TRANSFER OF RESISTANCE TO HALO-BLIGHT (*PSEUDOMONAS PHASEOLICOLA*) FROM *PHASEOLUS VULGARIS* TO *P. COCCINEUS*

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Runner bean crops grown in Britain are often severely infected with halo-blight (Taylor, 1970). There are no well-documented reports of resistance to halo-blight in runner beans, and Walkey and Taylor (1979) were unable to find resistance in any of the 19 cultivars of runner beans which they tested. As several good sources of resistance to halo-blight are known in the common bean (*Phaseolus vulgaris*) it was decided to transfer this resistance to *P. coccineus*. The source of resistance used was PI 150414 which carries a single recessive gene conferring resistance to both races of the pathogen (Patel & Walker, 1966).

The F_1 hybrid between the two species can be made much more easily with *P. vulgaris* as the female parent but the hybrid is then often highly sterile. We used *P. coccineus* as the female parent, in the hope that any hybrids produced would have reasonable fertility. Despite careful emasculation, most of the seed obtained from several hundred crosses gave self plants. Eventually four true hybrid plants were obtained, these being recognised by their intermediate morphology (eg. pink flowers) and reduced pollen stainability (50-85%). These hybrids were readily backcrossed to a range of forms of *P. coccineus*. Attempts to improve the success rate of hybrid production by culturing 2-3 week old pods in plastic bags (Ibrahim & Coyne, 1975) were not successful. Seeds which had distorted and misshaped cotyledons and were most probably hybrid, germinated very slowly if at all, and generally rotted before the shoot emerged. Because embryo abortion seemed to be one of the main difficulties in obtaining hybrids, embryo culture was then used. From culturing over 500 embryos, four true F_1 hybrid plants were obtained, but again many of the embryos successfully cultured were self rather than hybrid. Neither of the methods tried greatly increased the yield of F_1 hybrid plants and the best chance of success seems to lie in making the cross as many times as possible, using a wide range of genotypes as the female parent.

Each BC_1 plant (*P. coccineus* x F_1) was selfed, and the BC_1 F_2 progenies screened for resistance to halo-blight in a glasshouse seedling test. Half of these progenies were expected to carry the resistance gene, but of 15 progenies tested, 12 were completely susceptible. The other three progenies segregated for resistance, with two progenies having more resistant than susceptible plants. Resistant F_2 plants were selfed and nine F_3 progenies were screened for resistance. All segregated, most progenies having more resistant than susceptible plants. Because of the difficulty of stabilising the resistance, four F_4 progenies of 20 plants each were screened. All the plants were resistant in one progeny, whereas in the other three there was a small number of susceptible plants. These results indicate that we have successfully transferred halo-blight resistance from PI 150414 to *P. coccineus*, and the expression of the gene from PI 150414 is modified by the segregation of minor genes in a *coccineus* background. The line in which the resistance has been stabilised is much more similar to *P. coccineus* than to *P. vulgaris*, but shows various morphological abnormalities and poor pod production. It will probably require 2 more backcrosses to *P. coccineus* to produce a runner bean of good agronomic type.

The artificial inoculation technique for the infection of glasshouse-grown seedlings described by Taylor et al (1978) seems to give clearer results with P. vulgaris than with P. coccineus. It is important that the primary leaves of P. coccineus should be inoculated at precisely the right stage of growth, normally when they are about half of their full size. If the primary leaves of susceptible plants are too old when inoculated they will often show few if any water-soaked lesions, and are liable to be scored as at least partially resistant. Furthermore, there are indications that the British cultivars of runner beans have some field resistance to race 2 of the pathogen (Taylor, 1970). To combat these difficulties, the screening procedure has been modified so that the primary leaves are inoculated with a mixture of races 1 and 2, while the trifoliate leaves are inoculated 10-12 days later with race 1 only.

References

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