



Introduction

1.0 INTRODUCTION

Stevia rebaudiana (Bertoni) is a natural herb, having enormous sweetening power and is safe for consumption. Stevia extract is acceptable and its use can be a boon to diabetics and weight looser (Mogra and Dashora, 2009). Stevia sweeteners have been increasingly popular over the last several years because of consumer demand for all natural foods and beverages especially for ones low in calories (Clos *et al.*, 2008).

Paraguayan chemist, Ovidio Rebaudi documented Stevia in early 1900's. In 1905, a botanist of same country Moises Bertoni gave the present name to the plant. For hundred of years, native Brazilians and Paraguayans have employed the leaves as a sweetening agents. Stevia extracts are used today as a non calorie sweetner (Sapna *et al.*, 2008).

Stevia is commonly known as sweet leaf or sugar leaf. It belongs to the family Asteraceae. It is a perennial shrub growing upto 1m tall. Stems are weak and semi-woody, it produces upward branches. The sessile leaves are oppositely arranged, lanceolate to oblanceolate and serrated above the middle. The flowers are small, white and arranged in indeterminate heads. The seed is an achene with a feathery pappus.

Extracts are up to 300 times sweeter than table sugar, which is attributed to the diterpenoid glycosides, stevioside and rebaudioside A. Many companies are now focusing on isolation of each of the individual diterpenoid glycosides, not just stevioside and rebaudioside A, for use in

products as a low calorie sugar alternative (Hoekstra and Schaneberg, 2007).

The Coca-Cola Company and Cargill foods have a patent pending for Rebiana, a zero-calorie sweetener derived from Stevia. In 2006, the World Health Organization (WHO) evaluated all the recent experimental data on Stevia and concluded that “stevioside and rebaudioside A are not genotoxic *in vitro* or *in vivo*” (<http://www.ianrpubs.unl.edu/epublic/pages/publicationD>). Market cost of dried Stevia leaves is Rs 80/kg.

Many researchers have demonstrated that Stevia may be used for different therapeutic effects such as hypoglycemic (Lailerd *et al.*, 2004 and Gregersen *et al.*, 2004) and hypotensive activity (Liu *et al.*, 2003). It is a potential source of natural antioxidants (Ghanta *et al.*, 2007). The chloroform and methanol extracts of *S. rebaudiana* leaves proved significant anti-inflammatory effect and caused marked inhibition of carrageenan induced paw oedema in rats (Ibrahim *et al.*, 2007). In addition, it has been used for patients suffering from obesity, heart diseases and dental caries (Kinghorn and Soejarto, 1985).

In India, the plant has been introduced in the states of Maharashtra, Tamil Nadu, Karnataka, Rajasthan and West Bengal. Stevia cultivation is limited by several factors and among these, fungal diseases play a major role. Few fungal diseases reported on *S. rebaudiana* include leaf spot caused by *Alternaria alternata* (Maiti *et al.*, 2007a), root rot caused by *Sclerotium rolfsii* (Kamalakannan *et al.*, 2006), *Septoria* leaf spot caused by *Septoria steviae* (Lovering and Reeleder, 1996) and black spot caused by *Alternaria steviae* (Ishiba *et al.*, 1982).

In agriculture, phytopathogenic fungi can cause plant diseases and much loss of crop yields. Pesticides are used to control plant diseases. However, agrochemical treatment causes environmental pollution and decreased diversity of non target organisms. Microorganisms as biological control agents have high potential to control plant pathogens and no effect on the environment or other non target organisms (Khamna *et al.*, 2009)

The use of synthetic chemicals has recently raised concerns due to their actual and potential impact on human health and ecosystem functioning. In this regard, certain studies have shown that some of the fungicides which are widely used in agriculture may potentially alter the normal development of human reproductive organs and can also reduce the populations of beneficial mycorrhiza (Brimner and Boland, 2003; Blystone *et al.*, 2007). To alleviate all these ill effects, environmentally safe, long lasting and eco-friendly, non chemical means are in need for effective plant disease management.

The biological control of plant diseases with bacterial antagonism is a potential alternative of chemical control, as it is safe, effective, economical and ecofriendly. Plant Growth Promoting Rhizobacteria (PGPR) especially *Pseudomonas fluorescens* and *Bacillus subtilis*, are promising candidates of biological control (Kamalakaran *et al.*, 2004; Thilagavathi *et al.*, 2007; Kavino *et al.*, 2007; Latha *et al.*, 2009). Induced systemic resistance (ISR) has been reported as one of the mechanism by which PGPR reduce plant disease (Saravanakumar *et al.*, 2007a; Domenech *et al.*, 2007).

Alternaria leaf spot is considered as the most serious leaf disease in Stevia growing areas which causes economic loss. As Stevia is a newly introduced crop, there are only few researches on the management of foliar diseases.

The present work was therefore formulated with specific objectives as follows:

- Collection and maintenance of antagonistic bacteria and fungal pathogen
- Screening of effective antagonistic bacteria against *A. alternata* under *in vitro* conditions
- Studying the mode of action of antagonists
- Evaluation of the efficacy of antagonists under green house conditions