kumta taluk) and for brown spot are Kagawad village (Athani taluk) and Mandhanakere village (Sirsi taluk). The maximum severity of ring spot was found in ratoon crop as compared to main crops in all districts (Belagavi, Bagalkote, and Dharwad) except Uttar kannada. Similarly maximum severity of brown spot was found in ratoon crop as compared to main crops in all districts (Belagavi, Bagalkote, and Uttar kannada) except. Dharwad.

Table.1 Survey for severity and distribution of ring spot disease in major sugarcane growing districts during, 2018

Districts	Taluk	Village	Genotype	1/2/3 year	Main/ ratoon	Stage of crop (month)	PDI
							Ring spot disease
Dharwad	Dharwad	Hebbali form	86032	3	Ratoon	7	33.33
		Jodally	86032	1	Main	7	33.33
		Narendra	86032	1	Main	11	37.03
		Mugad	86032	2	Ratoon	11	51.85
		UAS, Dharwad	86032	1	Main	7	37.03
		UAS, Dharwad	86032	2	Ratoon	7	55.55
						Taluk mean	**41.35**
	Hubballi	Chikkabagalli	89032	1	Main	11	54.55
		Kelegeri	Bili kabbu	1	Main	11	33.33
		Kudichikoppa	86032	1	Main	7	51.85
						Taluk mean	**46.57**
District mean							**43.96**
Belagavi	Athani	Ainapura	86032	1	Main	7	25.52
		Katral	86032	1	Main	7	29.62
		Kagawad	Co 263	2	Ratoon	11	0
		Mangasuli	86032	1	Main	11	25.92
		Mole	86032	1	Main	5	0
		Mole	265	1	Main	11	0
						Taluk mean	**13.81**

Table.1 contd….

Districts	Taluk	Village	Genotype	1/2/3 year	Main/ ratoon	Stage of crop (month)	PDI Ring spot disease
	Hukkeri	Heerebagavadi	Red kabbu	2	Ratoon	11	51.85
		Hukkeri	86032	1	Main	7	11.11
		Karadigudda	Mulgudi	1	Main	11	22.22
		Karadigudda	Red kabbu	1	Main	11	40.74
		Konnur	Snk 44	1	Main	8	0
	Taluk mean						25.18
	Khanapur	Khanapur	86032	1	Main	7	0
		Khanapur	Red kabbu	2	Ratoon	11	55.55
						Taluk mean	27.71
						District mean	**22.23**
Bagalkote	Bagalkote	Gavankere	86032	2	Ratoon	11	0
		Govinakoppa	86032	2	Ratoon	10	0
	Taluk mean						**0**
	Bilagi	Anagawadi	86032	1	Main	7	0
		Arakeri	86032	1	Main	7	0
		Budhihal	86032	2	Ratoon	11	7.40
		Janamatti	86032	1	Main	7	0
		Sunaga	86032	1	Main	7	0
						Taluk mean	2.64

Table.1 contd….

Districts	Taluk	Village	Genotype	1/2/3 year	Main/ ratoon	Stage of crop (month)	PDI Ring spot disease
	Badami	Hongeri	86032	2	Ratoon	11	0
		Kulgeri	86032	2	Ratoon	10	0
			Taluk mean				0
	Mudhol	Mudhol	86032	3	Ratoon	11	11.11
		Mudhol	910	2	Ratoon	11	0
		Mallapur	86032	1	Main	9	0
		Lokapur	910	3	Ratoon	11	11.11
						Taluk mean	**5.55**
						District mean	**2.03**
Uttar kannada	Kumta	Bandal	Konankatte	1	Main	11	85.18
		Devanahally	Konankatte	1	Main	10	77.77
		Hebbail	Konankatte	1	Main	10	77.77
		Hegadegatta	Baduskabbu	1	Main	10	85.18
		Janmane	Konankatte	1	Main	11	85.18
		Vanahalli	Das kabbu	1	Main	9	70.37
						Taluk mean	**80.24**
	Sirsi	Kanakoppe	Konnankatte	1	Main	11	77.77
		Madhanakere	Co 86032	1	Main	10	59.25
		Madhanakere	Morin	1	Main	10	77.77
		Madhanakere	Konankatte	1	Main	10	74.07
		Mareguddi	Co 932	1	Main	10	66.66
		Mareguddi	Mandya variety	1	Main	11	77.77
		Sarakuni	Konankatte	1	Main	10	74.07
		Usari	Konankatte	1	Main	10	66.66
						Taluk mean	**71.75**
						District mean	**75.99**

Table.2 Occurrence of ring spot disease in different sugarcane genotypes cultivated as main / ratoon crop in four districts of Northern Karnataka

Districts	Main/ Ratoon	Average of PDI	
		Ring spots	Brown spots
Dharwad	Main	39.81	60.64
	Ratoon	52.85	62.95
Belagavi	Main	13.43	37.93
	Ratoon	53.70	48.14
Bagalkot	Main	0.00	0.00
	Ratoon	2.96	3.70
Uttarkannada	Main	78.46	13.16
	Ratoon	0.00	0.00

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