**Phoma complanata-resistant. UG-10 Parsnip Germplasm**

**V.I. Shattuck**  
*Horticultural Science Department, University of Guelph, Guelph, Ontario N1G 2W1, Canada*

**R.F. Cerkauskas**  
*Agriculture Canada, Vineland Research Station, Vineland Station, Ontario LOR 2E0, Canada*

Additional index words. Pastinaca sativa, vegetable breeding

In North America, several canker-forming fungal pathogens affect parsnip (*Pastinaca sativa L*), with the most important incited by *Phoma complanata* (Tode ex Fr.) Desm. (*Cerkauskas, 1986*) and *Itersonilia perplexans* (Davis et al., 1989; Wilkinson, 1952). The canker caused by *P. complanata* can be a limiting constraint in parsnip production (*Cerkauskas, 1987*). Symptoms of this seed-borne disease include formation of dark-tan or brown leaf spots, leading later to blighting of leaves, and black lesions (cankers) on petioles and roots (*Cerkauskas, 1985*). Root cankers may occur in the field or arise during long-term cold storage at 0°C or above, resulting in yield and quality losses. Enhanced concentrations of various photocarcinogenic furocoumarins have also been found in parsnip cultivars infected with *P. complanata* (*Cerkauskas and Chiba, 1991*). At present, only low to moderate resistance of known pathogenicity that were isolated from diseased plants from fields within the Cookstown and Bradford Marsh areas of southern Ontario. Forty to 50 days after inoculation, the plants were harvested and visually screened for *Phoma* canker resistance along with commercially acceptable root characteristics, including smoothness, firmness, white flesh, and medium to small lenticels. Plants selected at harvest had <1% of the foliage area covered with lesions and had no lesions on roots. Selected roots were placed in cold storage at 0°C and 95% relative humidity for 3 months to assess storage potential and for vernalization. Since *P. complanata* is still active above 0°C, the roots were reassessed externally for the presence of lesions following cold storage. Roots showing <0.570 of the surface area covered with lesions were planted and allowed to mass-pollinate in screen tents within the greenhouse during the winter. The number of roots selected for each cycle varied, but usually ranged from 2% to 5% of the total number of roots grown in the field. Common houseflies (*Musca domestica L.* L.) were used to effect pollen transfer in this predominantly cross-pollinated crop. Seeds were harvested from vigorous greenhouse-grown plants, bulked, and sown in the field for disease screening.

**Origin**

UG-10 originated from a seed population developed in 1986 by randomly intercrossing 10 selected ‘Harris Model’ and three ‘Hollow Crown’ plants that displayed low levels of foliar and root symptoms when field-inoculated with *P. complanata*. From 1986 to 1990, four cycles of mass selection were used to intensify *Phoma* canker resistance within this initial genetic material. Each year, more than 2000 plants were grown on muck Soils at the Muck Research Station, Kettleby, Ontario, under standard commercial practices (Shattuck et al., 1987). To ensure uniform and high selection pressure for resistance to *P. complanata*, 90-day-old plants were sprayed until run-off with a blended spore suspension of 5 × 10^5 spores/ml prepared in distilled water containing 0.1% Tween 20. The spore suspensions were produced by combining spores from various isolates of *P. complanata* of known pathogenicity that were isolated from diseased plants from fields within the Cookstown and Bradford Marsh areas of southern Ontario. Forty to 50 days after inoculation, the plants were harvested and visually screened for *Phoma* canker resistance along with commercially acceptable root characteristics, including smoothness, firmness, white flesh, and medium to small lenticels. Plants selected at harvest had <1% of the foliage area covered with lesions and had no lesions on roots. Selected roots were placed in cold storage at 0°C and 95% relative humidity for 3 months to assess storage potential and for vernalization. Since *P. complanata* is still active above 0°C, the roots were reassessed externally for the presence of lesions following cold storage. Roots showing <0.570 of the surface area covered with lesions were planted and allowed to mass-pollinate in screen tents within the greenhouse during the winter. The number of roots selected for each cycle varied, but usually ranged from 2% to 5% of the total number of roots grown in the field. Common houseflies (*Musca domestica L.* L.) were used to effect pollen transfer in this predominantly cross-pollinated crop. Seeds were harvested from vigorous greenhouse-grown plants, bulked, and sown in the field for disease screening.

**Description**

When grown on muck soils, UG-10 plants are vigorous and foliage is moderate. At harvest, UG-10 plants that were inoculated with *P. complanata* lacked root cankers but exhibited variation in the number of lesions on foliage. Generally, the lesions on plants cov-

---

Received for publication 26 Feb. 1990. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked advertisement solely to indicate this fact.

---

Table 1. Incidence of root canker caused by *P. complanata* at harvest of parsnip cultivars grown on muck soils in 1986 at the Muck Research Station, Kettleby, Ontario.

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Roots with canker* (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All-American</td>
<td>20.6 a</td>
</tr>
<tr>
<td>Avonresister</td>
<td>37.5 ab</td>
</tr>
<tr>
<td>Gladiator</td>
<td>50.7 b</td>
</tr>
<tr>
<td>White Gem</td>
<td>78.7 C</td>
</tr>
<tr>
<td>Harris Model</td>
<td>90.3 c</td>
</tr>
</tbody>
</table>

*Roots were evaluated 65 days after foliar inoculation; mean separation by Duncan’s multiple range test, P = 0.05.*

---

**Fig. 1.** Representative roots of UG-10 parsnip germplasm.
ered <0.1% of the foliage area. In comparison, > 90% of inoculated 'Harris Model' plants, grown in each selection cycle as a susceptible check, were devoid of foliage, and the corresponding roots had canker lesions covering ≈ 20% of the surface area. UG-10 roots have been selected for resistance to sprouting during vernalization, and many roots are devoid of *Phoma* cankers after 3 months of cold storage. However, all roots from cold storage, when planted, will exhibit lesions during the regrowth of foliage. Roots range in shape from wedge to bayonet (Fig. 1), which should allow plant breeders the opportunity to select out preferred shapes. Greenhouse seed production and seed set in plants comprising UG-10 is comparable to ‘Harris Model’.

**Availability**

A limited amount of 1990 greenhouse-harvested seed is available upon request by writing R.F. C.

**Literature Cited**


