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Effect of different fungicides on Karnal Bunt (*Tilletia Indica* Mitra (*Syn. Neovossia Indica*) disease of wheat in Uttar Pradesh

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Abstract
Experiments were conducted at during Kharif 2017-18 at supervision of Asha Bhagwan Bax Singh P.G. College Ayodhya, in the 7 farmer's field of Ayodhya and Ambedkarnager district of Uttar Pradesh, to evaluate the compatibility of fungicidal evaluation against Karnal Bunt disease of Uttar Pradesh The karnal bunt causing major loss of wheat production. The experiment consisted of nine treatments viz. T1Carbendazim 50 WP @ 2.5g/l., T2- Vitavax 75WP @ 2.0g/l., T3- Propiconozole 20 EC @ 1.0 ml/letter, T4- Azoxystrobin 18.2 % w/w @ 1.0ml/l., T5- Tricyclazole 18 % w/w @ 2.5g/l, T6- Flusilazole 12.5%w/w @ 1.0ml/l., T7- Tebuconazole 50% WG @ 1.0ml/l., T8- Hexaconazole 4%WP @ 2.5g/l. and T9- Untreated control (Spray of plain water), were applied the recommended dose of each product to diseased plants at the rate of two sprays with an intravel of 15 days.. Observations were recorded at 20 days after the second spray. Analysis of the data showed that among the treated with Tricyclazole 18 % w/w @ 2.5 g/l was found best in checking the disease severity karnal bunt (13.2%) and incidence was (11.6%) respectively and the better grain yield 3733 kg/ha was recorded. While severity and incidence of karnal bunt had gone to the extent of 42.7 and 38.7 % respectively in unsprayed plots. In check plots reduced grain yield was recorded (1967 kg/ha). In spite of increase in grain yield of treated with Tricyclazole 18 % w/w was 89.78 percent respectively, followed by treated with Tebuconazole 50% WG was severity and incidence of karnal bunt 13.6 and 12.6% and grain yield was 3600 kg/ha, increase 83.01, over check minimization of disease severity.

Keywords: Wheat, Karnal bunt, incidence, severity, fungicide

Introduction
The three species of wheat namely, *Triticum aestivum* (bread wheat), Triticum durum (macaroni wheat) and *Triticum dicoccum* (Emmer or Khapli wheat) grown on commercial basis in the Indian subcontinent from pre-historic times with share of production in percent 95%, 4% and 1% respectively, are being cultivated in the country. Wheat is a very adaptable crop and is grown under the wide range of soil & climatic conditions. Wheat is used by human being in the form of flour for making Chapaties, Semolina and Pasta products. It is also used for preparation of bread, biscuits, cookies, cracks, noodles, dalia, maida, vermicelli, etc. Wheat contains about 70% carbohydrates, 12% protein, 1.7% fat, 2.7% minerals, 2% fiber and 12% moisture. (Status paper on wheat ministry of agriculture). Crop occupies an area of about 28.5 million hectare with total production of 80.70 million tones and a productivity of 2.83 tones/ha and a shares 12.43% of total production of world (MOF, 2010) [14]. Current estimate indicates that in India around 13.5 million hectare of wheat is heat stressed (Joshi *et al*., 2007) [5]. Karnal bunt caused by *Tilletia indica Mitra* (Neovossia indica Mitra) (Mundkur) was first recorded in April, 1930 from Botanical Research Station, Karnal (Haryana). Wheat Varieties in to India and Pakistan. Till 1974-75 the disease remained restricted to Jammu and Kashmir, Punjab and Uttar Pradesh. Karnal bunt (Mundkur, 1943a, 1943b) [8, 10], new bunt (Mitra, 1931, 1935, 1937) [6] or partial bunt (Bedi *et al*., 1949) [2] of wheat was first discovered by Mitra in April 1930 in the experimental seed material grown at the Botanical Station, Karnal and was reported by him in 1931. Karnal bunt is a disease of wheat, durum, rye and triticale (9 hybrid wheat and rye). After the first report by Mitra in 1931, McRae reported Karnal bunt in a virulent form at Karnal in 1934, and later the disease was found in Sind Province of Pakistan in 1941 and the erstwhile United Province and the Delhi State of India in 1942 (Mundkur,

1944) [9]. By 1943, it was prevalent in Punjab and North West Frontier Provinces of Pakistan (Mundkur, 1943a) [8]. During 1944-45, the incidence was low but in 1948, serious damage by Karnal bunt was observed in the Punjab and North West Frontier Provinces of Pakistan (Bedi *et al*., 1949) [2]. Karnal bunt is visible on wheat grains, which are partially or completely converted into black powdery masses enclosed by the pericarp. The pathogen infects the ovaries in the emerging wheat heads and converts the grain partially or completely into dark coloured powdery masses of teliospores. The diseased fields emit a foul smell like that of rotten fish due to production of trim ethylamine. Karnal bunt differ from other diseases of wheat in that the pathogen infects plants during anthesis and it sporulates on the same generation of the host which it infects. Neither all spikes of plant nor all grains in spike are affected by the disease and usually a few irregularly distributed kernels are bunted. Karnal bunt had spread to extensive areas in the states of India viz., Jammu & Kashmir, Punjab, Haryana, Himachal Pradesh, Uttar Pradesh, Delhi and Rajasthan (Swaminathan *et al*., 1971) [15]. During 1974-75 crop season, the disease was severe at many locations in North India particularly, of Uttar Pradesh, Punjab and Himachal Pradesh. The severity of infection was as high as 15 to 50 per cent at Hempur and Pantnagar in Uttar Pradesh (Agarwal *et al*., 1976; Singh *et al*., 1977; Joshi *et al*., 1980) [1, 13, 4].

Materials and Methods

Causal Agent

Karnal bunt (KB) disease, caused by the fungus Tilletia indica Mitra (syn. Neovossia indica), was first reported from wheat grain samples collected near Karnal, Haryana, India (Mitra, 1931) [6]. Since then, the disease has been of frequent occurrence in northern India and has been reported in parts of several countries including Afghanistan, Iran, Iraq, Mexico, Nepal, Pakistan, South Africa, and the USA. The disease has occurred in those countries where the average temperature during the crop season varies from 5 to 300C and relative humidity is 45-100%.

Disease cycle

The disease cycle starts with deposition of Karnal bunt teliospores in the soil. Teliospores may remain dormant, but viable for several years. The source of teliospores could have been seed, the wind, animals, contaminated equipment, or other sources. Teliospores located at the soil surface germinate in response to moist conditions and produce sporidia. The plants are susceptible to infection for a 2 to 3 week period from awn emergence to the end of flowering when sporidia infect the florets and fungal hyphae enter the ovary. Subsequent disease development in the embryo end of the kernel results in the formation of new teliospores some of which are deposited back in the soil at harvest, adding further to soil inoculum.

Symptoms

Karnal bunt is not easily detected in the field because few florets are typically infected and the area of the kernel affected might be small and facing inwards. A mass of black teliospores is found at the embryo end of the kernel and, at higher levels of infection, along the crease or in the entire kernel. Generally, only a portion of the kernel is occupied by teliospores (partial bunt). Fully bunted kernels will often be destroyed during harvest. A "fishy odor" that may be detectable from heavily infected grain is common to Karnal bunt as well as several other bunt diseases and is caused by aromatic alkaloids present in the spores.

Host

A host of biotic and abiotic stresses affect wheat crop leading to huge losses in grain quality and yield. The most serious biotic constraints to wheat production are fungal diseases such as rusts (yellow, brown, black), Karnal bunt, powdery mildew, foliar blights and loose smut.

Disease Control

The experiment were carried out at various parts of different villages in Ayodhya and Ambedkarnager of Uttar Pradesh viz. Marna and Jogapur (Ayodhya), Kewari, Parmanand (Ambedkarnager), were evaluated against karnal bunt disease of wheat the susceptible wheat variety PBW 343. The gross plot size was 50 sq. metres and all packages of practices were followed for conducting the experiment. This experiment was laid out in randomized block design with seven replications (four village of Ayodhya viz. Sarairasi, Marna, Jogapur & and three village of Ambedkarnager viz. Chachikpur, Barahi and Raniva). One village one replication, the soil of the farmers' field was sandy loam in texture, neutral in reaction and had low nitrogen and medium phosphorus and potassium contents. Variety specific agronomic practices were adapted to raise the crop. No plant disease measures were used to create congenial environment for disease incidence. The experiment consisted of nine treatments viz. T1Carbendazim 50 WP @ 2.5g/l., T2-Vitavax 75WP @ 2.0g/l., T3- Propiconozole 20 EC @ 1.0 ml/letter, T4- Azoxystrobin 18.2 % w/w @ 1.0ml/l., T5-Tricyclazole 18 % w/w @ 2.5g/l, T6- Flusilazole 12.5%w/w @ 1.0ml/l., T7- Tebuconazole 50% WG @ 1.0ml/l., T8-Hexaconazole 4%WP @ 2.5g/l. and T9- Untreated control (Spray of plain water), were applied the recommended dose of each product to diseased plants at the rate of two sprays with an intravel of 15 days.. Observations were recorded at 20 days after the second spray. The data on grain yield of each plot were recorded separately by threshing the harvested wheat variety PBW 343 on tarpaulin followed by proper sun drying and winnowing, grain yield measured in kilogram. The data so obtain were subjected to statistical analysis after necessary transformation for final statistical analysis. Severity was scored and calculated by area of wheat panicle parts affected by total area of panicle parts examined.

1. Disease Incidence (%) = No. of infected plant/total plant examined X100
2. disease Severity (%) = No. of plant tissue affected /total area of plant parts affected X100

Results and Discussion

There was significant difference among the treatments in karnal bunt disease severity and yield. The data on different disease parameters is summarised in table 1. Treated with Tricyclazole 18 % w/w @ 2.5 g/l was found best in checking the disease severity (13.2%) and incidence was (11.2%) respectively and the better grain yield 3733 kg/ha was recorded presented in Table-1. While severity and incidence of karnal bunt had gone to the extent of 42.7 and 38.7 % respectively in unsprayed plots. In check plots reduced grain yield was recorded (1967 kg/ha). In this treatment 89.78 increased grain yield over untreated check was observed. The plot treated with had also shown good response with T7-Tebuconazole 50% WG @ 1.0ml/l the disease severity (13.6%) and 12.6 % disease incidence, along with good grain yield 3600 kg/ha was recorded. In treatment of T6-

Flusilazole 12.5%w/w @ 1.0 ml/l, showed response of disease severity (16.8%) and 14.6% disease incidence, along with grain yield 3443 kg/ha was recorded. In the plot treated with T4- Azoxystrobin 18.2 % w/w @ 1.0ml/l. 16.6% disease severity and 15.4% disease incidence along with grain yield 3333 kg/ha. was recorded. The plot treated with T8- Hexaconazole 4%WP @ 2.5 g/l., 19.2% disease severity and 19.2 % disease incidence with yield 3211 kg/ha was recorded. The plot treated with T3- Propiconozole 20 EC @ 1.0ml /l. 18.8% disease severity and 17.8%, disease incidence with yield 2960 kg/ha was recorded. The plot treated with T1- Carbendazim 50 WP @ 2.5g/l, 22.4% disease severity and 22.4%, disease incidence with yield 2560 kg/ha was recorded, and plot treated with T2- Vitavax 75WP @ 2.0g/l disease severity was 29.6% and disease incidence of 26.4% and grain yield was 2360 kg/ha, recorded.

All eight fungicidal treatments significantly reduced the disease severity and incidence at all test locations when compared to control. The fungicide Tricyclazole 18 % w/w (2.5g/l) was significantly reduced the severity and increase the grain yield of wheat over check, followed by Azoxystrobin 11% Tebuconazole 50% WG @ 1.0ml/l. Minimization of disease severity may be one of the possible reasons for enhancement of grain yield by the spraying of these fungicides.

Table 1: Effect of different fungicides on severity and incidence of karnal bunt of wheat

	Treatments	Dose/l or g	Karnal Bunt Incidence %	Karnal Bunt disease severity (%)	Yield	Increase % over control
T1	Carbendazim 50 WP	2.5g	20.6	22.4	2560	30.14
T2	Vitavax 75WP	2.0 g	26.4	29.6	2360	19.97
T3	Propiconozole 20 EC	1.0 ml	17.8	18.8	2960	50.48
T4	Azoxystrobin 18.2 % w/w	1.0 ml	15.4	16.6	3333	69.44
T5	Tricyclazole 18 % w/w	2.5 g	11.6	13.2	3733	89.78
T6	Flusilazole 12.5%w/w	1.0 ml	14.6	16.8	3443	74.52
T7	Tebuconazole 50% WG	1.0 ml	12.6	13.6	3600	83.01
T8	Hexaconazole 4%WP	2.5 g	16.2	19.2	3211	63.24
T9	Control (plane water spray)	-	38.7	42.7	1967	-

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