INTRODUCTION

In most potato clones the susceptibility of tubers and haulms to Phytophthora infestans (Mont.) de Bary is correlated, but there are exceptions both in “field-resistant” clones and in clones whose resistance is based on R-genes derived from Solanum demissum (Black, 1952). Only R-gene clones are considered in this paper, but even so resistance can be of two types:

1. a hypersensitivity effective against individual races conferred by specific R-genes;
2. “field” resistance shown against all races.

For convenience, these two reactions will be termed “hypersensitivity” and “resistance” respectively. The objects of the investigation were: first to determine the tuber reaction of R-gene clones to races to which the haulm is hypersensitive, for Müller, Cullen and Kostrowicka (1955) showed, e.g. with Pentland Ace (R₃), that the tuber may be susceptible although the haulm is hypersensitive; second, to assess the reaction of tubers to specialized races that spread in the haulm.

MATERIALS AND METHODS

Tubers of 21 named and 25 unnamed clones, all (except for King Edward) with one or
more R-genes derived from *S. demissum*, were harvested from plants grown in 1959 at the John Innes Institute or at Rothamsted Experimental Station. The unnamed clones included Black's differential host series for identifying races of *P. infestans* and a number of breeding lines of various origins. The tubers used in the experiments were stored at 4°C and washed, but not surface sterilized, before inoculation.

Vigorously growing isolates of *P. infestans*, races 4:1,2:1,4; 2,4; 1,3,4 and 1,2,3,4, which gave unambiguous reactions on leaflets of the differential host series, were maintained on slices of tuber tissue of King Edward. In preparing inocula, sporangia were washed off and the resulting suspensions kept at 13°C to stimulate zoospore liberation; the suspensions were then adjusted to approximately equal densities.

Inoculations were made by placing discs of filter-paper 7 mm in diameter, which had been dipped in the mixed sporangial and zoospore suspensions, on cut surfaces of the tubers. The inoculated tubers were stored at 15°C in shallow metal trays with glass lids, all the trays that constituted a replicate being wrapped together in a polyethylene sheet. High humidity was maintained for 24 hr. after inoculation by moist blotting paper adherent to the glass lids; the blotting papers and the filter-paper discs were removed 24 hr. after inoculation.

Subjective estimates of reaction were made by classifying lesions in four categories based on the extent and density of mycelial development on the surface. At the end of the experiment, the tubers were cut to verify the correspondence between surface growth and the internal spread of the fungus. The data were expressed quantitatively by assigning numerical "infection scores" of value 0, 1, 2, 3 to the four categories, in the order zero to maximal response.

Details of any method peculiar to particular experiments are described in the appropriate sections.

**RESULTS**

Results are summarized in the tables 4-6; only selected illustrative examples are described in this section.

**Expt. 1.** This was a comprehensive experiment in which tubers of 36 types were inoculated with all six races of *P. infestans*. The tubers were sliced lengthwise and each half was inoculated with all six races by placing the filter-paper discs on the cut surfaces equidistantly in the region of the vascular ring and rotated with respect to the heel and rose ends of the tuber. Six tuber halves of each variety were inoculated to give six replications; infection was recorded 5 and 10 days after inoculation.

Table 4 gives the mean infection scores at ten days, and Fig. 1 those for some representative clones covering a range of R-gene types. The infection scores of the different races on King Edward tubers indicate that the isolates of races 2,4; 1,4 and especially 1,2,3,4 were less vigorous than the remainder, though these differences were much smaller at 10 days than at 5 days after inoculation. The results, summarized also in Table 1, show that the gene R$_1$ generally prevented tuber infection by races to which the foliage is hypersensitive, Placid being the most susceptible of the R$_1$ clones.