Frequency distribution of soybean rust urediospore clumps collected from naturally infected kudzu leaves in Nanning, China

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Introduction

Previous observations indicated that urediospores of soybean rust pathogen *Phakopsora pachyrhizi* tend to form clumps (Melching, et al., 1979). As the pathogen produces urediospores in pustules which are most on the lower surface of leaves, urediospores released from pustules would fall to ground quickly if they are not picked up by air currents. The time of an urediospore reaching ground is associated with its terminal velocity. When urediospores form clumps, the clump size would affect clump physical characteristics such as terminal velocity significantly (Seinfeld and Pandis, 2006). Single spores may be picked up by air current easier than large clumps due to low terminal velocity, which also gives them longer time to reach ground. This makes difference in spore dispersal, especially for long-distance dispersal. Information on spore clump of this fungus is lacking. Associated with terminal velocity of urediospores, information on frequency distribution of *P. pachyrhizi* urediospore clump size may help us model the urediospores escaping from host canopy, particularly important to model long distance spore dispersal.

Objectives

To determine urediospore clump size frequency distribution by observing urediospore clumps from diseased kudzu leaves collected in naturally infected kudzu field.

Materials and methods

Our experiment was conducted in Nanning, China in spring 2006, where soybean rust is present year-around on various hosts including soybean and wild or cultured kudzu. Due to availability of soybean in the early spring, urediospores were collected from a wild kudzu patch (Fig. 1 and Fig. 2) naturally infected by *P. pachyrhizi*. Infected leaves were arbitrarily sampled. Severity of leaves used for spore collection ranged from 10% to 50% defined by pustule area. Urediospores of *Phakopsora pachyrhizi* were collected in the field and in the room condition. In the field, leaves were gently shaken without detaching leaves from kudzu vines. Other leaves were detached for collecting spores in room condition. Sample leaves were put in dark moist chamber for 1 day before urediospore were collected in room as many spores may be lost during transportation. Urediospores falling from leaf surface were collected on blue wax paper (Fig. 3). Spores were examined under dissecting microscope with magnifications 50-200 times. Number of spores in each spore clump was counted, or estimated if too many spores in one clump to count.

Results and discussion

Total 3300 including single urediospores and spore clumps from 29 leaflets were collected and examined under dissecting microscope. Observations generally agreed with Melching’s previous report. Many urediospore formed clumps (Fig. 4 and 5), some of them were of large sizes that might be up to 100 spore/clump. For large clumps, number of urediospores was estimated. Sum of all the urediospores was 29160. Clump size ranged in 2-100 spore/clump, average size was 8.9. 5000 urediospores from 12 leaflets were collected in field, in which 6% of them were single and average clump size was 6.2 spore/clump. 24160 urediospores from 17 leaflets were collected in room, in which 2% of them were single and average clump size was 9.7 spore/clump. The profiles of clump size frequency were different for spores collected in the field from that in the room condition(Fig. 6). Generally, there were more clumps, large and small, for the urediospores collected in the room condition.

Fig. 7 shows clump size frequency for all 3300 spore clumps. Although frequency of single urediospores was highest, they only took a small percentage in all collected spores (Fig. 8). About 30% urediospores were in clumps with 2-10 spores per clump, among them clumps with 3-4 urediospores were of highest frequency. In Fig. 8, a large number of urediospores seemed form clumps with 20-30 spores per clump. The accumulated percentage of sum of urediospores in a clump size showed a sigmoid shape.

Reference


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