

Trichoderma in Brazil: history, research, commercialization and perspectives

Wagner Bettiol, Marcelo A.B. Morandi

Embrapa Environment, CP 69, 13820-000, Jaguariúna, SP, Brazil,

E-mail: bettiol@cnpma.embrapa.br; mmorandi@cnpma.embrapa.br

Abstract: In 1987, thirty-seven years since the first publication on biocontrol of plant diseases by *Trichoderma* in Brazil, a pioneer product arrived on the market against *Phytophthora cactorum* in apple trees. At that time, the biocontrol agent (BCA) used to be supplied in polypropylene bags containing 24 g of sorghum seeds colonized by *Trichoderma viride*. The first enterprise specialized in production and commercialization of *Trichoderma* started to operate in 1992. Since then, other products came out and nowadays there are more than ten commercial trademarks. In April 2008, we did a survey to check the state-of-the-art of the use of *Trichoderma* in Brazil and verified: (1) main species in the market are *T. asperellum*, *T. harzianum*, *T. stromaticum*, and *T. viride*; (2) pathogen targets include *Fusarium*, *Pythium*, *Rhizoctonia*, *Macrophomina*, *Sclerotinia*, *Sclerotium*, *Botrytis*, and *Crinipellis perniciosa*; (3) recommended crops are bean, soybean, cotton, tobacco, strawberry, tomato, onion, garlic, ornamentals, and cacao; (4) *Trichoderma* are mostly produced by solid fermentation on rice or millet grains (approximately 550 ton/year); and (5) formulations include wettable powder and granules, suspension concentrates, emulsion oil, grain+spores, and dry spores. The average cost of treatment, for example, against bean white-mold with *Trichoderma* is US\$ 54.00/ha while with fungicides is about US\$ 92.00/ha. The area treated with *Trichoderma* has highly increased during the last three years. The recent organization of a Brazilian Biocontrol Association and the enhancement of the legislation for registration and commercialization of BCAs are boosting the market, particularly for *Trichoderma* that is in frank expansion.

Key words: biological control, commercial products, plant diseases

Introduction

The first publication on biocontrol of plant diseases by *Trichoderma* in Brazil is dated to the 50's (Foster, 1950) and reported the inactivation of the tobacco mosaic virus (TMV) by *Trichoderma* sp. Culture filtrates of the antagonist caused up to 90% reduction in the infection capacity of the TMV, measured in number of local lesions on *Nicotiana glutinosa* half-leaf inoculations. Only in 1987, however, thirty-seven years since the first publication, a pioneer product against *Phytophthora cactorum* in apple trees arrived on the market (Valdebenito-Sanhueza, 1991). The biological control agent was designed to colonize the soil and protect the apple seedling following replant. At that time, the biocontrol agent (BCA) used to be supplied in polypropylene bags containing 24 g of sorghum seeds colonized by *T. viride*. In the years of 1989 and 1990, more than 50.000 units were produced by Embrapa (Brazilian Agricultural Research Corporation) and used in South Brazil.

The first private company specialized in mass production and commercialization of *Trichoderma* started to operate in 1992 in Sao Paulo State, southeast Brazil. Since then, several other companies launched new products and nowadays there are more than ten commercial trademarks in Brazilian market. *Trichoderma* is the most studied agent against plant pathogens in Brazil and in other countries of Latin America (Bettiol et al., 2008a).

During the IX Brazilian meeting about biological control of plant disease (Campinas, SP, November 6-9, 2007), 33% of the submitted abstracts were on the subject of *Trichoderma* as biocontrol agent (Bettiol et al., 2008b). The objective of this study was verifying the state-of-the-art of the use of *Trichoderma* against plant pathogens in Brazil.

Material and methods

In April, 2008 we did a survey to check the state-of-the-art of the use of *Trichoderma* in Brazil. A questionnaire was prepared and submitted to the companies that commercialize *Trichoderma* for biological control of plant diseases. Besides that, a literature survey was done in order to get historical information about the use of the biocontrol agent.

Results and discussion

The compiled results of the survey are presented hereinafter:

Companies:

- Number of companies that produce and commercialize *Trichoderma* in Brazil: 13;
- Number of companies that responded to the questionnaire: 8 (61.5%);
- The companies are restricted to six states, mainly in Southeast Brazil (Fig. 1)

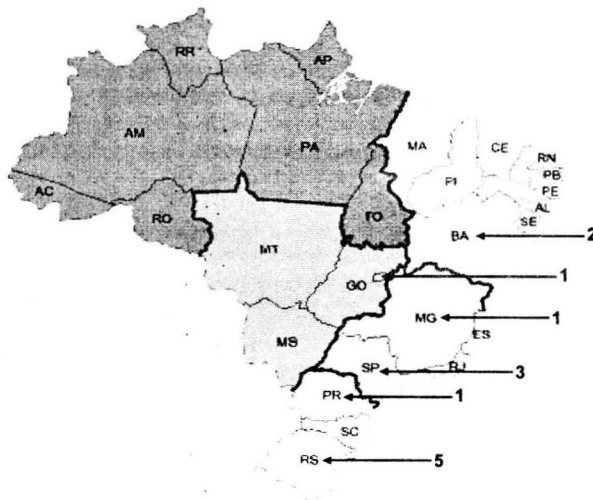


Fig. 1. Localization of companies that commercialize *Trichoderma* in Brazil

The main species of the biological control agent that have been commercialized in Brazil are *T. asperellum*, *T. harzianum*, *T. stromaticum*, and *T. viride*. The main pathogen targets of biocontrol are *Fusarium*, *Pythium*, *Rhizoctonia solani*, *Macrophomina phaseolina*, *Sclerotinia sclerotium*, *Sclectoium rolfsii*, *Botrytis cinerea*, and *Crinipellis pernicioso*. The recommended crops are bean, soybean, cotton, tobacco, strawberry, tomato, onion, garlic, ornamentals, and cacao. Besides that, several products are recommended for substrate treatment.

Mass production method is usually solid fermentation on rice or millet grains (approximately 550 ton/year). Formulations available on the market are WP (wetable powder), WG (wetable granules), SC (suspension concentrates), EC (emulsion oil); grain+spores, and dry conidia. Quality control methods applied are counts of conidia (minimum 1×10^8 conidia/g), germination (minimum 85%) and viability (minimum 8.5×10^7 cfu/g) tests.

The shelf-life of products ranges from 30 to 180 days at room temperature (about 26°C) and from 180 to 360 days at 4-6°C.

The average cost for treatment is US\$ 53.00/ha/application (ranging from US\$ 12.00 to US\$ 188.00).

The treated area with *Trichoderma* is increasing since the last three years. Environmental and cost concerns are the main reasons for the current expansion of the biological control market in Brazil. The average cost of treatment, for example, against bean white-mold with *Trichoderma* is US\$54.00/ha while with fungicides it is about US\$92.00/ha (Pomella, 2008).

The recent organization of a Brazilian Biocontrol Association (ABCbio) that occurred during the IX Brazilian meeting about biological control of plant disease and the enhancement of the legislation for registration and commercialization of BCAs are boosting the market, particularly for *Trichoderma* that is in frank expansion.

Acknowledgements

We thank the companies that collaborated with the survey and the FAPESP ('Fundação de Amparo à Pesquisa do Estado de São Paulo') for the financial support.

References

- Bettiol, W., Ghini, R., Morandi, M.A.B., Stadnik, M.J., Kraus, U., Stefanova, M. & Prado, A.M.C. 2008a: Controle biológico de doenças de plantas na América Latina. – In: Alves, S.B. & Lopes, R.B. (eds). Controle Microbiano de Pragas na América Latina – Avanços e Desafios: 303-331.
- Bettiol, W., Morandi, M.A.B., Ghini, R., Melo, I.S., Valarini, P.J. & Stefanova, M. 2008b: Anais da IX Reunião Brasileira sobre Controle Biológico de Doenças de Plantas. – Summa Phytopathol. 34: 156-203.
- Foster, R. 1950: Inativação do vírus do mosaico comum do fumo pelo filtrado de culturas de *Trichoderma* sp. – Bragantia 10: 139-148.
- Pomella, A.W.V. 2008: A utilização do controle biológico para grandes culturas – a experiência do grupo Sementes Farroupilha. – Summa Phytopathol. 34: 195-196.
- Valdebenito-Sanhueza, R.M. 1991: Possibilidades do controle biológico de *Phytophthora* em macieira. – In: Bettiol, W. (ed.). Controle Biológico de Doenças de Plantas. EMBRAPA/CNPDA, Jaguariúna, Brazil: 303-305.