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Concealing of *Ocimum gratissimum* germplasms in natural field condition against leaf spot disease caused by *Alternaria alternata*

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Abstract
A field experiment was conducted during *Kharif* season (2016-2017) on Tulsi for resistance in natural field condition against leaf spot disease caused by *Alternaria alternata* at Main Experimental Station, Department of Medicinal and Aromatic Plants, N. D. University of Agriculture and Technology, Kumarganj, Faizabad. The oil content percent, number of leaves per plant, leaf weight per plant (Kg), leaf yield (q/ha) and disease severity percent were recorded in 90 days old plants. Results revealed that germplasm NOB-7 showed maximum oil content (2.14%).While the maximum leaves yield recorded in NOB-1 (14.81 q/ha) with disease severity (15%).

Keywords: Germplasm, oil content, leaf yield, leaf weight, disease severity, *Ocimum gratissimum*

Introduction

The Basil is native of Asia and Africa and grows wild as a perennial on some pacific islands and was brought from India to Europe through the Middle East in sixteenth century, subsequently to America in the seventeenth century.

The three types of Tulsi are encountered with in cultivation, the green leafed (Sri or Rama Tulsi) is the most common, the second type (Krishna Tulsi) bears dark green-to-purple leaves, a third type is a forest variety Vana Tulsi (*Ocimum gratissimum*) that often grows wild. *Ocimum gratissimum* is a herbaceous plant of the *Lamiaceae* family. Tulsi meaning 'the incomparable one' is an important medicinal plant which is in demand. The medicinal properties of Tulsi were known since antiquity. It is used for the treatment of problems related to heart, blood, intestine and snake bite. Eugenol the important chemical constituent of Tulsi is useful for the synthesis of vanillin.

Ocimum gratissimum leaf extract is commonly used in traditional medical practice for the treatments of mental illness, epilepsy, high fever, diarrhoea, pneumonia, cough, and conjunctivitis (Eboh *et al.*, 2013) [4]. It has been estimated that over 50% of medicines have their origins in these natural products, (Mc Corkle, 1995) [8].

Materials and Methods

The experiments were conducted in Kharif season at experimental farm of Medicinal and Aromatic Plants of Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad. Randomized Block Design (RBD) was adopted with three replications.

The percent disease intensity (PDI) was recorded during August to October 2017. Twenty four germplasm obtained from the Department of Medicinal and Aromatic Plants bearing the IC number from IC- NOB-1 to IC- NOB-24 shown in (Table-1) was shown on 25th July, 2016 at Main Experimental Station, Department of Medicinal and Aromatic Plant in Randomized Block Design. The crop suffer from leaf spot disease during different stages of crops but among all the leaf spot disease amounts heavy loss in leaf yield which ultimately effects the oil yield.

The twenty four germplasms of *Ocimum gratissimum* were screened, disease severity will be recorded using 0-9 scale. Each germplasm was planted in well prepared field at row to row distance 60 cm and plant to plant distance 45 cm. Details regarding the experiment are described in Table-1.

Table 1: List of germplasms of *Ocimum gratissimum*

S. No.	Germplasms	S. No.	Germplasms
1.	NOB-1	13.	NOB-13
2.	NOB-2	14.	NOB-14
3.	NOB-3	15.	NOB-15
4.	NOB-4	16.	NOB-16
5.	NOB-5	17.	NOB-17
6.	NOB-6	18.	NOB-18
7.	NOB-7	19.	NOB-19
8.	NOB-8	20.	NOB-20
9.	NOB-9	21.	NOB-21
10.	NOB-10	22.	NOB-22
11.	NOB-11	23.	NOB-23
12.	NOB-12	24.	NOB-24

Source: Germplasm were taken from Department of Medicinal and Aromatic plants

Research findings and Discussion

The present investigation has been carried during on 2016-17 "Screening of *Ocimum gratissimum* germplasms in natural field condition against leaf spot disease caused by *Alternaria alternata*".

The symptoms started from middle of the leaves as small light brown, circular to sub circular spots but in some spots coalesce to form necrotic spots and cover large area. Similar symptoms were reported by Kumar *et al.* (2016) [7] and Garibaldi *et al.* (2011) [6] that the disease affects 10% of 60 day old plants and 40% of 5-month-old plants. The brown-black lesions often surrounded by a yellow halo developed from the margins and tips of the upper side of older leaves, leading to the progressive defoliation of plants, followed by plant death. Gilardi *et al.* (2011) [6] reported that affected plants showed black-brown leaf spot normally circular, usually 1 to 50 mm in diameter surrounded by a yellow halo, frequently located on the tips and margins of leaves. In later stages leaves may turn brown and die. Although *Alternaria alternate* reported on *Ocimum* sp. from Kenya (Caretta *et al.* 1999) [3], *Alternaria* sp. on *Ocimum bacilicum* from California (French 1989) [5] and Florida (Alfieri *et al.* 1984) [2] and *Alternaria tenuissima* from Pakistan (Ahmad *et al.* 1997) [1] and from India, *Alternaria alternata* has been reported on leaves of *Ocimum sanctum* from Poona, M.S. (Narendra and Rao 1975) [9], on seeds of *Ocimum sp.* from Solan, H.P. (Sharma 1977) [10] and leaves of *Ocimum basilicum* from Nagarjun University, A.P. (Vijayalaxami and Rao 1989) [11].

The fungus *Alternaria alternata* was isolated from the diseased leaves of *Ocimum gratissimum*, which has some healthy portion on PDI slants. The growth of fungus was observed after five days of incubation at 25±2 °C. The fungal colony was olivaceous black with dark olive-green margins, and abundant branched septate, golden brown mycelium. The conidiophores were branched, straight, golden-brown and smooth walled. The conidia were obpyriform, muriform produced in long branched chains, with a short pale beak, Garibaldi *et al.* (2011) [6] have observed that a fungus, consistently isolated on PDA from symptomatic leaves, formed conidia singly or in short chains (2-8 elements), dark brown, with 3-7 transverse and 0-4 longitudinal septa, 23.7-73.4×8.8-15.1 µm in size, and with a conical or cylindrical beak 3.5-19.4 µm long. The pathogen was identified as *Alternaria* sp. based on morphology.

In the month of August, the disease severity was in negative correlation (-0.988) with minimum temperature while the maximum temperature was significantly positive (0.487) in relation to disease severity followed by month of September where disease severity was in negative correlation (-0.997) with the minimum temperature and maximum temperature was also negatively correlated (-0.783) to disease severity while in the month of October the disease severity was positively correlated (0.323) with minimum temperature and negative correlated (-0.199) with maximum temperature, whereas the disease severity was positive correlated with rain fall, relative humidity (RH) in rest of the months, while September and October month were significantly positive towards rain fall and relative humidity (RH).

Table 2: Effect of meteorological data on development of disease on *Ocimum gratissimum*

Date of sowing	Months in which data was recorded	Standard week	Rainfall (mm)	Temperature ˚C		R.H. (%)	Diseases severity (%)
				Min.	Max.		
27 July 2017	August 2017	31	20.6	26.9	32.6	85.7	35.12
		33	1.0	26.8	31.9	84.4	37.44
		34	38.6	26.3	32.9	84.7	42.53
	September 2017	35	100.6	25.6	33.0	81.3	48.23
		36	49.4	26.0	34.0	80.1	44.82
		38	88.2	25.8	32.7	84.8	46.75
	October 2017	40	0.0	24.8	33.8	79.9	67.55
		42	0.0	21.4	33.7	71.7	63.78
		43	0.0	16.7	32.7	67.5	66.00

Table 3: Correlation co-efficient of disease severity in relation to meteorological data:

Months	Rain fall (mm)	Temperature °C		Relative Humidity (%)	Disease severity (%)
		Min.	Max.		
August 2017	0.653	-0.988	0.487	-0.574	38.36
September 2017	0.488	-0.997	-0.783	0.318	46.60
October 2017	0.0	0.323	-0.199	0.569	65.77

Table 4: Screening of *Ocimum gratissimum* germplasms in natural field condition against leaf spot disease caused by *Alternaria alternata*

S. No.	Entries	Disease severity (%)	No. of leaves /plant	Green leaf weight /plant (Kg)	Green leaf yield (Q/ha)	Oil content (%)
1.	NOB-1	15	2897	0.144	14.81	0.44
2.	NOB-2	13	3245	0.142	8.51	1.49
3.	NOB-3	62	1380	0.032	3.33	0.58
4.	NOB-4	44	2176	0.053	5.46	0.62
5.	NOB-5	66	2348	0.028	2.96	0.86
6.	NOB-6	37	2762	0.064	6.66	1.53
7.	NOB-7	40	2480	0.103	10.67	2.14
8.	NOB-8	20	1541	0.062	6.38	0.91
9.	NOB-9	58	2010	0.041	4.25	1.05
10.	NOB-10	30	1835	0.082	8.51	0.63
11.	NOB-11	23	1752	0.091	9.44	1.86
12.	NOB-12	35	1642	0.070	7.24	0.54
13.	NOB-13	40	1376	0.062	6.38	0.50
14.	NOB-14	45	1862	0.051	5.27	1.20
15.	NOB-15	50	1754	0.045	4.62	1.02
16.	NOB-16	55	1840	0.040	4.16	1.54
17.	NOB-17	40	2044	0.062	6.38	1.02
18.	NOB-18	18	1665	0.104	10.74	0.66
19.	NOB-19	32	1488	0.074	7.68	1.08
20.	NOB-20	38	1932	0.090	9.25	1.75
21.	NOB-21	36	2110	0.068	7.03	1.55
22.	NOB-22	60	1738	0.037	3.88	1.52
23.	NOB-23	42	2052	0.055	5.74	1.33
24.	NOB-24	26	2246	0.063	6.48	0.56

Conclusion

The minimum percent disease intensity was recorded in month of August followed by September. The maximum percent disease intensity was noted in month of October. In the month of August the disease intensity mean have negative correlation with minimum temperature while, the maximum temperature was significantly positive. Similarly, in month of September the disease intensity was negative correlated with minimum temperature as well as maximum temperature. In the October month disease intensity mean have significantly positive correlation with minimum and negative with maximum temperatures. On the final note keeping in view the importance of experimental crop *Ocimum gratissimum* having high medicinal value specially in Ayurveda as the herbs was known for its antiquity.

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