



## First Report of *Peronospora dianthicola* causing downy mildew of carnation in China

C.F. Duan<sup>1</sup>, A.Z.Tong<sup>2</sup>, Y.Q.Long<sup>1</sup>, G.H.Liu<sup>1</sup>, X.P.Luo<sup>1</sup>, Y.L.Lv<sup>1</sup>, Y.Q.Lou<sup>1</sup>, Z.Y.Zhang<sup>2</sup>, G.H.Yang<sup>2</sup> and M.Gui<sup>3\*</sup>

<sup>1</sup> Tropical and Subtropical Cash Crops Research Institute, YAAS, Baoshan, 678025, China; <sup>2</sup> The Key Lab of Plant Pathology of Yunnan Province, Yunnan Agricultural University, Kunming 650201, China; <sup>3</sup> The Key Lab of Flower Breeding of Yunnan Province, Flower Research Institute, YAAS, Kunming, 650205, China

\*E-mail: gming-114@163.com

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Carnation (*Dianthus caryophyllus*) is the most important cut flower in Yunnan, China. During a survey of carnation plants in Kunming, Yunnan, from 2008 to 2010, pale green leaves that turned yellow with sporulation on both sides of infected leaf surfaces were observed (Fig. 1). Infected plants were stunted and eventually withered. Up to 20% of carnation plants in the areas surveyed had these symptoms. Microscopic observations showed white conidiophores that turned slightly darker after maturation of conidia. Sporangioophores were 257-388 x 6.9-8.2 µm (average 331 x 7.3 µm), ramified dichotomously 3-6 times. Some sporangioophores were observed exiting through the stoma. Sporangia were light brown, obovoid to elliptical, measuring 19.0-22.1 x 16.4-18.6 µm (average 21.0 x 19.7 µm) with a length/width ratio of 1.0 to 1.3. Oospores were 39-41 µm in diameter, with a yellow-brown, heavily and evenly verrucose or warted wall. Oospores were seen abundantly in leaf sections (Fig. 2). Symptoms on the leaves and oomycete morphology were similar to those described for downy mildew (Francis, 1983). ITS 1 and ITS 4 primers were designed for the amplification of the 5.8s rDNA-ITS region. The amplified ITS sequence of collected sporangioophores and sporangia from infected carnation plants was 873 bp. Results of sequence analysis of the isolates showed similarity with sequences from 20 isolates of *Peronospora* spp. in GenBank. The pathogen was identified as belonging to *Peronospora dianthicola* based on its phenotypic characteristics (Francis, 1983).

Pathogenicity tests were performed by inoculating leaves of 60-day-old healthy carnation plants with sporangioophores and sporangia collected

from naturally infected carnation plants. Plants were incubated at 20°C and 95% relative humidity with a 12 h photoperiod. After 20 days incubation, typical downy mildew symptoms were observed on the inoculated carnation, but no symptoms were observed on water-treated control plants. Downy mildew of carnation caused by *P. dianthicola* has been reported to occur in France (Francis, 1983), Israel (Ben-Ze'ev *et al.*, 2006) and Colombia (Arbeláez, 1979). To our knowledge, this is the first report of downy mildew of carnation caused by *P. dianthicola* in China.

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Figure 1

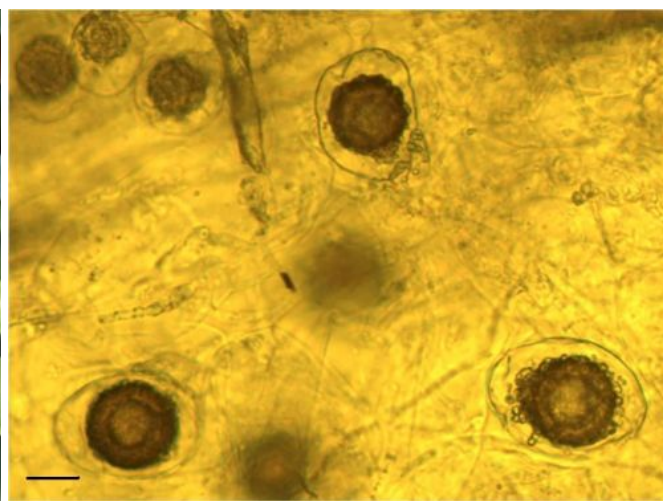


Figure 2

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