J. Mycopathol. Res. **44**(1) : 113-115 (2006)

Narrow Brown Leaf Spot disease of rice : A review

A BISWAS
Rice Research Station, Chinsurah 712101, West Bengal, India

Narrow brown leaf spot (NBLS) caused by the fungus *Cercospora janseana* (Racib) O. Const. = *C. oryzae* Miyake (teleomorph : *Sphaerulina oryzina* K. Hara) is considered as a minor disease of rice. Recent findings on various aspects of the disease (distribution, economic importance, disease cycle, epidemiology, verietal resistance, management) are reviewed.

Key Words : Rice, narrow brown leaf spot disease, *Cercospora janseana*, review

INTRODUCTION

Narrow brown leaf spot (NBLS), also known as *Cercospora* leaf spot of rice is considered to be minor disease of less economic importance at present but occasionally severe outbreaks of the disease have been noticed (Chakrabarti, 1964). Comprehensive reviews (Gangopadhyay, 1983; Ou, 1985; Hollier, 1992; Growth and Lee, 2003) have highlighted the importance of NBLS as a problem of rice. In the present paper, an attempt has been made to give an appraisal of latest findings so far achieved in India and abroad. An intensive study is of urgent need to reinvestigate the various aspects of the disease as it might become a possible future constraint to rice production.

Distribution and Economic Importance

Though Metcalf (1906) mentioned the presence of a *Cercospora* on rice leaves in North America but the disease was first described by Miyake (1910) in Japan by *Cercospora oryzae*. The disease has been reported from major rice-growing regions in the tropics and subtropics of Asia, Africa, Australia and North, Central and South America. In a broad sense, the disease is of worldwide distribution except Europe (Baloch *et al*, 1978; Ou, 1985; Hollier, 1992; Biswas, 2000, 2003). Yield losses of up to 40% have been reported (Overwater, 1960). Tullis (1937) believed that damage confined to the reduction of the effective leaf surface of the plant, while Ryker and Jodon (1940) stated that the disease causes premature killings of leaves and sheaths, and predisposes the plant to lodging. Generally heavy damage occurs only on very susceptible cultivars.

Symptoms

Symptoms usually occur during the later (dough and mature grain) growth stages and are characterized by many short, linear red-brown lesions on the leaf blades, restricted between the veins. The lesions are 2-10 × 0.5-1 mm and they coalesce to form long, threadlike brown lesions parallel to the veins on the entire leaves. The lesions tend to be narrower, shorter and dark brown on resistant cultivars and wider and lighter brown with gray necrotic centers on susceptible cultivars. Leaf necrosis may occur on susceptible cultivars. Symptoms similar to those on the leaves also found on the leaf sheaths, pedicels and glumes. On sheaths, the disease is referred to as net blotch,

because of the brown sheath cell walls and the tan-to-yellow intracellular areas that form a netlike pattern.

The disease should not be confused with brown spot disease incited by *Bipolaris oryzae*. The lesions are longer, narrower and without any halo margin. The symptoms of NBLS are also somewhat similar to those of white leaf streak, caused by *Ramularia* (=*Mycovellosiella*) *oryzae*, the characteristic brown color of the lesion is the point of differentiation.

Casual Organism

Narrow brown leaf spot is caused by *Cercospora janseana* (Racib) O. Const. = *C. oryzae* Miyake. The fungus produces pale brown to dark brown, geniculate, multiseptate (three or more) conidiophores, singly or in fascicles (generally 17), which emerge from the host stomata and measure 80-140 × 4-9 µm. Conidia are hyaline or light olive, cylindrical to subclavate, with 3-10 septa, an obeonic base, blunt tips, in whorls of 3-4 on the conidiophore tip and measuring 15-60 × 3-5 µm (Ou, 1985; Hollier, 1992; Biswas, 2003). *Sphaerulina oryzina* K. Hara was described as the teleomorph of *C. oryzae* (Hara, 1918). Ganguly (1946) noted catenulate conidia in India.

The fungus grows on bean agar and produces conidia in culture (Ryker, 1943). Tasugi and Ikeno (1956) find that growth is best on potato and soybean agar ; while production of conidia is most luxuriant on rice-straw agar. It grows in the temperature range 6-33°C, the optimum being 25-28°C. the optimum pH lies between 5.7 and 7.1. Several races of the fungus have been identified based on the reactions of a differential set of eight cultivars (Ou, 1985).

Disease Cycle and Epidemiology

The fungus penetrates the host through the stomata and grows intercellularly in the host tissue. Symptoms may take up to 30 days to develop after inoculation. The primary factors affecting disease development are susceptibility of the cultivar to the race or races of the fungus present and the growth stage of the plant. Although rice plants are susceptible to the fungus at all stages of growth, they are most susceptible from panicle emergence to maturity. In India, the disease is observed in the beginning of November when the plants have flowered. The intensity of the disease increases with increase in the level of potash in the soil (Chakrabarti, 1964; Ou, 1985; Hollier, 1992). Sridhar (1970) reports the fungus occurring on *Panicum repens*.

VARIETAL RESISTANCE

Resistance has been tested under conditions of natural infection in the field and by artificial inoculation, plants kept in a moist chamber or in the open after sundown being sprayed with a conidial suspension (Ryker, 1943). Estrada and Ou (1978) develope methods to screen many cultivars in the field by artificial inoculation. The Standard Evaluation System (SES) designed by IRRI (1996) for NBLS is based on affected leaf area where O = Highly Resistant (HR) (no incidence), 1 = Resistant (R) (less than 1%), 3 = Moderately Resistant (MR) (1-5%), 5 = Moderately Susceptible (MS) (6-25%), 7 = Susceptible (S) (26-50%), and 9 = Highly Susceptible (HS) (51-100%), Artificially inoculated or naturally infected cultivars may be scored according to this scale. In USA, Tullis (1937), Ryker and Jodon (1940), Ryker and Cowart (1948), Adair and Crally (1950) and Jodon (1953, 1954, 1955) identified several resistant cultivars. Sukapanpotharam *et al.*, (1976) screened 220 cultivars and Kannaiyan (1979) tested 14 cultivars in Tamil Nadu, India under natural field condition but a few cultivars showed resistance to NBLS. The genetics of disease resistance has been studied by Ryker and Jodon (1940) in USA and found that single recessive gene control the resistance and in some crosses the resistance is governed by a dominant gene.

MANAGEMENT

Use of resistant cultivars is recommended. Groth (1986) suggested three benomyl @ 0.56 kg a.i. ha^{-1} sprays at 10 days intervals starting at 45 days after transplanting for NBLS management.

ACKNOWLEDGEMENTS

Grateful thanks are due to Dr. D. Konar, Director of Agriculture and Ex-officio Secretary, West Bengal, Dr. S. D. Chatterjee, Addl. Director of Agriculture (Res.) West Bengal, Dr. P. Bhattacharya, Joint Director of Agriculture, (Res.), West Bengal and Dr. J. Ahmed, Joint Director of Agriculture (Rice Dev.), West Bengal for their interest and encouragement.

REFERENCES

Adair, C. R. and Cralley, E. M. 1950. Rice yield and disease control tests. Rep. Series, Ark. Agril. Exptr. Sta, No. 15, 20 pp

Baloch, K. K., Bhatti, I. M. and Ahmed, G. U. 1978. Occurrence of *Cercospora* leaf spot disease of rice in Pakistan. *Intern. Rice Res. Newsl.* **3**(4) : 6.

Biswas, A. 2000. Changing trends of rice diseases in West Bengal, India. *J. Mycopathol. Res.* **38**(1) : 33-36.

–*ibid.*-2003. First report of narrow brown leaf spot disease of rice in West Bengal, India. *Intern. Rice Res. Newsl.* **28**(2) : 35.

Chakrabarti, N. K. 1964. The relation between host nutrition and *Cercospora* leaf spot of rice. *Sc. Cult.* **30**(9) : 458-459.

Gangully, D. 1946. A note on the occurrence of *Cercospora oryzae* Miyake on paddy in Bengal. *Sc.Cult.* **11**(10) : 573-574.

Gangopadhyay, S. 1983. Narrow brown leaf spot. pp. 205-208 in *Current concept on fungal disease of rice*. Today and Tomorrow's Print. Publ., New Delhi, India.

Groth, D. E. 1986. Control of rice diseases with foliar application of benomyl, iprodione, and propiconazole. *Phytopath.* **76** : 1060 (Abstr. 26).

Groth, D. and Lee, F. 2003. Rice diseases, pp. 413–436 in *Rice : Origin, History, Technology, and Production*, ed. by C. W. Smith, John Wiley & Sons, Inc.

Hara, K. 1918. *Diseases of the Rice Plant*. Agric. Deptt., Tokyo.

Hollier, C. 1992. Narrow brown leaf spot. p. 18, in *Compendium of rice diseases*. ed. by R.K. Webster and P. S. Gunnell St. Paul, Minn., U.S.A.

IRRI 1996, *Standard Evaluation System for Rice*. International Rice Research Institute, Manila, Philippines, p. 25.

Jodon, N. E. 1953. Louisiana releases Sunbonnet through seed Growers' Association. *Rice J.* **56** : 40.

–*ibid.* - 1954. Breeding for improved varieties of rice and other cereal grains. *Rice J.* **57** : 32-36.

–*ibid.* - 1955. Toro and Sunbonnet, two new midseason, long grain rice varieties compared. *Rice J.* **58** : 8-11.

Kannaiyan, S. 1979. Reaction of certain promising rice cultures to narrow brown leaf spot disease. *Madras Agric. J.* **66**(5) : 332.

Metcalf, H. 1906. A preliminary report on the blast of rice, with notes on other rice diseases. Bull. South Carolina Agril. Expt. Sta. No. 121, 43 pp.

Miyake, I. 1910. Studien uber die Pilze der Reispflazane in Japan. *J. College Agril. Imp. Univ. Tokyo* **2** : 237-276.

Ryker, T. C. 1943. Physiologic specialization in *Cercospora oryzae*. *Phytopath.* **33** : 70-74.

Ryker, T. C. and Cowart, L. E. 1948. Development of *Cecospora* – resistant strains of rice. *Phytopath.* **38** : 23[Abs.].

Ryker, T. C. and Jodon, N. E. 1940. Inheritance of resistance to *Cercospora oryzae* in rice. *Phytopath.* **30** : 1041-1047.

Sridhar, R. 1970. A new collateral host of *Cercospora oryzae*. *Pl. Dis. Rep.* **54** : 272-273.

Sukapanpotharam, S., Chongkid, B. and Weerapat, P. 1976. Varietal reaction to brown spot and narrow leaf spot under natural infection. *IRRI Newsl.* **1**(2) : 11-12.

Tasugi, H. and Ikeno, S. 1956. Studies on the morphology, physiology and pathogenicity of *Cercospora oryzae* Miyake, the causal fungus of narrow brown spot of rice plant. *Bull. Nat. Ins. Agril. Sui.*, Tokyo, **C6,** 167-178.

Tullis, E. C. 1937. *Cercospora oryzae* on rice in the United States. *Phytopath.* **27** : 1007-1008.

Ou, S. H. 1985. Narrow brown leaf spot. pp. 227-231, in *Rice Diseases*, CMI, Kew, Surrey, UK.

Overwater, C. 1960. Tien jaren Prins. Bernhard polder, 1950-1960, *Surinaamese Landbounw* **8** : 159-218. [*Rev. Appl. Mycol.* **40** : 465 (1961)].

(Accepted for publication January 06 2006)