Scientia Horticulturae 211 (2016) 126–139

Contents lists available at ScienceDirect

Scientia Horticulturae

journal homepage: www.elsevier.com/locate/scihorti

Review

Major diseases of pomegranate (*Punica granatum* L.), their causes and management—A review

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ARTICLE INFO

Article history:
Received 15 June 2016
Received in revised form 5 August 2016
Accepted 23 August 2016
Available online 29 August 2016

Keywords:
Diseases
Fruit quality
Biopesticides
Postharvest management
Punica granatum

ABSTRACT

Pomegranate (*Punica granatum L.*) diseases often caused by a range of fungi and bacteria, pose direct significant financial, nutritional and postharvest loses along the value chain. Common postharvest pathogens of pomegranate fruit include *Botrytis cinerea, Alternaria alternata, Penicillium implicatum, Coniella granati* and *Aspergillus niger*. A major bacterial disease of pomegranate is bacterial blight caused by *Xanthomonas axanopodis pv. punicae*. Field application of fungicides is necessary to control pathogens, which infect the fruit during developmental stages. Additionally, postharvest fungicides could be used to control localised infections in the fruit tissue or to prevent new infections during postharvest handling processes and storage. However, global trends towards reducing application of chemical fungicides are growing, with the demand for 'green' and cost effective strategies. This review discusses the details of various pomegranate postharvest diseases, symptoms and their causative microorganism. The importance and types of disease control and management strategies for pomegranate fruit and fruit tree are critically evaluated. This review will provide a critical guide to all the role players along the pomegranate value chain.

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http://dx.doi.org/10.1016/j.scienta.2016.08.016
0304-4238/

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1. Introduction

Long term storage of pomegranate fruit is compromised by pathogens that cause postharvest rots and decay. Pomegranates are predisposed to attack from various pathogens at pre- and/or postharvest stage, which has a significant impact on fruit quality and storage life. These pathogens often cause damage to the tissues, thereby making the fruit unsaleable. A significant portion of pomegranate pre- and postharvest losses is attributed to diseases associated with various bacterial and fungal species (Tziros and Tzavella-Klonari, 2008; Mondal et al., 2012). Additionally, commercial marketability of pomegranate fruit is further limited by physiological disorders like rind cracking, chilling injury, husk scald, and excessive weight loss (Caleb et al., 2012).

Postharvest handling practices also have detrimental influence on the overall quality and shelf life of pomegranate fruit. In India, inadequate packaging and storage facilities cause pomegranate losses of about 25–38% annually (Murthy et al., 2009; Sudharshan and Nadu, 2013). The unavailability of fruit due to postharvest losses affects both the producers and consumers. Postharvest fruit losses impede on the producers potential to maintain and grow their market share; i.e. to retain a competitive edge this often leads to financial losses and price hikes (Hess-pierce and Kader, 2003; Defilippi et al., 2006; Petersen et al., 2010). For the consumers losses cause reduced availability and higher prices due to increased cost of production of fruit that never reaches the consumer, as well as higher unit costs of fruit marketing and transportation. The losses also limit the retention and extension of the nutritional quality of the produce (Kerch, 2015). Fungal infections in pomegranate can spread across nested fruit during cold storage (Northover and Zhou, 2002; Palou and Del Río, 2009). Therefore, evaluating the incidence and impact of diseases is a crucial factor towards developing effective and sustainable management strategies.

Fruit disease refers to a combination of several disorders that result from the infection of plant material and manifest in various external and internal symptoms. These diseases are of three general types: fruit surface rots, internal fruit infections and stem end rots (Ammar and El-Naggar, 2014). Fruit infections occur in all producing areas and can cause serious yield losses. Postharvest losses of 10–25% from disease infections are common (Palou et al., 2013; Thomidis, 2014). Severe disease outbreaks can wipe out an entire orchard or fruit consignment in a short space of time (Petersen et al., 2010; Day and Wilkins, 2011).

There are different pathways through which pathogens infect pomegranate fruit, these include flowers (via the petals, stigmas, styles, or stamens); on fruit through stigmata, pedicels, wounds (due to insect exit holes, bird pecks, thorn punctures, and natural cracking); or directly through the cuticle (Thomidis, 2014). The disease infections can spread by cross contamination between infected and healthy fruit packed together (Badawy and Rabea, 2009). Diseases typically associated with pomegranate postharvest storage losses, are often overlooked due to the slow development and late symptom expression by quiescent pathogens (Michailides et al., 2010). The pathogens invade the fruit during flowering stage. As fruit development progresses the incidence declines as some of the infected material probably dies off from the diseases, however some may remain latent until postharvest. In the absence of proper sanitation and hygiene, the diseases can rapidly spread, causing extensive fruit breakdown, and even spoiling an entire consignment (Day and Wilkins, 2011).