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New Record of White Blister Rust (*Wilsoniana* sp.) on *Amaranthus cruentus* in Tripura, North East India and its management

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The studywas carried out at experimental farm of Multi Technology Testing Centre (MTTC), Central Agricultural University (Hq. Imphal), Lembucherra, Tripura (27° 35' 36.6036'' N, 77° 49' 47.064'' E) in the year 2022-2023. The chlorotic lesion and patches are on the upper surface of the leaves of *Amaranthus cruentus* (Laal Saag), but lower surface of the leaves showed white blister/ pustules of elliptical to oval shape having 3-4 mm of diameter. The oospore released from the blisters were globose, dark brown of average 46.0 µm that is ranged between 38.4 to 54µm in diameter. The morphological studies of oospores, pustules and symptoms revealed that the pathogen belongs to *Wilsoniana* genus. But with available facilities and morphological studies are not enough to identify the species within the genus. The highest disease severity and incidence during the first cropping season (i.e. December, 2022 to January 2023) was 35.40 and 50.60 percent, respectively.However, during the 2nd cropping period (February to March, 2023), these figures increased to 68.3 and 88.2 percent, respectively. Among the ecofriendly diseases management practices, the *Azadirachta indica* leaves extract was determined to be the most effective treatment out of seven different plant extracts, with a disease control rate of 58.38 percent, followed closely by *Lantana camara* at 49.68 percent. Neem oil was determined to be the most efficient out of the seven bio-products, with an efficacy rate of 74.76 percent, while the list effective was FYM (Farm Yard Manure) with 36.95 percent of efficacy.

Keywords : *Amaranthus*, bio products, oospores, plant extracts, White Blister Rust

INTRODUCTION

Lal Saag scientifically known as the *Amaranthus cruentus* belongs to family Amaranthaceae. This is a very popular herbaceous, annual leafy vegetable of West Bengal, Tripura and other Eastern and North Eastern states of India (Wolosik and Markowska, 2019; Nejad Falatouri, 2020).

Most of the members of Amaranthaceae family are good source of the micronutrients, minerals, dietary fibres and medicinal values (Sheikh and Babakhani, 2020). Few species of *Amaranthus* are unwanted or act as weed in cultivated crops and need to be uprooted (Manyelo *et al.* 2020). It is prone to a range of fungal pathogens which cause diseases like rust, smut, downy mildew, and white blister rust throughout the world (Farr and Rossman, 2021). According to Thines and Spring (2005) the genus *Albugo* has been merged with genus *Wilsoniana* on the basis of morphological and molecular analysis of pathogen of white rust disease on Caryophyllales. While the genus *Pustula* is associated with white blister rust in Asteridae (Ploch *et al.*2010).

MATERIALS AND METHODS

Identification and Symptomatology

The symptoms appeared as chlorotic spots, yellow to light green colour on the upper surface of the leaves. Blister/pustules sores that formed on the corresponding lower surface were white in colour, oval to ellipsoidal in shape, and ranged between 3 to 4 millimetres in diameter (Fig. 1 to 5). Oospore were globose, dark brown, reticulated and 38.4 to 54.0 (avg. 46.0 µm) in diameter (Fig. 6 to 7). Morphological analysis based on the symptoms, oospore and pustules, it is revealed that pathogen belongs to genus *Wilsoniana,* but

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present morphological analysis was not enough to reveal the identity of species within the genus. The morphological characteristics based on studies by Choi *et al*. (2007) and Mirzaee *et al*.(2021) revealed that it belongs to *Wilsoniana* genus.

Treatments

The field trials were laid out at experimental farm of Multi Technology Testing Centre (MTTC), Central Agricultural University (Hq. Imphal), Lembucherra, Tripura (27° 35' 36.6036'' N, 77° 49' 47.064'' E) during December 2022 to March, 2023to evaluate the efficacy of ecofriendly plant extracts and bio-products. The experiment was conducted in randomized block design (RBD) with seven bio-products and seven plant extracts with five replications of each treatment. Samples of *A.cruentus* exhibiting typical symptoms of white rust were collected and brought to laboratory for morphological analysis. Morphological characteristics of the causal agent were studied with help of microscope and oospores sizes were measured with micrometry as perthe methods given by Choi *et al.* 2007. The plant extracts and bio-products were prepared by the methods given by Kumar and Chandel (2018).

RESULTS AND DISCUSSION

Disease Severity and Disease Incidence

The fields of experimental farm of MTTC, CAU (I) was screened for the white blister rust during the month of December, 2022 to March, 2023 in two different cropping periods from December to March.Ten plants were selected randomly to record the disease severity and incidence, during the 1st and 2nd cropping periods.The data on disease incidence and severity are presented in Table1 which revealed that the disease was prevalent in light to moderate form during first cropping period, while moderate to severe form in 2nd cropping period. It is evident from the data that the disease incidence and severity, both were minimum in the month of December, 2023 i.e., 30.40 per cent and 14.50 per cent, respectively. Highest disease incidence and disease severity during 1st cropping period was observed in month of January with 50.60 per cent and 35.40 per cent, respectively. Symptoms of the disease on the leaves as well as in the field, along with microphotograph of oospores of Williamsonia are depicted in Fig.1.

During the 2nd cropping period highest disease incidence (88.20%) was observed in the month of the March, 2023, while the highest disease severity index recorded was 68.30 per cent. However lowest disease incidence and disease severity was reported in initial stage of cultivations i.e.,76.50 per cent and 60.50 per cent. Overall scenario suggested that the occurrence of the white blister rust on Laal Saag i.e., *Amaranthus cruentus* appeared severely in the months of February and March as compared to December to January months.

Role of Meteorological Factors on disease development under field conditions

In order to study the effect of meteorological factors on the progress of disease under field conditions,experiment was conducted at experimental farm of MTTC, CAU (I), Lembucherra, Tripuraunder natural epiphytotic conditions during year 2022 and 2023. The data on severity of the disease was recorded at weekly intervals commencing from 9th December, 2022 to 19th January, 2023 for 1st Cropping and 2nd February to 22nd March, 2023 for 2nd Cropping period. The data on weather parameters and disease development revealed that the disease appeared in the 2nd week of December with the prevalence of congenial weather conditions such as 20.93°C mean temperature; 0.00 mm cumulative rainfall, 75per cent mean relative humidity and total sun shine (hrs) 08.0 in 1st cropping period of year 2022. The disease was first noticed in 3rd week of December and the per cent disease index was 2.0 per cent. There was a progressive increasein the disease severity up-to 3rd week of January and was recorded maximum up-to 35.93 when the temperature remained 18.20°C, cumulative rainfall 0.0 mm,mean relative humidity 69.5 % & total sunshine (hrs) 9.0 hrs during the 1st cropping period.

During the 2nd cropping period the diseases appears in 2nd week of the February, 2023 i.e.,

Table1: Simple correlation coefficients between PDI and meteorological factors

Meteorological factors	1st Cropping	2nd Cropping
Mean temperature (°C) x PDI	-0.649	0.710
Cumulative rainfall (mm) x PDI	0.0878	0.745
Average relative humidity (%) x PDI	-0.775	-0.917
Total sunshine hours (hrs) x PDI	0.896	-0.729

Table 2: Effect of application of Plant Extracts on white blister rust of *Amaranthus cruentus* under natural epiphytotic conditions

Plant Extract (s)	Conc. (%)	Disease Index (%)	Disease Control (%)
Neem Leaves		27.33	58.38
(*Azadirachta indica*)	10	(31.50)	(49.81)
Lantana	10	33.00	49.64
(*Lantana camara*)		(35.04)	(44.78)
Bougainvillea	10	44.33	32.38
(*Bougainvillea glabra*)		(41.73)	(34.63)
Jackfruit Leaves	10	37.33	43.12
(*Artocarpus heterophyllus*)		(37.65)	(41.03)
Vitex	10	43.33	34.00
(*Vitex negundo*)		(41.15)	(35.65)
Myrobalan	10	46.33	29.44
(*Teminaliachebula*)		(42.88)	(32.85)
Behada	10	50.00	23.75
(*T. belerica*)		(44.98)	(29.06)
	-	65.67	0.00
Control		(54.12)	(0.00)
		2.19	
C.D.		0.72	3.30
SE(m)		1.01	1.08
SE(d)		3	1.52
C.V.		.02	5.58

Table 3 : Effect of application of Bio-products on white blister rust of *Amaranthus cruentus* under natural epiphytotic conditions

Bio-product (s)	Conc. (%)	Disease Index (%)	Disease Control (%)
	10	19.00	72.31
Vermiwash		(25.83)	(58.24)
	5	17.33	74.76
Neem Oil		(24.59)	(59.83)
	10	43.33	36.95
FYM		(41.14)	(37.39)
	10	35.33	48.57
Milk		(36.44)	(44.16)
	10	25.00	63.60
Anhydrous Milk Fat		(29.99)	(52.87)
	10	32.00	53.39
Chicken Manure		(34.43)	(46.93)
	10	28.67	58.26
Cow Urine		(32.36)	(49.74)
	10	68.67	0.00
Control		(55.94)	0.00
C.D.		1.98	2.71
SE(m)		0.65	0.89
SE(d)		0.91	1.25
C.V.		3.19	3.52

4.77 per cent, as 25.5 mm, with the prevalence of congenial weather conditions such as 20.4°C mean temperature; 0.00 mm cumulative rainfall, 63.5 per cent mean relative humidity and total sun shine (hrs) 9.0. Maximum disease severity was observed at later stage of*A. cruetus* i.e., 68.93 per cent (Table 3) when the temperature remained 25.4 °C, cumulative rainfall 24.40 mm, and mean relative humidity 63.2 % and total sunshine (hrs) 4.8 hrs.

Simple correlation coefficients between PDI and meteorological factors

Simple correlation coefficients were determined using all the combinations of per cent disease index (PDI) with temperature, relative humidity, rainfall and total sunshine hours, and are presented (Table1). It is evident from the correlation matrix that simple correlation coefficients between PDI and mean temperature was negative (-0.649) in the 1st cropping period and positive (0.710) in 2nd cropping period. Simple correlation coefficient of PDI with cumulative rainfall was positive (0.0878, 0.745) in both the cropping periods (1st and 2nd cropping). Simple correlation coefficient of PDI with average relative humidity was negative (-0.775, -0.917) in both cropping periods. Simple correlation coefficients of PDI and sunshine hours were negative (-0.729) in 2nd cropping period and negative in 1st cropping period.

Fig. 1: A-C: Pustules of rust on the leaves; **D-E**: White rust infection in the field **F-G**: Oospores of the pathogen

Management of the white blister rust of A. cruentus through different Eco-friendly strategies

Seven plant extracts like *Azadirachta indica*, *Lantana camara, Bougainvillea glabra, Artocarpus heterophyllus, Vitex negundo, Teminalia chebula* and *T. Belerica* were used against the white blister rust of *A. cruentus* at 10 per cent concentration. While, seven bio-products (Vermiwash, Neem Oil, Farm Yard Manure (FYM), Milk, Anhydrous Milk Fat,Chicken Manure, Cow Urine) were used against the white blister rust of *A.cruentus* at 10 per cent concentration except Neem oil (5%).

All the plant extracts significantly reduced and control the white blister rust (Table 2) in comparison to control (65.67%). The minimum disease (27.33 %) was registered with *Azadirachta indica* and correspondingly highest disease control (58.38 %) which was followed by the *Lantana camara* (49.64 %) and *Artocarpus heterophyllus* (43.12 %). The least effective plant extract was *T. belerica* which gave minimum disease controlof 23.75 per cent followed by the *Teminaliachebula* (29.44 %), *Bougainvillea glabra* (32.38 %) and *Vitex negundo* (34.00 %).

Among the bio-products (Table 3) the maximum disease control of 74.76 per cent was recorded in Neem oil,and Vermiwash (72.31%) treated plants. The other best efficacious bio-products were anhydrous milk fat (63.60%), cow urine (58.26%) and chicken manure (53.39%). However, very less disease control (36.95%) was found in FYM (Farm Yard Manure) followed by Milk (48.57 %). Azadirachtin and Nimbin are the triterpenoids found in Neem oil which exhibit antimicrobial and antifungal properties which might be the reason for controlling the white blister rust of *A. cruentus*.However, the anhydrous milk fat was found effective by Chee *et al.,* (2011) against rose powdery mildew. Effectiveness of the cow urine is also shown up by Kumar and Chandel (2018) against the powdery mildew of rose.

CONCLUSION

It has been concluded from the present study that the white blister rust of *A.cruentus* under natural epiphytotic conditions can be successfully managed through ecofriendly strategies by using plant extracts and bio-products i.e., *Azadirachta indica*, *Lantana camara,* Neem oil and Vermiwash. While it is also reported after extreme screening of literature that this is the first report of white blister rust on *A. crentus* in Tripura, North East India.

DECLARATION

Conflict of Interest. Authors declare no conflict of interest.

REFERENCES

Choi, Y.J., Shin, H.D., Hong, S.B.,Thines, M. 2007. Morphological and molecular discrimination among *Albugo candida* materials infecting *Capsella bursa-pastoris* world-wide. *Fungal Divers*. **27**: 11–34.

Farr, D.F., Rossman, A.Y. 2021. Fungal Databases, U.S. National Fungus Collections, ARS, USDA. Retrieved April 30, 2021, from https://nt.ars-grin.gov/fungaldatabases/

Kumar, V., Chandel, S. 2018. Management of rose powdery mildew (*Podosphaer apannosa*) through ecofriendly approaches. *Indian Phytopathol*. **71**: 393-397. https://doi.org/10.1007/s42360-018-0050-y

Manyelo, T.G., Sebola, N.A., Rensburg, E.J., Mabelebele, M. 2020. The probable use of genus *Amaranthus* as feed material for monogastric animals. *Animals* **10**: 1–17.

Mirzaee, M.R., Ploch, S., Thines, M. 2021. A new desert-dwelling oomycete, *Pustula persica* sp. nov., on *Gymnarrhena micrantha* (Asteraceae) from Iran. *Mycoscience* **62**: 239–243.

Nejad Falatouri, A., Hatami, S., Torabi, H., Ghezeli, F., Sarani, M. 2020. Some notes about the genus *Amaranthus* in Iran. *Rostaniha* **21**: 109–120.

Ploch, S., Choi, Y.J., Thines, M. 2018. The only known white blister rust on a basal angiosperm is a member of the genus *Albugo*. *Organisms Divers. Evol.***18**: 63–69.

Sheikh, M.A., Babakhani, B. 2020. Evaluation of antioxidant and cytotoxicity of an ethanol extract of *A. retroflexus* on human lung cancer A549 cell line. *The 3rd International Congress on BioMedicine*, November 10, 2020, Tehran.

Thines, M., Spring, O. 2005. A revision of *Albugo* (Chromista, Peronosporomycetes). *Mycotaxon* **92**: 443–458.

Wolosik, K., Markowska, A. 2019. *Amaranthus cruentus*: Taxonomy, botanical description, and review of its seed chemical composition. *Nat. Product Commun*. **16**: 1–10.