ARBORICULTURAL ABSTRACTS

INOCULUM OF ARBUSCULAR MYCORRHIZAL FUNGI FOR PRODUCTION SYSTEMS: SCIENCE MEETS BUSINESS

Silvio Gianinazzi and Miroslav Vosátka

The development of an industrial activity producing microbial inocula is a complex procedure that involves for companies not only the development of the necessary biotechnological know-how, but also the ability to respond to the specifically related legal, ethical, educational, and commercial requirements. At present, commercial arbuscular mycorrhizal (AM) inocula are produced in nursery plots, containers with different substrates and plants, aeroponic systems, or, more recently, in vitro. Different formulated products are available on the market, which creates the need for the establishment of standards for widely accepted quality control. Progress should be made towards registration procedures that stimulate the development of the mycorrhizal industry. Biotechnology science linked to this industrial activity needs to be reinforced, particularly with regards to (i) the development of molecular probes for monitoring arbuscular mycorrhizal inocula in the field, (ii) increasing knowledge on the ecophysiology of AM fungi in anthropogenically disturbed ecosystems and on the interactions of AM fungi with other rhizosphere microbes, and (iii) selection of new plant varieties with enhanced mycorrhizal traits and of AM fungi with new symbiotic traits. However, one of the main tasks for both producers and researchers is to raise awareness in the public about potentials of mycorrhizal technology for sustainable plant production and soil conservation. (Can. J. Bot. 2004. 82(8):1264–1271)

BIOLOGICAL EFFICACY OF GYPCHEK AGAINST A LOW-DENSITY, LEADING-EDGE GYPSY MOTH POPULATION

R.E. Webb, G.B. White, T. Sukontarak, J.D. Podgwaite, D. Schumacher, A. Diss, and R.C. Reardon

The USDA's Slow-the-Spread (STS) program seeks to retard the continued spread of the gypsy moth using ecologically desirable treatments such as Gypchek. At "trace" population levels, evaluation of treatment success by defoliation reduction, egg mass reduction, burlap counts, or larval collection is not feasible. We adapted the "bugs-in-bags" technique to evaluate an operational application of Gypchek against trace populations of gypsy moths in Wisconsin, an STS area. Late first- or early second-instar gypsy moth larvae were placed, 1 per bag or 10 per bag, in sleeve cages placed over treated foliage 1 hr post-treatment. Mortality observed for larvae placed 10 per bag was equivalent to that recorded for larvae placed 1 per bag, and both should approximate the mortality occurring to the larvae scattered in nature. A single application of Gypchek applied in 9.5 L of Carrier 038 at 10^{12} polyhedral inclusion bodies per hectacre was found to induce a higher rate of infection in blocks treated in the early morning than in blocks treated later in the morning, correlating significantly with a lowering of relative humidity and an increase in temperature and wind speed. Recorded levels of efficacy (24% to 67%) did not meet quarantine objectives; however, Gypchek, which kills only the gypsy moth, remains a product of choice by many land managers for use in certain environmentally sensitive areas. These results provide such land managers with a realistic assessment of the level of efficacy that can be expected from this formulation of Gypchek used at the currently recommended dose. (North. J. Appl. For. 2004. 21(3):144–149)

CARBON STORAGE BY URBAN TREE CULTIVARS, IN ROOTS AND ABOVE-GROUND

Andra D. Johnson and Henry D. Gerhold

Urban trees can favorably affect factors underlying global warming by storing carbon and by reducing energy needs for cooling and heating buildings. To estimate carbon stored in roots and aboveground portions of trees, data were collected consisting of whole tree sampling of *Amelanchier, Malus, Pyrus,* and *Syringa* cultivars. Roots were excavated using an Air-Spade®. Regression analysis resulted in two equations for predicting total carbon storage based on height and diameter of trees up to 20 cm dbh: $Y = 0.05836\ (\text{dbh}^2)$ for root carbon storage, and $Y = 0.0305\ (\text{dbh}^2 \times \text{h})^{0.9499}$ for aboveground carbon storage, explaining 97% and 96% of the variation, respectively. Average carbon stored in roots of various cultivars ranged from 0.3 to 1.0 kg for smaller trees, those 3.8 to 6.4 cm dbh, to more than 10.4 kg for trees 14 to 19.7 cm dbh. Average total carbon stored by cultivars ranged from 1.7 to 3.6 kg for trees less than 6.4 cm dbh to 54.5 kg for trees larger than 14 cm. The data from these equations apply mainly to trees in nurseries and recently transplanted trees. Comparisons showed that aboveground estimates from previous studies using a sampling technique overestimated values obtained from actual above-ground weights. (Urban For. Urban Green. 2003. 2:065–072)

NICHES IN THE URBAN FOREST: ORGANIZATIONS AND THEIR ROLE IN ACQUIRING METROPOLITAN OPEN SPACE

Jane A. Ruliffson, P. H. Gobster, R.G. Haight, and Francis R. Homans

As a response strategy to minimize the impacts of urban sprawl, public and private organizations are striving to acquire open lands that will contribute to a resilient and multifunctional urban forest. In the Chicago metropolitan region, we interviewed representatives of 15 organizations to understand the land acquisition process—the structures and functions of groups involved, their acquisition goals, and the cooperation among groups as they work to build metropolitan green infrastructure. Our findings reveal strength in diversity—a variety of groups working at different levels with complementary goals can help meet the complex challenges of land protection in rapidly urbanizing areas. J. For. 2002. 100(6):16–23)

THE EVOLUTIONARY IMPLICATIONS OF EXPLOITATION IN MYCORRHIZAS

Keith N. Egger and David S. Hibbett

Some views of mutualism, where the fitness of two symbiotic partners is higher in association than when apart, assume that they necessarily evolve toward greater benefit for the partners. Most mutualisms, however, seem prone to conflicts of interest that destabilize the partnership. These conflicts arise in part because mutualistic outcomes are conditional, depending upon complex interactions between environmental, developmental, and genotypic factors. Mutualisms are also subject to exploitation or cheating. Although various compensating mechanisms have been proposed to explain how mutualism can be maintained in the presence of exploiters, none of these mechanisms can eliminate exploitation. In this paper we explore various compensating mechanisms in mycorrhizas, examine the evidence for exploitation in mycorrhizas, and conclude that mycorrhizal mutualisms exhibit characteristics that are more consistent with a concept of reciprocal parasitism. We propose that researchers should not assume mycorrhizas are mutualistic based upon structural characteristics or limited functional studies showing bilateral exchange and should view mycorrhizas as occupying a wider range on the symbiotic continuum, including commensalism and antagonism. We recommend that comparative studies of mycorrhizas incorporate other types of root associations that have traditionally been considered antagonistic. (Can. J. Bot. 2004. 82(8):1110–1121)

HOST PLANT QUALITY AND FECUNDITY IN HERBIVOROUS INSECTS

Caroline S. Awmack and Simon R. Leather

Host plant quality is a key determinant of the fecundity of herbivorous insects. Components of host plant quality (such as carbon, nitrogen, and defensive metabolites) directly affect potential and achieved herbivore fecundity. The responses of insect herbivores to changes in host plant quality vary within and between feeding guilds. Host plant quality also affects insect reproductive strategies: Egg size and quality, the allocation of resources to eggs, and the choice of oviposition sites may all be influenced by plant quality, as may egg or embryo resorption on poor-quality hosts. Many insect herbivores change the quality of their host plants, affecting both inter- and intraspecific interactions. Higher-trophic level interactions, such as the performance of predators and parasitoids, may also be affected by host plant quality. We conclude that host plant quality affects the fecundity of herbivorous insects at both the individual and the population scale. (Annu. Rev. Entomol. 2003. 48:505–519)