



First report of *Diplodia bulgarica* a new species causing canker disease of apple (*Malus domestica* Borkh) in India

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Apple (*Malus × domestica* Borkh), one of the commercially grown fruit in India, is susceptible to canker disease caused by various *Diplodia* spp. To identify the species associated with the disease, diseased samples were collected during 2017–18 from various apple growing regions. The observed symptoms were sunken brown elliptical lesions having series of concentric rings. The fungus was isolated from 8–10 mm size infected tissue and cultures were purified by hyphal tip technique. The cultural characteristics revealed fluffy colonies with irregular margin having dark centre and reached 20–30 mm after 7 days on PDA. The pycnidia produced after 20–25 days were immersed in culture. Conidiogenous cells were hyaline, cylindrical, somewhat swollen at base and measured about 9–17 × 2–5 µm, producing a single apical conidium. Conidia were initially hyaline and later became pale brown, aseptate, few developing a central transverse median septum, smooth, thick walled, oblong to ovoid apex and measured 20.0–28.0 × 9.0–14.5 µm. The fungus was morphologically identified as *Diplodia bulgarica* (Phillips et al. 2012). To confirm at the molecular level, the regions of internal transcribed spacer (ITS) and translation elongation factor 1-alpha gene (tef1-

alpha) were amplified and sequenced (White et al. 1990; Quaglia et al. 2014). Both the sequences showed nearly 99% sequence similarity with *Diplodia bulgarica* NCBI reference strain NR111444 and GQ923821, respectively. The generated sequences were submitted to GenBank (MK583441 and MN369029). To confirm the pathogenicity, two-year-old potted plants of apple cv. Red Delicious main stems were inoculated by *Diplodia bulgarica* mycelia discs under glasshouse. The symptoms of canker on stem of the inoculated plants were similar to those observed in the field 30 days after inoculation. The same fungus was re-isolated from the inoculated plants. *Diplodia bulgarica* was earlier reported only from Iran causing canker disease in apple (Abdollahzadeh 2015), but to the best of our knowledge, this is the first report from India.

Compliance with ethical standards

Declaration of interest statement Authors declare that they have no conflict of interest.

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References

- Abdollahzadeh J (2015) *Diplodia bulgarica*, as a new pathogen and potential threat to the apple industry in Iran. *Phytopathol Mediterr* 54(1):128–132
- Phillips AJ, Lopes J, Abdollahzadeh J, Bobev S, Alves A (2012) Resolving the *Diplodia* complex on apple and other Rosaceae hosts. *Persoonia*. 29:29–38
- Quaglia M, Moretti C, Buonauro R (2014) Molecular characterization of *Diplodia seriata*, a new pathogen of *Prunus laurocerasus* in Italy. *Phytoparasitica*. 42:189–197
- White TJ, Bruns T, Taylor J (1990) PCR protocols: a guide to methods and applications. Academic Press, San Diego

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