International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(2): 1031-1033

Received: 19-01-2019
Accepted: 23-02-2019

AR Khunt
Department of Plant Pathology, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat, India

LF Akbari
Professor and Head, Department of Plant Pathology, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat, India

IB Kapadiya
Wheat Research Station, Assistant Research Scientist, Junagadh Agricultural University, Junagadh, Gujarat India

GJ Goswami
Department of Plant Pathology, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat, India

Correspondence
AR Khunt
Department of Plant Pathology, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat, India

Evaluation of combination fungicides on spore germination inhibition of *Puccinia triticina* Eriks causing rust in wheat

AR Khunt, LF Akbari, IB Kapadiya and GJ Goswami

Abstract
Wheat is attacked by number of diseases caused by fungi among them rusts are most important caused huge economic damage to wheat crop. Among all three rust, leaf rust caused by *Puccinia triticina* is the most important fungal disease of wheat. The present investigation was formulated to generate the information on spore germination inhibition of *Puccinia triticina* with different combination of fungicides in laboratory condition. The relative efficacies of eight different fungicides combination were tested in different concentrations *viz*., 200, 500 and 1000 ppm. The evaluated data indicated that the maximum mean reduction of uredospore germination (84.48%) was found in the treatment of pyraclostrobin 13.3% + epoxyconazole 5% WP followed by tebuconazole 50% + trifloxystrobin 25% WG with 76.34 per cent inhibition, on the other hand cymoxanil 8% + mancozeb 64% WP (71.90%) was found moderately effective fungicide.

Keywords: *Puccinia triticina*, leaf rust, fungicides combination and wheat

Introduction
Wheat (*Triticum aestivum* L. em. Thell) an important cereal crop in global agricultural economy is cultivated in a range of mega environments of the world. It is the most widely grown and consumed food crop of the world cultivated on a larger area and produce more tonnage of food than any other cereal. Wheat grown in India under subtropical environment during *Rabi* season and occupies an area of 30.97 million hectares with production 88.94 million tones and productivity of 2880 kg/ha in India (Anon., 2016) [1]. In Gujarat, irrigated wheat occupies an area of 9.76 lakh hectares with production of 28.79 lakh tones and productivity of 2950 kg/ha (Anon., 2016) [2]. Diseases are the major threat to wheat production and they are taking heavy toll of the crop in the country and elsewhere in the world. The most widely prevalent, notorious and shifty enemies on wheat are the three rusts; stem (*P. graminis* f. sp. *tritici*), leaf (*P. triticina*) and stripe rust (*P. striiformis* f. sp. *tritici*). Among the three wheat rusts, brown rust (*Puccinia triticina* Eriks.) is the most widely distributed and prevalent all over the country (Bhardwaj *et al*., 2006) [3]. Wheat rusts have played significant role in the agriculture of early civilization and today, there is a well-documented account of their ability to cause epidemics throughout the world. The losses caused due to rusts vary from region to region. Leaf rust prevalent all over the country due to favorable temperature prevailing throughout the season in country. Now a days, the application of chemical has become an ineffectual exercise to manage wheat rusts. Therefore, an attempt was made to test the efficacy of various combinations of fungicides for inhibition of spore germination *in vitro* as it is necessary to evolve effective fungicides in laboratory condition before large application at famer level.

Mythology
Eight combination of fungicides i.e. iprodine 25% + carbendazim 25% WP, carbendazim 12% + mancozeb 63% WP, cymoxanil 8% + mancozeb 64% WP, tebuconazole 50% + trifloxystrobin 25% WG, metalaxyl 8% + mancozeb 64% WP, pyraclostrobin 13.3% + epoxyconazole 5% WP, captan 70% + hexaconazole 5% WP and tricyclazole 18% + mancozeb 62% WP with three repetition concentration *viz*., 200, 500 and 1000 ppm were evaluated against leaf rust pathogen under laboratory condition following spore germination inhibition technique in completely randomize design (factorial concept).

Various criteria were used to determine the effect of different physiological agents on germination, of which the most frequently used as the percentage of spores that produce germ tubes. Water is the prime factor in any germinating medium and for many spores is the only substance necessary to start germination. Its imbibition causes the first visible symptom of germination, the swelling of the spore, often to more than twice its original size. Thus absorption of water by spores resembles the imbibition activity of lyophilic colloids. This phenomenon, however, is dependent upon some vital mechanism of the spore, for dead spores do not swell and absorption varies with the viability of the spore (David, 1950) [4].

Leaf rust disease infected leaves of wheat were collected from field. The spores were collected by rubbing sterilized brush on pustules and added in sterilized distilled water. The stock solutions of various fungicides with different level of concentration were prepared and then diluted the stock solution with distilled water to obtain required concentration. One drop of each fungicide suspension and of urediniospore spore suspension were placed on a glass cavity slide, so concentration was obtained as per require for evaluation. The slides were then placed in Petri plates lined with moistened coarse filter paper to provide sufficient humidity for germination of uredospore for 6 hours at room temperature (25°C±1). After 6 hours observation of spore germination inhibition was taken by using light microscope at 40x objective lens.

Per cent inhibition of spore germination in each treatment was calculated by using following formula (Vincent, 1947) [7].

$$I = \frac{C - T}{C} \times 100$$

Where,

I = er cent spore germination inhibition

C = Number of germinated spore in control

T = Number of germinated spore in treatment

Results and Discussion

The perusal of data presented in the Table 1 revealed that all fungicides combinations were capable of inhibiting the spore germination at all concentrations. The results indicated that the most effective fungicide was pyraclostrobin 13.3% + epoxyconazole 5% WP with maximum mean spore germination inhibition was 84.48% followed by tebuconazole 50% + trifloxystrobin 25% WG with 76.34 per cent inhibition, on the other hand cymoxanil 8% + mancozeb 64% WP (71.90%) was found moderately effective fungicide.

The cumulative spore germination inhibition was increased with increase in concentration of fungicides. The data showed the significantly highest spore germination inhibition was obtained in the combination of pyraclostrobin 13.3% + epoxyconazole 5% WP (85.42%) at 1000 ppm concentration which was at par with 500 ppm concentration (84.45%). The performance of rest of the fungicide combinations (cymoxanil 8% + mancozeb 64% WP, carbendazim 12% + mancozeb 63% WP, captan 70% + hexaconazole 5% WP, metalaxal 8% + mancozeb 64% WP, iprodine 25% + carbendazim 25% WP) tested under present investigation was inferior as compared to pyraclostrobin 13.3% + epoxyconazole 5% WP and tebuconazole 50% + trifloxystrobin 25% WG. This combination of fungicide has combine effect of triazole group and strobilurin group. Triazole group of fungicides interfere with biosynthesis of sterols and strobilurin group fungicides may inhibit electron transfer in mitochondria, disrupting metabolism and also inhibit respiratory chain. They are part of the larger group of Qol inhibitors.

The minimum mean spore germination of 29.28 per cent was recorded in the treatment of tricyclazole 18% + mancozeb 62%. These results are also in agreement with finding of Kadvani (2012) [5] stated that cymoxanil 8% + mancozeb 64%, metalaxyl 8% + mancozeb 64% found effective while working with pearl millet rust. But in present investigation, it was found moderately effective in performance. In addition, Sunil (2013) found complete inhibition of spore germination with trifloxystrobin + tebuconazole and pyraclostribin + epoxiconazole at 10 µl and 20 µl, respectively against *P. striiformis* f. sp. *tritici*.

Table 1: Effect of combination fungicides on spore germination inhibition of *P. triticina in vitro*

Sr. No.	Fungicides	Spore germination inhibition after 6 hrs (%)			Mean inhibition (%)
		Concentration (ppm)			
		200	500	1000	
1	Iprodine 25% + Carbendazim 25% WP	38.52** (38.80)*	40.27 (41.78)	43.18 (46.83)	40.66 (42.47)
2	Carbendazim 12% + Mancozeb 63% WP	54.19 (65.77)	56.10 (68.88)	56.79 (70.00)	55.69 (68.22)
3	Cymoxanil 8% + Mancozeb 64% WP	56.24 (69.11)	58.00 (71.92)	59.79 (74.68)	58.01 (71.90)
4	Tebuconazole 55% + Trifloxystrobin 25% WG	59.57 (74.34)	60.73 (76.09)	62.45 (78.60)	60.91 (76.34)
5	Metalaxal 8% + Mancozeb 64% WP	44.73 (49.52)	46.22 (52.13)	47.64 (54.60)	46.20 (52.08)
6	Pyraclostrobin 13.3% + Epoxyconazole 5% WP	66.12 (83.57)	66.80 (84.45)	67.59 (85.42)	66.83 (84.48)
7	Captan 70% + Hexaconazole 5% WP	50.86 (60.15)	52.60 (63.09)	52.93 (63.66)	52.13 (62.30)
8	Tricyclazole 18% + Mancozeb 62% WP	28.45 (22.72	31.68 (27.60)	37.76 (37.52)	32.63 (29.28)
A.	B.	C. F	D. C	E. F*C	F.
G.	S.Em. ±	0.39	0.24	0.68	H.
I.	C.D at 5%	1.12	0.68	1.94	J.
K.	CV %	2.30	L.	M.	N.

**Data were transformed (Arcsine) prior to analysis, *Data given in parentheses are retransformed values, F = Fungicides, C = Concentration

Conclusion

Leaf rust (*Puccinia triticina*) continues to cause losses worldwide in wheat production. Research on *P. triticina* would be advanced by testing effect of new combination of fungicides on inhibition of spore germination. From the ongoing laboratory work, it was concluded that all fungicide combinations were effective to reduce spore germination but maximum uredospore germination inhibition (84.48%) was found in the treatment of pyraclostrobin 13.3% + epoxyconazole 5% WP followed by tebuconazole 50% + trifloxystrobin 25% WG with 76.34 per cent inhibition as compared to other combinations of fungicides.

References

1. Anonymous. Crop-wise second advance estimate of area, production and yield of food grains, oilseed and other crop for 2016-17 of Gujarat state. Directorate of Agriculture, Gujarat state, Gandhinagar, 2016. (http://www.cibrc.nic.in/mup.htm).
2. Anonymous. Pocket Book on Agricultural Statistics 2016, Ministry of Agriculture, Department of Agriculture and Cooperation, Government of India, New Delhi, 2016. (http://eands.dacnet.nic.in).
3. Bhardwaj SC, Prashar M, Kumar S, Datta D. Virulence and diversity of *Puccinia triticina* on wheat in India during 2002-04. Indian Journal of Agricultural Science. 2006; 76:302-306.
4. David G. The physiology of spore germination in fungi, The Botanicals Review. 1950; 14(5):229-230.
5. Kadvani DL. Management of pearl millet rust (*Puccinia substricta* Ell. & Barth. Var. *indica* Ramachar & Cumm.). 2012; Thesis submitted to Junagadh Agricultural University, Junagadh, 2012.
6. Sunil. Influence of weather factors on occurrence and development of stripe rust (*Puccinia striiformis* f. sp. *tritici*) of wheat and its management. 2013; Thesis submitted to Punjab Agricultural University, Ludhiana, 2013.
7. Vincent JM. Distoration of fungal hyphae in the presence of certain inhibitor. Nature. 1947; 150:850.