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First Report of Umbel Browning and Stem Necrosis Caused by *Diaporthe angelicae* on Carrot in France

L. Ménard, P. E. Brandeis, P. Simoneau, and P. Poupard, Université d'Angers, UMR 1345 Institut de Recherche en Horticulture et Semences, SFR 4207 QUASAV, PRES L'UNAM, 49045 Angers, France; INRA, UMR 1345 Institut de Recherche en Horticulture et Semences, 49071 Beaucouzé, France ; Agrocampus Ouest, UMR 1345 Institut de Recherche en Horticulture et Semences, 49045 Angers, France ; **I. Sérandat, J. Detoc, L. Robbes, F. Bastide**, GEVES, 25 rue Georges Morel, 49071 Beaucouzé, France; **E. Laurent, J. Gombert**, FNAMS, Impasse du Verger, 49800 Brain-sur-l'Authion, France ; **E. Morel**, FNAMS, 45 voie Romaine, BP 23, 41240 Ouzouer-le-Marché, France

In 2011, carrot (*Daucus carota* L.) seed production occurred on 2900 ha which accounts for approximately 25% of the area devoted to the production of vegetable fine seeds. Since 2007, symptoms of umbel browning have been regularly observed in carrot production areas located in the Central Region. Initially, triangular necrotic lesions appeared on carrot umbels. that later spread to the entire umbels and often progressed on to the stems. Diseased umbels became dried prematurely, compromising seed development. The loss in seed production was estimated at approximately 8% of the harvested carrot umbels during the cropping seasons of spring and summer 2007 and 2008 in France. In collaboration with seed companies, diseased carrot stems were collected from seven fields of seed production (eight plants per field) and a fungus was isolated from the tissue. The cultures were grown on malt (2%)-agar (1.5%) medium and incubated for 2 weeks at 22°C in darkness. Young fungal colonies were white and a brownish green pigmentation developed when the colonies became older. The same color was observed from the top and on the reverse of the colonies. To induce sporulation, isolates were grown on water-agar (1.5%) medium in the presence of carrot stem fragments for one week at 22°C in darkness, followed by one week at 22°C in white light under a 16-h photoperiod. Pycnidia were produced on stem fragments and contained alpha- and beta conidia, typical of the genus *Diaporthe* (2). Alternatively, pycnidia were also obtained on malt-agar medium after two weeks of culture at 25°C in white light under a 12-h photoperiod. The size of alpha- and beta- conidia was $6.3 \pm 0.5 \times 2.3 \pm 0.4 \mu\text{m}$ and $23.3 \pm 1.8 \times 0.9 \pm 0.2 \mu\text{m}$ respectively (n= 170). In order to confirm the identification at the genus level and determine the species, DNA was extracted from the mycelium of three representative isolates and the ITS regions of the ribosomal DNA were amplified using universal primers (1). The sequences of the amplified products (GenBank acc. N° KF240772-KF240774) were 100% identical with the ITS sequence of a *Diaporthe angelicae* isolate deposited in the NCBI database (CBS 111592 isolate, GenBank acc. N° KC343027). To confirm pathogenicity, the three isolates of *D. angelicae* were inoculated on carrot umbels in the greenhouse. A total of nine plants were inoculated (three plants per isolate). Using a micropipette, ten microliters of a conidial suspension containing alpha- and beta-conidia (10^5 conidia.mL⁻¹) were deposited at the base of the primary umbel and two secondary umbels, which were wounded before inoculation using a scalpel blade. Seven inoculated plants developed triangular, necrotic lesions that were typical umbel browning. *Diaporthe angelicae* was re-isolated on malt-agar medium from the inoculated diseased carrot umbels. To our knowledge, this is the first report of *D. angelicae* in carrot cultivated for seed production in France. The disease resembles the

lesions described in the Netherlands in 1951 on carrot inflorescence caused by *Phomopsis dauci* (3). In future experiments, it would be crucial to precisely determine if *D. angelicae* could be transmitted to the seeds.

References: (1) M. A. Innis et al. *PCR protocols: A guide to methods and applications*. Academic Press, Salt Lake City, UT, 1990. (2) J. M. Santos and A. J. L. Philips *Fungal Divers.* 34:111, 2009. (3) J. A. von Arx *Eur. J. Plant Pathol.* 57:44, 1951.