

Short Report

Effect of Plant Size on Resistance to Snow Damage in Winter Wheat and Barley

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Received May 18, 1993

コムギとオオムギの耐雪性に及ぼす植物体の大きさの影響：渡辺好昭・竹中重仁（北陸農業試験場）

キーワード：オオムギ，コムギ，雪腐病

Key words: Barley, Snow mold, Wheat.

Snow injury has been a very serious problem for winter cereal production in the Hokuriku district, which is one of the typically heavy snowfall areas in Japan. There have been many observations that resistance to snow damage is strongly influenced by seeding date, and that earlier-seeded plants have the higher resistance to snow damage^{5,9,12,13}). Conflicting experimental results reported that later-seeded plants survived more^{3,11}). In the Hokuriku district, the main causes of snow damage are snow mold diseases, especially *Pythium iwayamai*, *P. paddicum* and *Typhula incarnata*⁷). Therefore, the purpose of this study was to determine the relationships between plant size and resistance to the three snow mold diseases in wheat and barley. The relationship of plant size and resistance can not be clarified correctly by field test because snow mold pathogens usually coexist in the field and their distribution differs from field to field^{6,7}). Therefore, we used artificial inoculation methods in this study.

Materials and Methods

Winter wheat (*Triticum aestivum* L.) cultivar Yukichabo and barley (*Hordeum vulgare* L.) cultivar Minorimugi, which were popular in the district, were seeded in plastic pots on three seeding dates; Nov. 6, 17 and 27 in 1989. The plants were grown under greenhouse condition and were hardened for 2 weeks under natural conditions from Dec. 8. On Dec. 22, the plants were inoculated with *P. iwayamai*, *P. paddicum*, and *T. incarnata*, individually. The artificial inoculation method was essentially the same as described previously¹⁰). Each pot

was incubated in the dark at 0.5 C for 4 weeks. The percentage of rotted leaf area, surviving tillers and the recovery dry weight were recorded after a recovery period of 3, 14 and 21 days, respectively.

Results and Discussion

In wheat inoculated with *P. iwayamai*, the percentage of rotted leaf area, an index of resistance to fungal progression in the leaf tissue of large plant was lower than that of a small plant (Fig. 1 A). The percentage of surviving tillers and the recovery dry weight, indexes of recovery ability, of larger plants were also higher than in small plants (Fig. 1 B, C). These results indicate that larger plants have higher resistance to *P. iwayamai*. On the contrary, Lipps et al⁴) reported that smaller wheat plants were more resistant to *P. iwayamai* than larger plants. It is thought that the difference in these results was caused by moisture conditions during incubation. They tested under flood conditions. Consequently plants were also tested for endurance to O₂-deficiency accompanied by tests for resistance to *P. iwayamai*.

Similarly, the resistance of wheat to *P. paddicum* and *T. incarnata* increased with plant size (Fig. 1). The resistance of wheat to other snow mold pathogens such as *T. idahoensis*, *Fusarium nivale* and *Coprinus psychromorbidus*, was also reported to increase with plant size^{1,2}).

In barley, the larger plants had the higher resistance to three snow mold pathogens, as was similarly the case for wheat (Fig. 1). However, the recovery dry weight of *T. incarnata*-inoculated plant was low, even in the largest plants (Fig. 1 C). This suggests that the ability of barley to recover from a *T. incarnata* attack would be low regardless of

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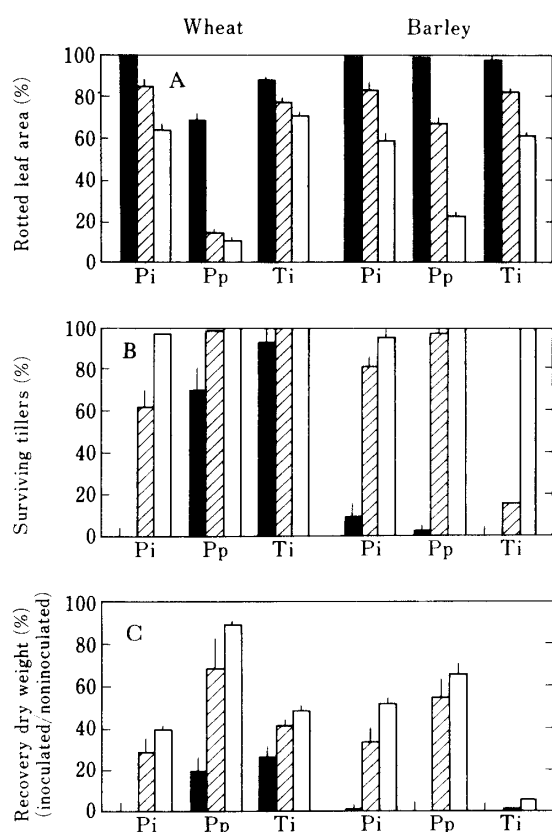


Fig. 1. Influence of plant size on percentage of rotted leaf area, surviving tillers and recovery dry weight (inoculated/noninoculated) of wheat and barley inoculated with *P. iwayamai* (P. i), *P. paddicum* (P. p) and *T. incarnata* (T. i). ■ Small plants: seeded on Nov. 27, no tillers.

▨ Middle plants: seeded Nov. 17, 1.2 and 0.6 tillers of wheat and barley, respectively.

□ Large plant: seeded Nov. 6, 2.5 and 1.8 tillers, respectively.

Vertical bar indicates standard error of the mean (n=3).

plant size because this pathogen can easily infect underground parts of barley⁸⁾.

These results indicated that the larger plants of wheat and barley have higher resistance to the snow mold diseases, which are the main causes of snow damage.

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