

Evaluation of Appropriate Carriers for Bio-control Agents of Apple Fire Blight

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ABSTRACT

Fire blight is a dangerous calamity for apple, pear and quince gardens. Bio-control is a good measure to control this calamity. Carrier has an important role in biocontrol for survival of microorganisms. The aim of this study was to evaluate different compounds as carriers for *Pseudomonas fluorescens* and *Erwinia herbicola* that are used as bio-control agents in Iran. Different compositions were prepared as carriers including peat, bagasse, bagasse-perlite and bagasse-charcoal. The carriers were sterilized and inoculated with bacteria at final concentration of 10^8 CFU/g approximately. Inoculated carriers were stored in room temperature at 4°C for 6 months. The viable bacteria and pH were measured in the carriers after inoculation and every 14 days, whether add or measure increments for six months. The carrier was found to be of a good composition that could significantly retain bacteria viable for 6 months. According to these criteria, all the formulae were suitable as carriers at 4°C . Bagasse was the best carrier at room temperature, because the numbers of bacteria were changed from 8.7×10^7 CFU/g after inoculation to 1.5×10^9 CFU/g after 6 months for *P. fluorescens* and from 2.53×10^8 CFU/g after inoculation to 1.13×10^8 CFU/g after 6 months for *E. herbicola*. The pH variation was not sensible in bagasse. The findings are suggestive for application of bagasse as a suitable carrier for its being nature friendly, cheap and availability in Iran.

Key words: Antagonistic effect, Carrier, *Erwinia herbicola*, Fire blight, *Pseudomonas fluorescence*.

INTRODUCTION

Fire blight is a destructive disease of apple, pear and woody ornamentals. The disease is caused by *Erwinia amylovora*. Fire blight is native to North America. It was first reported in 1780 on pear and quince in the Hudson Valley of New York. The name "fire blight" was derived from the characteristic blackening of vegetative tissue caused by the disease, often making trees appear as if they were burnt. The main type of disease control is based on chemical bactericides, such as copper derivative compounds or certain antibiotics, depending on the specific regulations of each country (Psallidass and Tsiantos, 2000). Nevertheless, the selection of strains resistant to antibiotics, the environmental impact of such substances and consumer concerns about pesticide residues in food have favored the development of alternative or complementary methods for disease management such as biological control (Wilson *et al.* 1992; Johnson and Stockwell, 1998; Albajes *et al.* 1999; Mathre, 1999 and Montesinos, 2003). Biological control against fire blight has been developed based on epiphytic bacteria (Wilson and Lindow, 1993). Some strains belonging to different bacterial species have shown their aptitude in preventive application such as *Pseudomonas fluorescens* (Wilson and Lindow, 1993, and Pujol *et al.* 2005), *Pantoea agglomerans* (Ishimaru, 1988

and Stockwell, 2002) or *Bacillus subtilis* QST 713 (Aldwinckle, 2002).

Biological control focuses on suppression of epiphytic growth phase of pathogen on blossoms prior to infection and endophytic growth (Johnson, 1993 and Mercie and Lindow, 2001). The earliest studies on biological suppression of fire blight with a bacterium was conducted in the 1930s with a "yellow pigmented" bacterium, which has since classified as *Pantoea agglomerans* (syn. *Erwinia herbicola*) (Beer and Rundle, 1983).

The fire blight is a very problematic phyto-disease in Iran. In our earlier study, two bacteria viz; *E. herbicola* and *P. fluorescence* with an antagonistic effect were isolated, from infected plants and these bacteria were used as biocontrol agents. Biocontrol agents are usually based on a carrier, a natural, synthetic or semi-synthetic material can persist bacteria for a long time without significant reduction in their number. Peat is a natural compound that is widely used as carrier in the world. Peat is not found in Iran, and ultimately other suitable compounds may be looked for as carrier.

Carrier composition has important role in bio-control agents and bio-fertilizers. Carrier is defined as a natural, synthetic or semi-synthetic material