

Evaluation of Chrysanthemum germplasms for resistance against Leaf blotch disease caused by *Septoria chrysanthemella* Sacc. under field condition

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Septoria leaf blotch (*Septoria chrysanthemella* Sacc.) is the most important disease of Chrysanthemum at Nadia district in West Bengal, India. To identify resistance against the leaf blotch disease, 77 non-hybrid and 109 hybrid germplasms were evaluated at two dates of observations. Of the 77 non-hybrid germplasms, none of them were found immune but 32 germplasms were highly resistant, 13 resistant, 11 moderately resistant, 13 moderately susceptible, 5 susceptible and 3 highly susceptible at first date of observation. During second date of observation, none of them were found immune but 10 germplasms were highly resistant, 10 resistant, 20 moderately resistant, 27 moderately susceptible, 9 susceptible and 1 highly susceptible. When the disease reactions of all non-hybrid germplasms recorded at two dates of observations were compared, 16 non-hybrid germplasms under different reaction categories [viz. 7 highly resistant, 3 moderately resistant, 5 moderately susceptible and 1 highly susceptible] were observed common at both dates of observations. Of the 109 hybrid germplasms examined during the first date of observation, none of them were found immune and highly susceptible but 69 germplasms were observed highly resistant, 12 resistant, 22 moderately resistant, 5 moderately susceptible and 1 susceptible. The screening of same number of germplasms at the second date of observation indicated that 52 germplasms were highly resistant, 21 resistant, 28 moderately resistant and 8 moderately susceptible. On comparing the disease reactions of all hybrid germplasms at two dates of observations, 57 hybrid germplasms under different disease reaction categories [viz. 43 germplasms highly resistant, 3 resistant and 11 moderately resistant] were noted common at both dates of studies.

Key words: Evaluation, Chrysanthemum, germplasm, *Septoria chrysanthemella*

INTRODUCTION

Chrysanthemum is the most important flower crop in the world as well as in India. Out of total area of 253.7 thousand hectare under flower cultivation in India, 18.68 thousand hectare is occupied by chrysanthemum, producing 14.7 thousand MT of flower (Annonymous, 2013). Improved and intensive technologies are being adopted for enhancing pro-

duction and productivity of the crop as well as for keeping pace with its demand in domestic and international markets. Adoption of such intensity technologies invites a number of diseases that adversely affect growth, vigour, survival ability of plants and also the yield and quality of the flower (Sohi, 1992). Out of the sixteen fungal, one bacterial, six viral and three nematode diseases, leaf blotch disease caused by *Septoria chrysanthemella* Sacc. is one of the most important diseases which caused considerable loss to the crop (De, 2013).

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Control of Septoria leaf blotch disease with the application of synthetic chemicals is the common practice (Chacko and Rao, 1986; Jash *et al.*, 2003) and which may increase the cost of control, lead to the resurgence of resistance, destroy non-target beneficial microorganisms and deteriorate soil health and environment. Use of resistant genotypes/ cultivars for cultivation of this flower crop provides undoubtedly the most cost-effective, logistically the easiest, environment friendly and also the safest of all the methods used for the control of this disease. Its use not only reduces the disease epidemic but also helps to maintain biological balance in the ecosystem. A large number of chrysanthemum germplasms are now available (Anonymous, 2012). Those are needed to test for searching of resistance against major and important Septoria leaf blotch disease. A few attempts on such screening of chrysanthemum germplasms were made earlier (Meeta *et al.*, 1989; Sen and Pathania, 1997; Ahmad *et al.*, 2003; Kulkarni *et al.*, 2005). Considering the changes in disease spectrums in the contest of climate change, apprehending threat from the evolution of new strains of pathogens and knowing the existence of variations in reaction responses of genotypes to this disease in different geographical locations, evaluation of some available improved hybrid and non-hybrid germplasms in search of resistance is needed and that to be done location wise and to be renewed continuously. Keeping the above utilities of screening of genotypes against diseases in mind and considering the very meager information available in this regard from this location, the present research work on the evaluation of chrysanthemum genotypes against Septoria leaf blotch disease has been conducted in the Gangetic alluvial zone of West Bengal, in order to assess the level of resistance present within the existing genotypes, to categorize them according to the level of resistance and to prepare a cafeteria of resistant genotypes for their immediate use in the replacement of highly susceptible genotypes(s) and their future use in the breeding programme.

MATERIALS AND METHODS

One field experiment was conducted at the Horticultural Research Farm of Bidhan Chandra Krishi Viswavidyalaya, Mondouri (22°43' N latitude and 88°34' E longitude at an elevation of 9.75 m above mean sea level), Nadia, West Bengal, India. Seedlings of 77 non-hybrid germplasms (Table 1) were

transplanted in 4th September during 2011 and 28th July during 2012 in 1 m x 1 m sized plots at a planting distance of 25 cm x 25 cm following randomized block design (RBD) with two replications for screening against Septoria leaf blotch disease of chrysanthemum. One hundred nine hybrid germplasms were also transplanted (Table 5) in 25th August during 2011 and in 7th August during 2012 respectively, keeping plot size, spacing and replications same as in case of non-hybrid germplasms. Recommended agronomic practices and need based intercultural operations were followed during the entire period of crop growth. Natural incidence of leaf blotch disease was allowed. Disease severity of all randomly selected plants was scored on 12th May and 12th September, 2012 following 0-6 disease rating scale [0 (Immune) = 0% leaf area covered by disease, 1 (Highly resistant) = 1-5% leaf area covered, 2 (Resistant) = 6-10% leaf area covered, 3 (Moderately resistant) = 11-25% leaf area covered, 4 (moderately susceptible) = 26-50% leaf area covered, 5 (Susceptible) = 51-75% leaf area covered, 6 (Highly susceptible) = 76-100% leaf area covered] at 251 and 46 days after transplanting (DAT) respectively for non-hybrid germplasms and 261 and 36 DAT respectively for hybrid germplasms, taking three plants per replication and six plants under two replications into consideration. PDI (Per cent Disease Index) was calculated replication wise following standard formula given by McKinny (1923)

$$PDI = \frac{\text{Sum of individual disease rating}}{\text{Number of observations} \times \text{Maximum disease grade}} \times 100$$

Before statistical analysis, percentage data were suitably transformed. Based on the PDI values of each of the date of observation, chrysanthemum non-hybrid and hybrid germplasms were attempted to classify into seven different reaction categories *viz.* immune, highly resistant, resistant, moderately resistant, moderately susceptible, susceptible and highly susceptible.

RESULTS AND DISCUSSION

Seventy seven non-hybrid chrysanthemum germplasms were screened during May and September, 2012 against Septoria leaf blotch disease following standard scale and their PDI were calculated and presented in Table 1. At the first date of observation on screening of non-hybrid germplasms; none of the germplasms were found im-

Table 1 : Reaction of chrysanthemum non-hybrid germplasms (BC) to leaf blotch disease under field condition at two dates of observation

Sl. No	Germplasms	PDI ¹ (12-05-12) ²	PDI ¹ (12-09-12) ³	Sl. No	Germplasms	PDI ¹ (12-05-12)	PDI ¹ (12-09-12)
1.	BC - 1	02.00 (8.07)*	25.00 (29.98)	40.	BC - 43	20.00 (25.07)	60.00 (50.78)
2.	BC - 2	30.00 (33.20)	20.00 (26.56)	41.	BC - 44	80.00 (63.50)	65.00 (53.74)
3.	BC - 3	10.00 (18.39)	30.00 (33.20)	42.	BC - 45	02.00 (08.07)	08.00 (16.36)
4.	BC - 4	01.00 (05.69)	30.00 (33.21)	43.	BC - 46	05.00 (12.86)	02.00 (08.07)
5.	BC - 5	10.00 (18.43)	25.00 (29.99)	44.	BC - 47	05.00 (12.91)	02.00 (08.07)
6.	BC - 7	70.00 (56.82)	40.00 (39.23)	45.	BC - 48	25.00 (29.99)	40.00 (39.23)
7.	BC - 9	05.00 (12.86)	35.00 (36.27)	46.	BC - 49	10.00 (18.39)	50.00 (45.00)
8.	BC - 10	05.00 (12.91)	70.00 (56.82)	47.	BC - 50	02.00 (08.11)	05.00 (12.86)
9.	BC - 11	35.00 (36.27)	60.00 (50.78)	48.	BC - 51	03.00 (09.94)	10.00 (18.39)
10.	BC - 13	70.00 (56.81)	02.00 (08.07)	49.	BC - 52	10.00 (18.41)	30.00 (33.20)
11.	BC - 14	05.00 (12.86)	70.00 (56.78)	50.	BC - 53	02.00 (08.11)	20.00 (26.56)
12.	BC - 15	75.00 (60.04)	40.00 (39.22)	51.	BC - 54	08.00 (16.40)	60.00 (50.77)
13.	BC - 16	60.00 (50.77)	30.00 (33.20)	52.	BC - 55	15.00 (22.78)	50.00 (45.00)
14.	BC - 17	07.00 (15.26)	05.00 (12.86)	53.	BC - 57	01.00 (05.69)	40.00 (39.23)
15.	BC - 18	02.00 (08.07)	40.00 (39.23)	54.	BC - 58	05.00 (12.91)	25.00 (29.99)
16.	BC - 19	02.00 (08.07)	10.00 (18.41)	55.	BC - 59	15.00 (22.78)	80.00 (63.44)
17.	BC - 20	15.00 (22.76)	25.00 (29.99)	56.	BC - 60	04.00 (11.51)	15.00 (22.78)
18.	BC - 21	30.00 (33.20)	40.00 (39.22)	57.	BC - 61	15.00 (22.76)	25.00 (30.00)
19.	BC - 22	10.00 (18.41)	25.00 (30.00)	58.	BC - 62	30.00 (33.21)	40.00 (39.23)
20.	BC - 23	10.00 (18.43)	35.00 (36.27)	59.	BC - 63	10.00 (18.41)	35.00 (36.27)
21.	BC - 24	02.00 (07.98)	05.00 (12.92)	60.	BC - 64	10.00 (18.39)	45.00 (42.13)
22.	BC - 25	03.00 (09.83)	10.00 (18.43)	61.	BC - 65	10.00 (18.41)	25.00 (30.00)
23.	BC - 26	05.00 (12.86)	10.00 (18.39)	62.	BC - 66	30.00 (33.20)	60.00 (50.77)
24.	BC - 27	20.00 (26.55)	15.00 (22.74)	63.	BC - 67	40.00 (39.23)	55.00 (47.87)
25.	BC - 28	03.00 (09.94)	08.00 (16.40)	64.	BC - 68	20.00 (26.56)	40.00 (39.23)
26.	BC - 29	05.00 (12.86)	07.00 (15.26)	65.	BC - 69	08.00 (16.42)	30.00 (33.20)
27.	BC - 30	01.00 (05.69)	06.00 (14.13)	66.	BC - 70	03.00 (09.94)	15.00 (22.78)
28.	BC - 31	50.00 (45.00)	30.00 (33.17)	67.	BC - 71	01.00 (05.69)	05.00 (12.91)
29.	BC - 32	30.00 (33.20)	25.00 (30.00)	68.	BC - 72	20.00 (26.55)	30.00 (33.21)
30.	BC - 33	01.00 (05.54)	08.00 (15.33)	69.	BC - 73	30.00 (33.21)	30.00 (33.21)
31.	BC - 34	35.00 (36.27)	15.00 (22.78)	70.	BC - 74	05.00 (12.86)	15.00 (22.74)
32.	BC - 35	55.00 (47.87)	45.00 (42.13)	71.	BC - 75	25.00 (29.99)	45.00 (42.13)
33.	BC - 36	45.00 (42.13)	40.00 (39.23)	72.	BC - 76	02.00 (08.07)	25.00 (29.99)
34.	BC - 37	05.00 (12.86)	05.00 (12.91)	73.	BC - 77	10.00 (18.39)	20.00 (26.56)
35.	BC - 38	20.00 (24.33)	45.00 (42.13)	74.	BC - 78	35.00 (36.27)	20.00 (26.56)
36.	BC - 39	90.00 (71.84)	30.00 (33.20)	75.	BC - 79	05.00 (12.86)	25.00 (30.00)
37.	BC - 40	45.00 (42.13)	67.00 (54.94)	76.	BC - 80	60.00 (50.77)	02.00 (08.07)
38.	BC - 41	05.00 (12.91)	08.00 (16.40)	77.	BC - 81	02.00 (08.07)	02.00 (08.07)
39.	BC - 42	05.00 (12.86)	18.00 (25.10)				

S.Em. (±) 1 2 3 1.01³
 CD (0.05) 3.08² 2.86³

* Value within parenthesis indicates arc-sine transformed values.
 1 - Mean of two replications.

immune but 32 germplasms were highly resistant, 13 resistant, 11 moderately resistant, 13 moderately susceptible, 5 susceptible and 3 highly susceptible (Table 2) while in case of second date of observation, none of them were found immune but 10 germplasms were highly resistant, 10 resistant, 20 moderately resistant, 27 moderately susceptible, 9 susceptible and 1 highly susceptible (Table 3). When the disease reactions of all non-hybrid germplasms recorded at two dates of observations

were compared, 16 non-hybrid germplasms under different reaction categories [viz. 7 highly resistant, 3 moderately resistant, 5 moderately susceptible and 1 highly susceptible] were observed common on both dates of studies (Table 4).

One hundred nine chrysanthemum hybrid germplasms were also screened during May and, September, 2012 respectively (Table 5). At the first date of screening none of the germplasms were

Table 2 : Categorization of chrysanthemum non-hybrid germplasms based on reaction (PDI) to *Septoria* leaf blotch disease observed on 12-05-2012

Reaction categories (PDI range)	No. of germplasms	Name of the germplasms
Immune (0%)	0	Nil
Highly resistant (1 – 5%)	32	BC – 1, 4, 9, 10, 14, 18, 19, 24, 25, 26, 28, 29, 30, 33, 37, 41, 42, 45, 46, 47, 50, 51, 53, 57, 58, 60, 70, 71, 74, 76, 79 and 81
Resistant (6 – 10%)	13	BC – 3, 5, 17, 22, 23, 49, 52, 54, 63, 64, 65, 69 and 77
Moderately resistant (11 – 25%)	11	BC – 20, 27, 38, 43, 48, 55, 59, 61, 68, 72 and 75
Moderately susceptible (26 – 50%)	13	BC – 2, 11, 21, 31, 32, 34, 36, 40, 62, 66, 67, 73 and 78
Susceptible (51 – 75%)	5	BC – 7, 13, 16, 35, 80
Highly susceptible (76 – 100%)	3	BC – 15, 39 and 44

Table 3 : Categorization of chrysanthemum non-hybrid germplasms based on reaction (PDI) to *Septoria* leaf blotch disease observed on 12-09-2012

Reaction categories (PDI range)	No. of germplasms	Name of the germplasms
Immune (0%)	0	Nil
Highly resistant (1 – 5%)	10	BC – 17, 24, 37, 46, 47, 50, 71, 80 and 81
Resistant (6 – 10%)	10	BC – 19, 25, 26, 28, 29, 30, 33, 41, 45 and 51
Moderately resistant (11 – 25%)	20	BC – 1, 2, 5, 20, 22, 27, 32, 34, 42, 53, 58, 60, 61, 65, 70, 74, 76, 77, 78 and 79
Moderately susceptible (26 – 50%)	27	BC – 3, 4, 7, 9, 15, 16, 18, 21, 23, 31, 35, 36, 38, 39, 48, 49, 52, 55, 57, 62, 63, 64, 68, 69, 72, 73 and 75
Susceptible (51 – 75%)	9	BC – 10, 11, 14, 40, 43, 44, 54, 66 and 67
Highly susceptible (76 – 100%)	1	BC – 59

Table 4 : Chrysanthemum non-hybrid germplasms showing same categories of disease reaction (PDI) to *Septoria* leaf blotch disease in two seasons of studies

Reaction categories (PDI range)	No. of germplasms	Name of the germplasms
Immune (0%)	0	Nil
Highly resistant (1 – 5%)	7	BC – 24, 37, 46, 47, 50, 71 and 81
Resistant (6 – 10%)	0	Nil
Moderately resistant (11 – 25%)	3	BC- 20, 27 and 61
Moderately susceptible (26 – 50%)	5	BC – 21, 31, 36, 62 and 73
Susceptible (51 – 75%)	0	Nil
Highly susceptible (76 – 100%)	1	BC - 59

found immune, 69 highly resistant, 12 resistant, 22 moderately resistant, 5 moderately susceptible and 1 susceptible (Table 6). In the second date of

screening of germplasms, 52 germplasms were highly resistant, 21 resistant, 28 moderately resistant and 8 moderately susceptible (Table 7). On

Table 5 : Reaction of chrysanthemum hybrid germplasms to leaf blotch disease under field condition at two dates of observation

Sl. No.	Germplasms	PDI ¹ (12-05-12) ²	PDI ¹ (12-09-12) ³	Sl. No.	Germplasms	PDI ¹ (12-05-12)	PDI ¹ (12-09-12)
1.	A-1/123	05.00(12.86)*	02.00(08.07)	56.	B-36/25	10.00(18.41)	20.00(26.55)
2.	A-2/77	01.00(05.54)	05.00(12.91)	57.	B-37/131	02.00(08.07)	05.00(12.86)
3.	A-3/45	10.00(18.41)	12.00(2.27)	58.	B-38/57	30.00(33.20)	22.00(27.97)
4.	A-4/119	02.00(08.07)	03.00(09.94)	59.	B-39/65	40.00(39.23)	03.00(09.94)
5.	A-5/82	05.00(12.91)	02.00(08.07)	60.	B-40/66	25.00(30.00)	30.00(33.21)
6.	A-6/67	02.00(08.07)	05.00(12.91)	61.	B-41/138	01.00(05.69)	04.00(11.54)
7.	A-7/116	02.00(12.91)	05.00(12.91)	62.	B-42/61	01.00(05.69)	08.00(16.42)
8.	A-8/17	05.00(08.07)	10.00(18.39)	63.	B-43/111	03.00(09.94)	10.00(18.39)
9.	A-9/10	02.00(08.07)	10.00(18.39)	64.	B-44/112	08.00(16.42)	03.00(09.97)
10.	A-10/46	02.00(12.86)	10.00(18.39)	65.	B-45/8	01.00(05.69)	05.00(12.86)
11.	A-11/1	01.00(08.11)	01.00(5.74)	66.	B-46/53	01.00(05.69)	02.00(08.07)
12.	A-12/92	02.00(08.07)	08.00(16.42)	67.	B-47/101	07.00(15.33)	02.00(08.13)
13.	A-13/63	15.00(05.69)	03.00(09.94)	68.	B-48/75	02.00(07.98)	03.00(09.97)
14.	A-14/72	01.00(08.11)	10.00(18.39)	69.	B-49/94	25.00(29.99)	25.00(29.99)
15.	A-15/2	01.00(22.78)	01.00(05.69)	70.	B-50/64	07.00(15.30)	15.00(22.78)
16.	A-16/29	05.00(05.69)	08.00(16.42)	71.	B-51/12	10.00(18.39)	08.00(16.40)
17.	A-17/14	02.00(08.07)	30.00(33.20)	72.	B-52/21	03.00(09.94)	23.00(28.65)
18.	A-18/122	01.00(12.86)	15.00(22.77)	73.	B-53/108	03.00(09.94)	05.00(12.91)
19.	A-19/48	01.00(08.07)	10.00(18.39)	74.	B-54/110	01.00(05.54)	01.00(05.74)
20.	A-20/9	01.00(05.69)	03.00(09.94)	75.	B-55/59	02.00(08.07)	15.00(22.78)
21.	B-1/3	05.00(12.91)	03.00(09.94)	76.	B-56/129	02.00(08.07)	35.00(36.27)
22.	B-2/51	02.00(08.07)	05.00(12.91)	77.	B-57/36	10.00(18.39)	30.00(33.21)
23.	B-3/43	05.00(12.86)	03.00(9.97)	78.	B-58/118	03.00(09.94)	05.00(12.91)
24.	B-4/97	03.00(09.94)	05.00(12.92)	79.	B-59/32	02.00(08.07)	03.00(09.94)
25.	B-5/18	03.00(09.94)	05.00(12.91)	80.	B-60/72	05.00(12.86)	08.00(16.41)
26.	B-6/139	15.00(22.78)	11.00(19.37)	81.	B-61/115	25.00(29.98)	15.00(22.78)
27.	B-7/106	15.00(22.78)	20.00(26.54)	82.	B-62/63	25.00(29.98)	20.00(26.55)
28.	B-8/5	03.00(09.94)	07.00(15.34)	83.	B-63/62	02.00(08.07)	03.00(09.97)
29.	B-9/95	02.00(08.07)	04.00(11.54)	84.	B-64/16	02.00(08.07)	04.00(11.54)
30.	B-10/133	08.00(16.42)	03.00(09.94)	85.	B-65/57	01.00(05.69)	15.00(22.78)
31.	B-11/28	25.00(29.99)	10.00(18.39)	86.	B-66/58	05.00(12.91)	20.00(26.56)
32.	B-12/81	02.00(08.07)	03.00(09.94)	87.	C-1/4	01.00(05.69)	02.00(08.13)
33.	B-13/54	10.00(18.41)	14.00(21.97)	88.	C-2/40	01.00(05.69)	05.00(12.89)
34.	B-14/44	05.00(12.91)	03.00(09.94)	89.	C-3/35	01.00(05.69)	03.00(09.94)
35.	B-15/124	25.00(30.00)	15.00(22.77)	90.	C-4/8	04.00(11.51)	15.00(22.77)
36.	B-16/19	03.00(08.07)	15.00(22.77)	91.	C-5/38	05.00(12.86)	02.00(08.13)
37.	B-17/104	25.00(29.99)	25.00(29.99)	92.	C-6/11	30.00(33.20)	27.00(31.31)
38.	B-18/31	60.00(50.77)	03.00(09.94)	93.	C-7/52	20.00(26.55)	18.00(25.10)
39.	B-19/10	15.00(22.78)	07.00(15.33)	94.	C-8/33	20.00(26.55)	02.00(08.07)
40.	B-20/9	02.00(08.11)	05.00(12.92)	95.	C-9/50	05.00(12.91)	03.00(09.97)
41.	B-21/114	03.00(09.94)	05.00(12.91)	96.	C-10/49	01.00(05.69)	02.00(08.07)
42.	B-22/137	10.00(18.43)	08.00(16.41)	97.	C-11/37	05.00(12.91)	02.00(08.13)
43.	B-23/134	03.00(09.94)	01.00(05.74)	98.	C-12/113	03.00(09.94)	05.00(12.89)
44.	B-24/50	15.00(22.78)	18.00(25.10)	99.	C-13/103	20.00(26.56)	25.00(30.00)
45.	B-25/39	15.00(22.78)	10.00(18.41)	100.	C-14/117	03.00(09.94)	03.00(09.97)
46.	B-26/96	08.00(16.40)	10.00(18.41)	101.	C-15/73	04.00(11.51)	03.00(09.97)
47.	B-27/102	03.00(09.94)	15.00(22.78)	102.	C-16/88	05.00(12.86)	10.00(18.39)
48.	B-28/126	05.00(12.91)	05.00(12.89)	103.	C-17/83	15.00(22.76)	10.00(18.39)
49.	B-29/13	40.00(39.23)	25.00(30.00)	104.	C-18/82	03.00(09.94)	50.00(45.00)
50.	B-30/35	30.00(33.21)	20.00(26.57)	105.	C-19/128	07.00(15.33)	05.00(12.92)
51.	B-31/60	25.00(29.99)	35.00(36.27)	106.	C-20/37	05.00(12.91)	20.00(26.54)
52.	B-32/20	20.00(26.56)	27.00(31.31)	107.	C-21/22	02.00(08.07)	20.00(26.54)
53.	B-33/56	15.00(22.78)	08.00(16.43)	108.	C-22/76	02.00(08.07)	04.00(11.54)
54.	B-34/86	05.00(12.91)	02.00(08.13)	109.	C-23/24	25.00(29.99)	25.00(29.99)
55.	B-35/42	15.00(22.78)	15.00(22.77)				

S.Em. (±) 0.97² 1.03³
 CD (0.05) 2.73² 2.90³

* Value within parenthesis indicates arc-sine transformed values. 1 - Mean of two replications.

comparing the disease reactions of all hybrid germplasms recorded at two dates of observation,

57 hybrid germplasms under different disease reaction categories [viz. 43 germplasms highly re-

Table 6 : Categorization of Chrysanthemum hybrid germplasms based on reaction (PDI) to Septoria leaf blotch disease observed on 12-05-2012

Reaction categories (PDI range)	No. of germplasms	Name of the germplasms
Immune (0%)	0	Nil
Highly resistant	69	A – 1/123, 2/77, 4/119, 5/82, 6/67, 7/116, 8/17, 9/10, 10/46, 11/1, 12/92, 14/72, 15/2, 16/29, 17/14, 18/122, 19/48 and 20/9 B – 1/3, 2/51, 3/43, 4/97, 5/18, 8/5, 9/95, 12/81, 14/44, 16/19, 20/9, 21/114, 23/134, 27/102, 28/126, 34/86, 37/131, 41/138, 42/61, 43/111, 45/8, 46/53, 48/75, 52/21, 53/108, 54/110, 55/59, 56/129, 58/118, 59/32, 60/72, 63/62, 64/16, 65/75 and 66/58 C – 1/4, 2/40, 3/35, 4/8, 5/38, 9/50, 10/49, 11/37, 12/113, 14/117, 15/73, 16/88, 18/82, 20/37, 21/22 and 22/76
Resistant (6 – 10%)	12	A – 3/45 B – 10/133, 13/54, 22/137, 26/96, 36/25, 44/112, 47/101, 50/64, 51/12 and 57/36 C – 19/128
Moderately resistant (11 – 25%)	22	A – 13/63 B – 6/139, 7/106, 11/28, 15/124, 17/104, 19/10, 24/50, 25/39, 31/60, 32/20, 33/56, 35/42, 40/66, 49/94, 61/115 and 62/63 C – 7/52, 8/33, 13/103, 17/83 and 23/24
Moderately susceptible (26 – 50%)	5	B – 29/13, 30/35, 38/57 and 39/65 C – 6/11
Susceptible (51 – 75%)	1	B – 18/31
Highly susceptible (76 – 100%)	0	Nil

Table 7 : Categorization of chrysanthemum hybrid germplasms based on reaction (PDI) to Septoria leaf blotch disease observed on 12-09-2012

Reaction categories (PDI range)	No. of germplasms	Name of the germplasms
Immune (0%)	0	Nil
Highly resistant (1 – 5%)	52	A – 1/123, 2/77, 4/119, 5/82, 6/67, 7/116, 11/1, 13/63, 15/2 and 20/9 B – 1/3, 2/51, 3/43, 4/97, 5/18, 9/95, 10/133, 12/81, 14/44, 18/31, 20/9, 21/114, 23/134, 28/126, 34/86, 37/131, 39/65, 41/138, 44/112, 45/8, 46/53, 47/101, 48/75, 53/108, 54/110, 58/118, 59/32, 63/62 and 64/16 C – 1/4, 2/40, 3/35, 5/38, 8/33, 9/50, 10/49, 11/37, 12/113, 14/117, 15/73, 19/128 and 22/76
Resistant (6 – 10%)	21	A – 8/17, 9/10, 10/46, 12/92, 14/72, 16/29 and 19/48 B – 6/139, 8/5, 11/28, 19/10, 22/137, 25/39, 26/96, 33/56, 42/61, 43/111, 51/12 and 60/72 C – 16/88 and 17/83
Moderately resistant (11 – 25%)	28	A – 3/45 and 18/122 B – 7/106, 13/54, 15/124, 16/19, 17/104, 24/50, 27/102, 29/13, 30/35, 35/42, 36/25, 38/57, 49/94, 50/64, 52/21, 55/59, 61/115, 62/63, 65/57 and 66/58 C – 4/8, 7/52, 13/103, 20/37, 21/22 and 23/24
Moderately susceptible (26 – 50%)	8	A – 17/14 B – 31/60, 32/20, 40/66, 56/129 and 57/36 C – 6/11 and 18/82
Susceptible (51 – 75%)	0	Nil
Highly susceptible (76 – 100%)	0	Nil

sistant, 3 resistant and 11 moderately resistant] were noted common at both dates of studies (Table 8).

Leaf blotch disease of chrysanthemum is one of the severe diseases causing large scale damage to the foliage and which may affect the yield of crop.

Table 8 : Chrysanthemum hybrid germplasms showing same categories of disease reaction to *Septoria* leaf blotch disease in two seasons of studies

Reaction categories (PDI range)	No. of germplasms	Name of the germplasms
Immune (0%)	0	Nil
Highly resistant (1 – 5%)	43	A – 1/123, 2/77, 4/119, 5/82, 6/67, 7/116, 15/2 and 20/9 B – 1/3, 2/51, 3/43, 4/97, 5/18, 9/95, 12/81, 14/44, 20/9, 21/114, 23/134, 28/126, 34/86, 37/131, 41/138, 45/8, 46/53, 48/75, 53/108, 54/110, 58/118, 59/32, 63/62 and 64/16 C – 1/4, 2/40, 3/35, 5/38, 9/50, 10/49, 11/37, 12/113, 14/117, 15/73 and 22/76
Resistant (6 – 10%)	3	B – 22/137, 26/96 and 51/12
Moderately resistant (11 – 25%)	11	B – 7/106, 15/124, 17/104, 24/50, 35/42, 49/94, 61/115 and 62/63 C – 7/52, 13/103 and 23/24
Moderately susceptible (26 – 50%)	0	Nil
Susceptible (51 – 75%)	0	Nil
Highly susceptible (76 – 100%)	0	Nil

The disease is severe during rainy season. Application of fungicides may reduce the disease intensity but requires frequent application of fungicides during rainy season and which makes the disease management a costly approach. Searching of resistant germplasms and its use would be a cheap and effective approach. Keeping this approach in mind, screenings of some hybrid and non-hybrid chrysanthemum germplasms were done. Some highly resistant and resistant germplasms could have been possible to identify amongst hybrid and non-hybrid germplasms. These germplasms could be used as such as a source of disease resistant cultivar or could be incorporated in future breeding programmes for disease resistance. Such types of screening works on Chrysanthemum leaf blotch disease were earlier conducted by several workers. Meeta *et al.* (1989) screened 70 cultivars against *S. chrysanthemella* under natural epiphytotic conditions. They found that none of the cultivars were immune but 8 were highly resistant and 17 resistant. Sixty chrysanthemum cultivars were screened for resistance to leaf spotting caused by *Septoria chrysanthemella* under field condition by Sen and Pathania (1997). They found that none of the 60 cultivars were free from disease. They classified all cultivars into different categories, 10 cultivars were classed as resistant, 13 as moderately resistant and the remaining 37 cultivars as moderate to highly susceptible. In another experiment, 50 cultivars of chrysanthemum were evaluated by Ahmad *et al.* (2003) for resistance against *Septoria* leaf blight (*Septoria obesa*). The test cultivars exhibited differential response to disease. None of

the cultivars were found immune. Pride of Madford, Universe, Dolly, Goldy and Liliput were resistant whereas COY, Arum Singer, Jyotsna and Apsara exhibited highest susceptibility to the disease.

From the results of the above experiment, it can be concluded that some highly resistant and resistant germplasms could have been possible to identify amongst hybrid and non-hybrid germplasms. Those germplasms could be use as such as a source of disease resistant cultivar or could be incorporated in future breeding programmes for disease resistance.

REFERENCES

- Ahmad, K., Khan, M.A. and Ahmad, S. 2003. Varietal performance of chrysanthemum against *Septoria* leaf blight. *Applied Biological Research*, 5: 56 – 58.
- Anonymous. 2012. *Annual report of AICRP on Floriculture*, Directorate of research, BCKV, Kalyani, Nadia, p. 91.
- Anonymous. 2013. *Indian Horticulture Database – 2012*, Ministry of Agriculture, Govt. of India, Sonex Print Pack Pvt. Ltd., p. 287.
- Chacko, C.I. and Rao, R.N.N. 1986. Chemical control of *Septoria* leaf blight of chrysanthemum. *Adv. Boil. Res.*, 4: 90 – 92.
- De, A.K. 2013. *Studies on diseases of tuberose and chrysanthemum*. M. Sc. (Ag) thesis under the Dept. of Plant Pathology submitted to the Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India, p. 110
- Jash, S., Bandyopadhyay, S., Dutta, S. and Laha, S.K. 2003. Comparative efficacy of fungicides against *Septoria* leaf spot of chrysanthemum under terai agroecological region of West Bengal. *Journal of Mycopathological Research*, 41: 109 – 110.
- Kulkarni, B.S., Reddy, B.S., Lingaraju, S. and Thammaiah, N. 2005. Response of selected cultivars of chrysanthemum (*Dendranthema indicum*) to *Alternaria* leaf spot disease. *Karnataka Journal of Horticulture*, 1: 33 – 35.
- McKinny, H.H. 1923. A new system of grading plant diseases. *Agric. Res.*, 26: 95 – 198.

Meeta, M., Shyam, K.R. and Sandhu, G.S. 1989. Reaction of some chrysanthemum cultivars to *Septoria* leaf blight. *Plant Disease Research*, 4: 90.

Sen, S. and Pathania, N.S. 1997. Field evaluation of chrysanthemum

germplasm against leaf spot fungi. *Plant Disease Research*, 12: 149 – 150.

Sohi, H.S. 1992. *Diseases of Ornamental Plants in India*. Indian Council of Agricultural Research, New Delhi, p. 195.