Development of powdery mildew-resistant adzuki bean using wild adzuki bean germplasm

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Objectives

Powdery mildew, or *Podosphaera phaseoli*, is a serious fungal disease threatening the cultivation of adzuki bean in tropical and subtropical regions. At present, resistant genotypes have not yet been detected in cultivated adzuki bean germplasm. In a greenhouse screening trial at the Okinawa Subtropical Station, we inoculated wild adzuki bean germplasm accessions (mainly collected by JIRCAS) with powdery mildew during their seedling stages by dusting them with spores of infected leaves using a soft brush.

Results

Cultivated and wild ancestral forms of adzuki bean (*Vigna angularis* var. *angularis* and var. *nipponensis*, respectively), *V. nakashimae* and *V. riukiuensis* were highly susceptible to the disease, whereas *V. hirtella* exhibited resistance (hypersensitivity). *V. hirtella* was discovered to have high cross-compatibility with adzuki bean, and we have successfully obtained fertile F_1 hybrids from them. These F_1 hybrids exhibited resistance like that of *V. hirtella* when artificially inoculated (Fig. 1). Types of reactions to powdery mildew pathogens on primary leaves of 8 day-old BC_1 plants obtained from adzuki bean and *V. hirtella* were segregated into 24 resistant types (R) and 21 susceptible types (S), with the χ^2 value for 1:1 segregation being 0.2 (0.7>p>0.5)(Fig. 2).

Judging from this ratio and the resistance found in the F_1 plants, it was concluded that a single dominant gene is responsible for the resistance exhibited by *V. hirtella*. Since the resistance was verified by artificially inoculating all progeny plants, it is anticipated that resistant adzuki bean varieties will be easily obtained through successive backcrossing to commercial cultivars. Currently, we are recurrently backcrossing to cv. 'Erimo shozu' to develop new powdery mildew-resistant adzuki bean varieties.

Fig. 1. Types of reactions to the powdery mildew pathogen, *Podosphaera phaseoli* on F_1 plants derived from adzuki bean and *V. hirtella* (left: resistant) and adzuki bean cv. 'Erimo shozu' (right: susceptible).

Fig. 2. Types of reactions to the powdery mildew pathogen, *Podosphaera phaseoli* on primary leaves of 8-day-old BC_1 plants obtained from adzuki bean and *V. hirtella* 5 days after inoculation. Resistant leaves are indicated by the letter "R" while susceptible leaves are marked with the letter "S".

References

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