

Discovery of two Hyperparasites, One of Which Has Not
Been Reported, On Uredosori of Puccinia Graminis Tritici

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Summary.

In the course of greenhouse studies with Puccinia graminis tritici Erickss. and Henn., two fungi have been found parasitizing the uredosori of the aforementioned rust organism.

The first fungus, which forms a gray-colored colony on the uredosori, has been identified, as Cephalosporium acremonium Sacc. This hyperparasite was previously reported by Hassebrauk on uredosori of Puccinia graminis tritici Erikss. et Henn. (Phytopathologische Zeitschrift, 1936, 1937).

The second fungus, forms colonies of a darker gray color on the uredosori. The walls of the vegetative hyphae are of an olive-gray color, septate, and fairly well ramified. The nonbranched conidiophores are well differentiated, rising at the sides of the vegetative hyphae almost at a right angle. They are continuous and unisepate only in the basal part, with olive-gray walls. They are slightly thinner at the distal end, on which appears a cylindrical cushion, more or less elongated, having over its whole surface little sterigmatic formations on which the conidia are inserted. The conidia are numerous and closely spaced ("radula spores" according to the nomenclature of Mason) with membranes slightly darker than the content, continuous, ellipsoid, and slightly pointed at the base. They measure 6-6.5 x 1.5-2 microns.

Because of these and other morphological and biological characters, this fungus has been identified as Rhinocodiella sp. and probably Rhinocodiella atrovirens Nannf., which, up to now, do not seem to have been reported as parasites of uredosori of Puccinia sp.

√Brown Necrosis, a Disease of Wheat Which Sometimes Becomes
Very Destructive Under Conditions of Heavy Rainfall at High
Elevations.

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Over the past 30 years it is entirely possible that several

different diseases or abnormalities some of them pathogenic and others of a physiologic or genetic nature have been grouped together under the names of black chaff, melanistic reaction, browning reaction and brown necrosis. There is no doubt but that true "bacterial black chaff" reported by Bamberg is distinct from the conditions reported by Waldron, Mac Fadden, Hart and Allison and herein referred to as brown necrosis.

Over the past 10 years many observations and a limited amount of experimental work has been done in Mexico in an attempt to uncover the true cause of brown necrosis, which often becomes very destructive in wheat that is grown at high elevations under conditions of low temperatures and high relative humidity and heavy rainfall.

Symptoms.

The abnormal condition herein referred to as "brown necrosis" is characterized by a browning of the tissues, and premature dying of the cells of part or all of the exposed portion of the culm and inflorescence of the affected plants. The parts of the plant most commonly affected are the portions of the internodes which are exposed above the leaf sheaths, especially the internodes located immediately above and below the flag leaf. Sometimes the rachis, rachilli and glumes are also affected.

The visible symptoms of this disease normally begin to appear soon after the plant has headed, in the case of susceptible lines which are being grown under environmental conditions favorable to development of the disease. The disease may become progressively worse as the plant nears maturity. In severe cases it results in the death of the culm when the grain is less than half formed. The rate of development and intensity of the browning varies with the variety and also with environmental conditions.

At the onset of the disease tiny strips of tissues running up and down the exposed portion of the internodes begin to turn brown. These streaks, at first very small, coalesce to form more conspicuous streaks and in very susceptible varieties may eventually girdle the culm and result in outright killing of the portion of the culm above the point of girdling.

The cells of the brown areas or strips appear to be dead by the time the color change becomes conspicuous. Killing of the cells in the affected areas progresses from the outside inward. Once the stem has been girdled the process of the translocation ceases, and the damage to the grain will vary directly with the stage of development of the grain when translocation is impaired.

Factors Affecting Severity.

There are a number of factors which appear to affect the

severity of brown necrosis. These are :

- 1.- The variety.
- 2.- Temperature.
- 3.- Relative humidity and precipitation.
- 4.- Light, perhaps both intensity and quality.
- 5.- This phenomenon is often associated with varieties carrying Hope type of stem rust resistance. It, however, also occurs in other wheats, some of which are susceptible to stem rust (Table No. 1).

Under irrigation during the winter months brown necrosis never develops to a point where it is of importance, although in very susceptible varieties and lines small brown or black areas can sometimes be found on the neck and glumes. This is the case whether the susceptible variety is grown near sea level or at 8500 feet. When the susceptible varieties are grown during the summer season, the intensity of the disease is greatest at higher elevations, but at these elevations there is also greater precipitation and higher relative humidity, thus making it difficult to separate the effects of light quality and intensity, and relative humidity or precipitation. In susceptible varieties there is much less development of brown necrosis on the exposed portion of the lowest internode which is partially shaded by neighboring culms and plants, than on the exposed portions of the higher internodes. Repeated observations have also shown that if the leaf sheath is removed from a culm below the area where the culms have been girdled by brown necrosis, the tissues which have been protected by the sheath are found to be entirely normal. In susceptible varieties when small squares of tissue are cut from the leaf sheath the tissues of the culm which are thereby exposed will begin to turn brown within a period of two to four days.

Without exception in the lines which we have studied, all bread wheat varieties which develop a "sun red" anthocyanin pigmentation when grown under irrigation during the dry winter season develop very severe brown necrosis when grown at high elevations during the cool, rainy season. Many lines which do not exhibit "sun red" anthocyanin pigmentation when grown under irrigation are also susceptible to brown necrosis under summer conditions. In some way the phenomenon of brown necrosis seems to be related to the response of the anthocyanin - anthozenthin formation in the plant, and is influenced by light quality and intensity.

When susceptible varieties are planted under environmental conditions conducive to the development of brown necrosis yields are decreased greatly and the grain has low test weight.

Table No. 1.- Varietal Reactions to Brown Necrosis when Grown Under Three Different Environmental Conditions.

Variety	TOLUCA (2675 Mts.)		SONORA (50 Mts)
	Winter ^{1/}	Summer ^{2/}	Winter ^{1/}
Redman	R	VS	R
Selkirk	R	VS	R
Thatcher	VR	R	VR
Newthatch	R	MS	R
Lee	R	MS	VR
Gabo	VR	VR	VR
Frontana	R	MS	R
Lerma 50	VR	VR	R
Lerma Rojo	R	S	R
Kentana 48	R	MS	R
Kenya 324	R	MS	R
Mentana	VR	VR	VR
Maribal 50	R	VS	R
Mariache 50	R	VS	R
Marfa Escobar x H44-Marquis (Various Lines)	R	VS	R
Hope	R	VS	R
Gabo 54	R	R	R
Chapingo 53	R	MS	R
Magnif MG	R	S	R

^{1/} Irrigated Winter Crop.

^{2/} Summer crop during rainy season.

REACTIONS :

VR = Very resistant

R = Resistant

MS = Moderately susceptible

S = Susceptible

VS = Very susceptible