Eyespot of Rice in Colombia, Panama, and Peru

SANG-WON AHN, Plant Pathologist, Rice Program, Centro Internacional de Agricultura Tropical, Cali, Colombia

ABSTRACT

AHN, S.-W. 1980. Eyespot of rice in Colombia, Panama, and Peru. Plant Disease 64:878-880.

Drechslera gigantea was the causal agent of an eyespot disease of rice, manifested as minute, longitudinally elongated, oval-shaped spots, 1–4 mm long and 0.5–1 mm wide, with white to light straw-colored necrotic centers and narrow dark brown margins. Diagnosis was easily confirmed by the presence of cylindrical conidia measuring 166–484 × 10–29.6 μm. The disease was observed on CICA 6 in Colombia, CICA 7 in Panama, and Naylamp in Peru. This is believed to be the first report of this disease on rice.

Additional key words: *Helminthosporium giganteum*, resistance to eyespot disease

In 1979, unfamiliar leaf spots were observed on the rice (*Oryza sativa* L.) variety CICA 7 in the Tocumen and Chiriqui provinces of Panama and on CICA 6 in Jamundi and Ibague, Colombia. Considerable leaf damage was observed at a late growth stage for both varieties (A. Ferrer, *personal communication*). I confirmed the presence of the same disease on the cultivar Naylamp in Chira, Peru, in 1980.

This study was done to identify the causal agent and evaluate resistance.

MATERIALS AND METHODS

Isolation and identification. Monoconidial isolates were obtained by gently touching lesions on 2% water agar plates and picking off individual conidia with a fine glass needle under the microscope. Conidia were then transferred to plates of V-8 juice agar medium, which contained 200 ml of V-8 juice, 18 g of agar, and 3 g of calcium carbonate per liter of distilled water. The plates were incubated at 20 C under continuous darkness.

Sixty conidia produced on 4-day-old cultures were measured. Conidial germination was observed by suspending conidia in sterile distilled water and incubating at 28 C for 2–3 hr. In Panama and Peru, identification of the disease and the pathogen was based on symptoms and conidial characteristics observed on lesions and preserved slides.

Pathogenicity. Seedlings were grown in plastic trays (35 × 40 × 14 cm) in the greenhouse at 22–31 C. Twenty-day-old seedlings were maintained in a wood box lined with cloth and vinyl for a few hours, then sprayed with a conidial suspension (5 × 10^3 conidia/ml). Inoculated plants were kept in the same box for 24 hr and then placed on a bench in the screenhouse under natural light at 20–33 C. The reaction was rated 7 days after inoculation, based on type, size, and number of lesions and the number of conidiophores per lesion observed with a dissecting microscope.

RESULTS

Symptoms. Symptoms were observed on leaves throughout the rice growing period. In the field, the most typical symptom was minute, longitudinally elongated, oval-shaped spots, 1–4 mm long and 0.5–1 mm wide, with white to straw-colored necrotic centers delimited by narrow dark brown margins (Fig. 1). The spots began as small, water-soaked olivaceous dots or rings. A yellow halo frequently appeared with young lesions but later disappeared.

Several eyespots, one large and several small, were commonly close together. Under favorable conditions, such as a prolonged period of leaf wetness, successive development and coalescence of lesions produced a characteristic zonation, which at first glance resembled the zonation of leaf scald caused by *Rhynchosporium oryzae* Hashioka & Yokogi. However, zonation of leaf scald is a more regular wavy pattern than that of eyespot, which is rather rough.

Development of lesions produced by artificial inoculation was very similar to that of rice blast caused by *Pyricularia oryzae* Cav. The water-soaked lesion of eyespot, however, could be observed 18 hr after inoculation. The leaves of highly susceptible varieties had several patches of eyespots, rapidly turned yellow, and withered. Numerous conidiophores and conidia were observed on or near lesions on those leaves.

The fungus. Isolation and artificial inoculation confirmed *Drechslera gigantea* (Heald & Wolf) Ito. (syn. *Helminthosporium giganteum* [7]) as the causal organism. Conidiophores were brown, 128–345 × 9.9–17 μm, with one to seven septa (usually three), and arose singly or in pairs, bearing a single light reflective conidium at the tip, frequently at an inclined angle. The conidia were straight, cylindrical with hemispherical or hemiellipsoidal ends, pale yellow, thin with flexible walls, and three to eight septa (usually three to six) and measured 166–484 × 10–29.6 μm (average 330 × 19 μm) (Fig. 2). The hilum was inconspicuous. Conidial shape varied slightly on artificial media. Conidia germinated from the apical or basal cell, rarely from middle cells (Fig. 2).

Colony color on V-8 juice medium was generally dark gray or olivaceous. Later, whitish cottony sterile sectors grew out and covered the entire colony.

Pathogenicity. Seventy-five cultivars and lines were inoculated in the screenhouse with one isolate (D-5) obtained from CICA 7. The cultivar reaction could be classified into five reaction groups based on type, size, and number of lesions (Table 1).

Eighteen entries produced typical eyespot lesions; nine entries showed relatively small lesions. The remaining entries produced either extremely minute spots, brown specks, or no lesions. When inoculated plants were atomized with water twice a day, some susceptible varieties, including CICA 6 and CICA 7, produced abundant conidia on chlorotic patches or necrotic portions of lesions 5–6 days after inoculation. However, some entries did not produce spores although they had typical eyespot lesions.

Field evaluation. In October 1979, the affected leaf area was visually evaluated on naturally infected 110-day-old plants in a trial plot at Jamundi, Colombia.

Lines 5684, 5685, 5698, 5732, 5738, 5852, 5854, and CICA 9 had less than 0.1% of leaf area infection. CICA 4, CICA 8, and lines 5709, 5715, 5728, and 5734 had 0.1–1% leaf area infection. However, CICA 6 had almost 25% of the leaf area affected. The border of plots adjacent to the plot of CICA 6 generally had more spots than the other parts of the same plots.

DISCUSSION

D. gigantea causes zonate eyespot of several grass species (1–3,5) and eyespot of banana (7), but this is the first report of

0191-2917/80/09087803/$03.00/0

eyespot disease on rice verified by identification of the fungus, pathogenicity tests, and field observations.

The disease appears to have existed for some time in Colombia, Panama, and Peru. In Colombia, the fungus was isolated from brown spots in 1975 (4). Later, the brown spot was confirmed as eyespot (E. García, *personal communication*). In Peru, the disease has been called "brown spot type disease" with epidemic levels on the cultivar Naylamp during 1976 and 1977 (A. C. Jimenez, C. Panizo, V. García, and J. Senmache, *unpublished data*). Although the pathogen was not identified in the original work, I confirmed its identity from preserved slides, cultures, and

Table 1. Reaction of rice cultivars and lines[a] to eyespot disease

Reaction group	Description	Conidiophores per lesion	Cultivar line
1	Few brown specks or minute roundish spots, less than 1 mm diameter	Rare	Milyang 30, Yushin, Dawn, IR 8, IR 22, IR 34, IR 40, CR 1113, Tikal 2, Fanny, Wagwag, IR 665-77-2-3-1, IR 4432-52-6-4, 5005[b], 5006, 5285, 5684, 5685, 5732
2	Larger brown specks or small eyespots, about 1 mm in diameter, with tiny necrotic center	Few	CICA 9, Blue Bonnet 50, IRAT 13, Zenith, Jinheung, Raminad Str. 3, NP-125, Usen, Khao-tah-haeng 17, Pi No. 4, Toride 1, Colombia 1, C 46-15, Dissi Hatif, Mamoriaka, Tadukan, Tapuripa, Moroberekan, Cempo Selak, Ciwini, Chokoto, Pai-kan-tao, Tetep, IR 1529-680-3, IR 2588-2-3-3-1, IR 2793-18-5, IR 2863-38-1-2, IR 442-2-58, 5393
3	Eyespots with distinctive brown margins, 1–2 mm in diameter with white or grayish center, seldom coalesce	10	Carreon, Ta-poo-cho-z, Dular, Kanto 51, Caloro, Shin 2, Fukunishiki, Sha-tiao-tsao (S), 5852
4	Typical eyespot, 3–4 mm in diameter with necrotic gray or straw-colored center, often coalesce, chlorosis around lesions is common	10–20	Aichi Asahi, Ishikari-Shiroke, 5009, 5010, 5029, 5715, 5728, 5452
5	Many typical eyespots with large chlorotic area; spots in this area do not have brown margin and appear as dull grayish spot	50	CICA 4, CICA 6, CICA 7, CICA 8, Tsuyuake, Ca 902/b/3/3, 5001, 5002, 5709, 5734

[a] Artificially inoculated with isolate D-5 in the screenhouse.
[b] Line number of regional trials in Colombia, 1979.

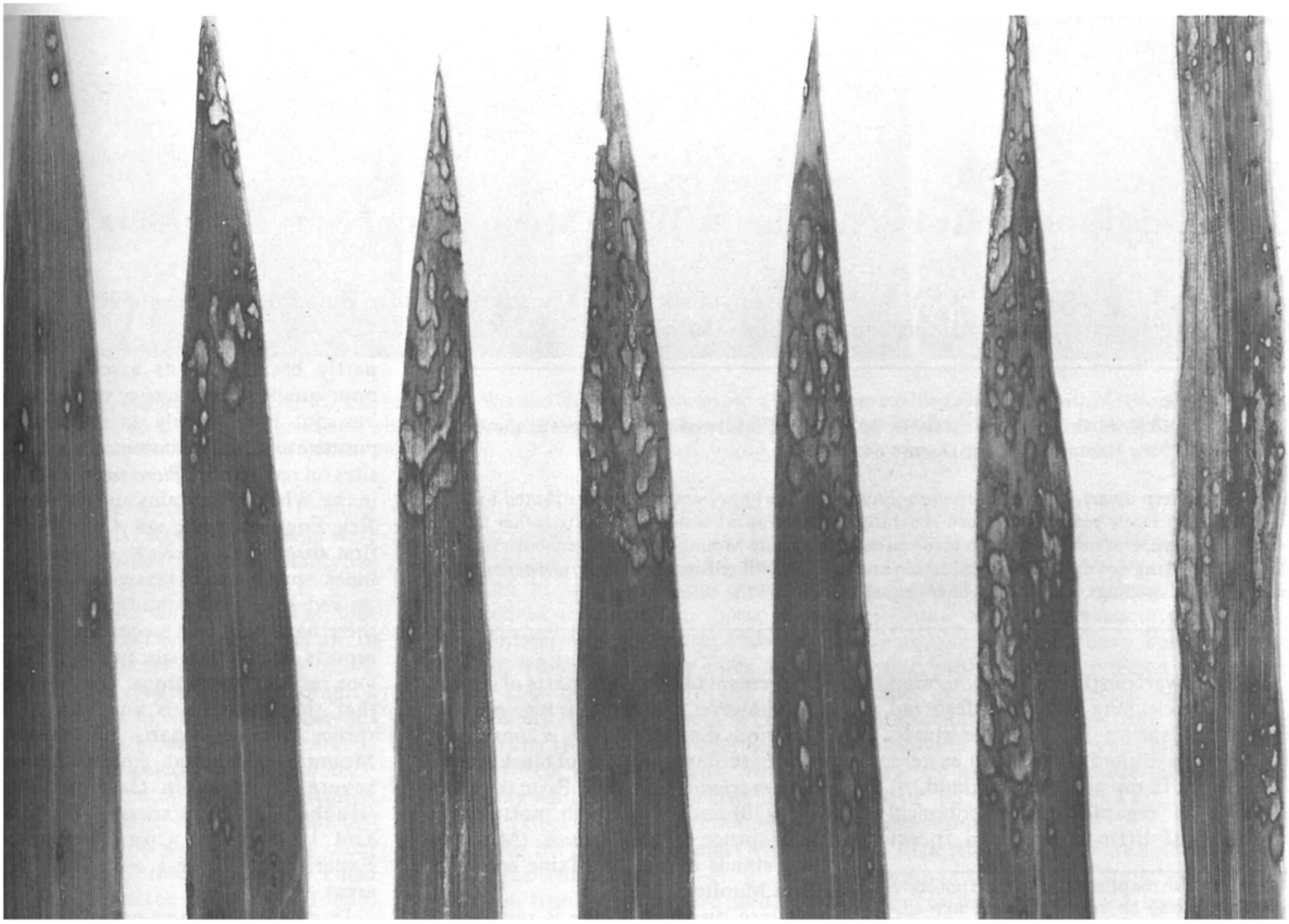

Fig. 1. Eyespot on CICA 6 rice caused by *Drechslera gigantea* (Heald & Wolf) Ito.

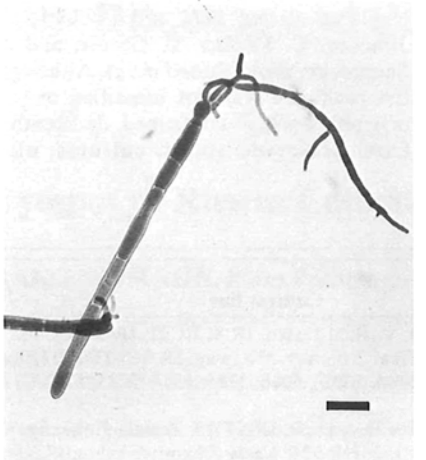

Fig. 2. Germinating conidia of *Drechslera gigantea.* (Scale bar represents 50 μm.)

symptoms on Naylamp in Chira, near Piura, Peru, in 1980. In Panama, it has been observed on CICA 7 since 1978 (A. Ferrer, *personal communication*).

The disease might not be well recognized because of its relatively limited pathogenicity on commercial varieties and its symptom similarity to brown spot caused by *Bipolaris oryzae* (B. de Haan) Shoem. (*Helminthosporium oryzae* B. de Haan).

All susceptible commercial cultivars and lines such as CICAs 4, 6, 7, and 8, and lines 5709, 5715, and 5734 have a common origin, the IR 930 cross (IR 8 × IR 12); CICA 9, which was resistant by artificial inoculation, does not have this cross in its parentage. Because IR 8 appears to be resistant by artificial inoculation, it is highly probable that IR 12 has high susceptibility to this fungus, although this needs to be demonstrated.

Although several entries produced typical lesions in large quantity in screenhouse tests, the disease did not build up under field conditions. The reason for this discrepancy may be related to failure of sporulation on lesions produced on these cultivars. Drechsler (2) called these uncongenial hosts. Thus, the banana cultivar studied by Meredith (6) may not be a congenial host since sporulation was not observed on banana eyespot lesions. Accordingly, varietal resistance to eyespot disease should be evaluated together with spore production or disease development, rather than a single evaluation based on lesion type or number.

So far, symptoms other than eyespot have not been observed. Nevertheless, the effect of the disease on rice yield could become highly significant if the disease starts earlier and continues during favorable environmental conditions such as prolonged wetting of leaves.

Among the reported host grasses, *Cynodon dactylon* L. and *Eleusine indica* (L.) Gaertn. are common in Central and South American rice fields and may be important alternate hosts for the eyespot pathogen.

Continuous efforts to produce improved rice varieties could unintentionally invite new diseases or previously minor diseases at epidemic levels. This may not be predictable, but the damage can be minimized through intensive disease monitoring and use of available resistance sources in a breeding program.

ACKNOWLEDGMENTS

I wish to thank M. E. Rubiano, A. Pineda, and G. Aricapa, Centro Internacional de Agricultura Tropical, for technical assistance; C. Martínez and E. García, Instituto Colombiano Agropecuario; A. Ferrer, Instituto de Investigaciones Agropecuarias de Panama, J. Hernández and V. García, Centro de Investigaciones Agropecuarias in Peru, for providing information; and S. H. Ou, University of Wisconsin, for suggestions and comments.

LITERATURE CITED

1. DRECHSLER, C. 1923. Some graminicolous species of *Helminthosporium*: I. J. Agric. Res. 24:641-740.
2. DRECHSLER, C. 1928. Zonate eyespot of grasses caused by *Helminthosporium giganteum*. J. Agric. Res. 37:473-492.
3. DRECHSLER, C. 1929. Occurrence of the zonate-eyespot fungus *Helminthosporium giganteum* on some additional grasses. J. Agric. Res. 39:129-136.
4. GRANADA, G. A., and E. GARCÍA. 1976. Mancha parda del arroz. ASCOLFI INFORMA 2:3-4. (In Spanish)
5. HEALD, F. D., and F. A. WOLF. 1911. New species of Texas fungi. Mycology 3:5-22.
6. MEREDITH, D. S. 1963. "Eyespot," a foliar disease by bananas caused by *Drechslera gigantea* (Heald & Wolf) Ito. Ann. Appl. Biol. 51:29-40.
7. SHOEMAKER, R. A. 1959. Nomenclature of *Drechslera* and *Bipolaris*, grass parasites segregated from '*Helminthosporium*.' Can. J. Bot. 37:879-887.