Micropropagation of *Teucrium fruticans* L., an ornamental and medicinal plant

M. Frabetti · P. Gutiérrez-Pesce ·
E. Mendoza-de Gyves · E. Rugini

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Abstract An efficient protocol for *in vitro* propagation of the valuable ornamental and medicinal plant Bush germander (*Teucrium fruticans* L.) was developed through axillary shoot proliferation. A Murashige and Skoog agar medium supplemented with benzylaminopurine (6.6 μ M), α -naphthaleneacetic acid (0.053 μ M), and sucrose (3%) significantly improved the production of multiple shoots directly from nodal segment explants, resulting in an average of 2.8 shoots per segment with an average of 6.8 nodes per shoot that would be potential newly formed explants. The new shoots were developed without a marked decrease in the average height of the shoots. Shoots treated with 2.5 μ M indole-3-butyric acid showed the highest average root number (7.9) and the highest percentage of rooting (94%). Plantlets were hardened off and transferred to jiffy pots for acclimatization under greenhouse conditions, resulting in a 100% survival rate.

Keywords Acclimatization · Bioactive compounds · Bush Germander · Nodal segments · *In vitro* culture · Rooting

Introduction

Teucrium fruticans L. is a shrub native to the Mediterranean region known by the common name of bush germander. It is widely used as an ornamental plant due to the attractive contrast of its striking blue flowers with its evergreen

foliage, which is gray-green above and silver-white beneath (López et al. 2006). In addition, this species is valued for its medicinal properties in some parts of Central Italy, where the leaf infusion is used as a depurative and diuretic (Maccioni et al. 1997). Chemical studies on *T. fruticans* have also reported the presence of *neo*-clerodane diterpenoids, which are known for their antifeedant activity against insects. Indeed, the genus *Teucrium* has been reported as one of the richest sources of such products (Savona et al. 1978; Bruno et al. 1999; Coll and Tandrón 2004). Studies of *T. fruticans* have resulted in the identification and isolation of other metabolites, including flavonoids that have diverse beneficial biochemical and antioxidant effects (Kisiel et al. 2001), fatty acid esters (Fontana et al. 1999), and important essential oils such as β -myrcene, an important chemical used in the perfumery industry (Flamini et al. 2001).

Propagation through seeds or cuttings appear to be unsatisfactory for the commercial cultivation of *T. fruticans* because of poor germination, a high percentage of male sterility (Ojeda and Díez 1992), and a limitation to certain periods of the year when this species sprouts adequately (Frangi and Nicola 2004). The application of micropropagation for commercial-scale plant production has been well demonstrated in several plant species that contain potentially useful secondary metabolites. Many of these species have shown excellent *in vitro* performance in terms of the number of explants produced in a short period of time. The more plant material is produced, the greater the possibility to enhance the amount of these scarce compounds for extractive manipulations (Makunga et al. 2003; Nalawade et al. 2003; Okemo et al. 2003; Parveen et al. 2005; Osuna et al. 2006; Van Twembeke and Geelen 2006).

The present study presents a protocol for the *in vitro* shoot multiplication of *T. fruticans*, improving upon a

M. Frabetti · P. Gutiérrez-Pesce · E. Mendoza-de Gyves (✉) ·
E. Rugini
Dipartimento di Produzione Vegetale,
Università degli Studi della Tuscia,
via S.C. de Lellis,
01100 Viterbo, Italy
e-mail: mendoza@unitus.it