EFFECTS OF WATER REGIME ON THE DISTRIBUTION OF MELOIDOGYNE GRAMINICOLA AND OTHER ROOT-PARASITIC NEMATODES IN A RICE FIELD TOPOSEQUENCE AND PATHOGENICITY OF M. GRAMINICOLA ON RICE CULTIVAR UPLR15

BY

J.-C. PROT1) and D. M. MATIAS2)

Division of Entomology and Plant Pathology, International Rice Research Institute, P.O. Box 933, 1099 Manila, Philippines

In a rice field toposequence including upland, rainfed lowland and irrigated rice, Meloidogyne graminicola was present in all three rice production systems, whereas Pratylenchus zeae was present only in upland rice, and Hirschmanniella oryzae in flooded fields. The prevalence and mean intensity of M. graminicola were greater in flooded fields than in upland fields. In a greenhouse experiment, M. graminicola reduced the growth and yield of rice cv. UPL R15 when this cultivar was grown under upland conditions but not under irrigated conditions. M. graminicola is well adapted to irrigated conditions and shallow flooding does not affect its reproduction. However, shallow flooding reduced the percentage of roots damaged by the nematode, resulting in an absence of yield-reducing effect by the nematode under irrigated conditions.

Keywords: ecology, Hirschmanniella oryzae, Meloidogyne graminicola, pathogenicity, Pratylenchus zeae, rice, toposequence, water regime

The rice root-knot nematode, Meloidogyne graminicola, Golden & Birchfield, has been observed mainly in upland rice, rainfed lowland rice and nurseries (Manser, 1968, 1971; Rao & Israel, 1971, 1972) where it can limit plant growth and cause yield losses (Rao et al., 1986; Jairajpuri & Baqri, 1991; Prot et al., 1994b). However, M. graminicola is well adapted to survive under flooded conditions and has been observed in deep water rice in Bangladesh and Vietnam (Page et al., 1979; Cuc & Prot, 1992) where it can reduce plant growth before flooding and cause yield loss by reducing stem elongation resulting in a drowning out of the plants during the deep flooding (Bridge & Page, 1982). Recently it has been observed in more than 50% of the irrigated rice fields in two of the major rice-producing areas of the Philippines (Prot et al., 1994a) but Kinh et al. (1982) have reported that permanent flooding reduced the damage to rice due to M. graminicola. Therefore, it appears important to study the effects of shallow flooding on the distribution of M. graminicola and on its pathogenicity.

The objectives of the experiments reported here were to study: i) the effect of the water regime on the distribution of M. graminicola under field conditions;

1) Nematologist ORSTOM, Visiting Scientist IRRI
2) Research Assistant IRRI

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and ii) the effect of the water regime on the pathogenicity of the nematode on rice cv. UPL Ri5.

MATERIALS AND METHODS

Distribution of root parasitic nematodes in a rice field toposequence

The distribution of *M. graminicola* and other root-parasitic nematodes associated with rice was studied along a 400 m long toposequence on the slope of Lake Taal shore in Laurel, Batangas, Philippines. In this location, rice is grown under upland rice conditions in the upper part of the toposequence (15-10 m above lake level), under rainfed lowland conditions in the middle part (10-5 m above lake level), and under irrigated conditions in the lower part along the shore of the lake (5-0.5 m above lake level). Under upland conditions, rice is grown from May to October, followed by maize or occasionally stringbean or sesame. Two rice crops are grown annually under rainfed lowland and irrigated conditions, the first crop from May to October and the second between December and March. Upland fields are ploughed while rainfed and irrigated fields are ploughed and puddled. Nurseries are prepared in the fields and 14-day-old seedlings are transplanted. Upland rice fields are never flooded. Rainfed lowland fields are intermittently flooded depending on the rainfall. Irrigated rice fields are flooded 3-5 days following transplanting and kept flooded until maturity of the rice crop. Soils are of sandy loam type in upland and rainfed lowland fields, and of silt loam type in the irrigated area.

The study was conducted in September, 1993 when the rice crop was between flowering and maturity stages. The rice cultivars C4 and UPL Ri5 were grown in the three rice production systems. Dumali, IR60, IR64, and PSBRC2 were grown under rainfed lowland and irrigated conditions. IR10, IR42, IR54, and IR65 were grown only under irrigated conditions. A total of 470 samples were collected (10 samples/ha), 130 in upland fields and 170 in each of the two other rice production ecosystems. Each soil (2 kg) and root (one root system) sample was collected by uprooting a rice hill. Nematodes were extracted from 200 cm$^3$ subsamples of soil with a combination of sieving and modified Baermann funnel methods (Hooper, 1986) and from 3 g subsamples of roots by chopping roots into pieces 5-10 mm long and then placing them in a mistifier for 5 days (Seinhorst, 1950).

Prevalence (percent of samples where the genus was present) and mean intensities per 200 cm$^3$ of soil and 3 g of roots were calculated (Boag, 1993) for each genus in each production system.

Pathogenicity of Meloidogyne graminicola on cultivar UPL Ri5

The pathogenicity of *M. graminicola* on UPL Ri5 was studied under two water regimes in two different soils: a clay loam and a sandy loam soil. The clay loam soil contained 44% clay, 37% silt, 19% sand, and 0.12% nitrogen. The sandy