Sampler for Monitoring Cereal Rust Uredospores in Rain

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Information on the arrival of uredospores of the cereal rusts into northern wheat-growing areas where rust infection does not normally overwinter could be useful in the prediction of epidemics. Impaction traps probably fail to detect the cereal rust uredospores involved in this long-distance transport (1). The role of rain-deposited uredospores in the epidemiology of cereal rusts in the northern United States and the probable relation to long-distance transport have been shown (2). Earlier methods of sampling rain for uredospore content consisted of separating the sediment from the rain water samples in the laboratory. This presented problems in shipment and filtration of the sample which were eliminated by direct filtration at the sampling site. The rain sampler used for this purpose is described herein.

The spores are removed from the collection filter as before (2) by three washes of 3 ml distilled water with ultrasonic scrubbing, and transferred to a centrifuge tube. After the sample is centrifuged at 1,500 *g* for 5 min, and the supernatant decanted to 3 ml, 7 ml of bromoethanol are layered beneath the remaining sample. The particles in the pellet are resuspended by immersing the sample in the ultrasonic bath for 1 min. The sample is centrifuged, gradually increasing to and then decreasing from 1,500 *g* over a 20 min period. The upper layer containing the organic particles is removed from the suspension by suction and filtered through a cellulose ester filter. The filter is dried and mounted in immersion oil for examination.

The rain sampler (Fig. 1) is constructed so raindrops fall directly into a funnel (15.24-cm diam). A 40- to 50-mesh screen inside the funnel, 3 cm below the top, prevents the entrance of large particles of plant and insect debris into the sample. The rain water from the funnel empties into a 30-cm length of acrylic tubing of 44-mm inside diam which acts as a reservoir during heavy rains. This reservoir is capable of holding a rainfall of 2.59 cm (1 inch) without any filtering; however, filtering normally occurs as fast as the rain falls. At the base of the reservoir tube is a 47-mm-diam cellulose acetate filter with an 8-μ pore size. The filter rests on a porous polyethylene support sheet with a pore size of approximately 8 mm that allows a quick discharge of the water after filtering. The filter and support sheet are held on the base of the reservoir tube by means of a plastic friction pipe cap from which the center was removed with a large cork borer. The filter and the uredospores trapped by it are removed after each rain and placed in an unbreakable plastic petri dish for mailing. In some studies, the sampler was washed and the filter changed daily, but in our standard procedure this was not done.

The sensitivity of this trap depends on the area of the funnel. We have found for stem rust that uredospores are recovered from rain samples approximately 10 days prior to trapping of uredospores on 5-mm rod

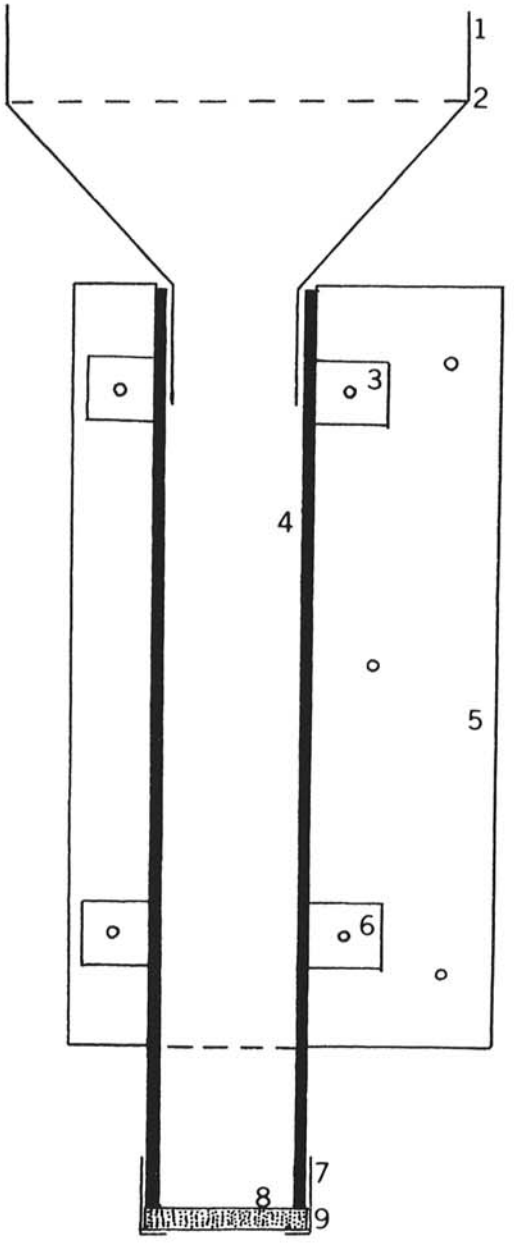

Fig. 1. Rain sampler for cereal rust uredospores diagrammed in cross section. 1 = Funnel; 2 = debris screen; 3 = mounting strap; 4 = reservoir tube; 5 = mounting board; 6 = mounting strap; 7 = friction cap; 8 = cellulose acetate filter; 9 = support screen. Scale: 1 cm = 2.54 cm.

impaction traps. The initial detection of stem rust spores on impaction traps generally coincides with the appearance of primary infection in the field. If one stem rust spore in 100 causes infection, then one infection per 1.8 m^2 (19.6 ft^2) of exposed plant surface would occur per spore trapped in the rain sampler. However, with a disease such as leaf rust, where 1 spore in 10 might cause infection, each spore trapped would represent 1 pustule/0.18 m^2 (1.96 ft^2) of exposed plant surface, an unusually high incidence of primary infection. Thus, a trap large enough to be sensitive in one disease may fail in another. In practice, during the period 1966-68, the funnel 15 cm in diam failed to detect the arrival of leaf rust spores in approximately 6% of the cases examined (1 of 18 location-years), while it always detected stem rust arrival (42 location-years). Increasing the size of the funnel would not otherwise affect the operation of the trap except that the number of nonspore particles per sample would increase, making separation more difficult. Furthermore, with funnels of greater than 30-cm diam, the reservoir might be insufficient.

LITERATURE CITED

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