

P 4: *Ex situ* regeneration of cross-pollinated MAP genetic resources in the Czech Republic



Karel Dušek, Elena Dušková, Kateřina Smékalová

Department of Genetic Resources for Vegetables, Medicinal and Special Plants, Centre of the Region Haná for Biotechnological and Agricultural Research, Crop Research Institute, Šlechtitelů 29, Olomouc, 78371, Czech Republic, e-mail: Smekalova@genobanka.cz (corresponding author)

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Abstract

The multiplication and/or regeneration of germplasm of medicinal and aromatic plants (MAPs) is financially demanding, it requires space, time and well educated experienced staff. It is a group with very different demands on the cultivation and propagation. Many of these species are cross-pollinated and entomophilous, in some of them still remain some attributes of wild plants, other species produce compounds, which may cause skin and other problems in humans. Perennial species produce small amounts of seed and their germination capacity is mostly lower in comparison with other crops. The two types of technical solving of multiplication and/or regeneration of genetic resources of allogamous medicinal and aromatic plants in Olomouc, where both stationary and mobile isolation cages are used, are presented in this manuscript.

Keywords: multiplication, technical isolation, isolation cage, mesh house, controlled pollination

Introduction

Ex situ collections of plant genetic resources consist of seed genebanks, field genebanks and *in vitro* collections. Species with orthodox seeds are stored in seed genebanks, while the latter two methods are used mainly for vegetatively propagated crops and for species with recalcitrant seeds that cannot be dried and stored for long periods under cold conditions. Seed storage is the predominant form of plant genetic resources conservation, accounting for about 90 % of the total accessions held *ex situ* (FAO, 1996). Effective regeneration programmes are essential to maintain the viability and genetic integrity of *ex situ* seed collections of germplasm. 100 % germination rate and zero genetic change on regeneration both represent the ideal but neither of them is achievable (HAMILTON and CHORLTON, 1997).

The type of reproduction of the targeted species will determine regeneration conditions. An autogamous species can be multiplied and/or regenerated in the field. Allogamous species are preferably multiplied and/or regenerated in the glasshouse, mesh house or also in the field, but the land must be isolated and pollination strictly controlled. If the accessions comprise wild species, they can be multiplied and/or regenerated in furrows or plots in the field, or in the mesh house or glasshouse, depending on the quantity of available seed and on the species' requirements (JARAMILLO and BAENA, 2002). The two types of technical solving of multiplication and/or regeneration of genetic resources of allogamous medicinal and aromatic plants in Olomouc are presented in this manuscript.

Materials and Methods

Multiplication and/or regeneration of genetic resources of allogamous medicinal and aromatic plants in Olomouc is carried out by two basic ways depending on persistence and/or pedigree status of accessions:

- Annual and/or culture/cultivated species (e.g. *Anethum graveolens* L., *Borago officinalis* L., *Calendula* L., *Cnicus benedictus* L., *Coriandrum sativum* L., *Foeniculum vulgare* Mill., *Malva* L., *Ocimum basilicum* L., *Oenothera biennis* L., *Origanum majorana* L., *Nigella sativa* L., *Satureja hortensis* L., *Silybum marianum* (L.) Gaertn. etc.)
- Perennial and/or wild species (e.g. *Agrimonia* Tourn. ex L., *Carum carvi* L., *Echinacea* Moench, *Hypericum* L., *Hyssopus officinalis* L., *Inula helenium* L., *Lavandula angustifolia* Mill., *Origanum*

vulgare L., *Polemonium caeruleum* L., *Ruta graveolens* L., *Salvia* spp., L., *Satureja montana* L., *Stachys officinalis* L. etc.)

Annual and/or culture/cultivated species are regenerated and/or multiplied in stabile isolation cages (mesh houses). Stationary isolation cage (Fig. 1) have a dimension 5.15 x 2.85 m and height 1.50 – 2.00 m and its construction is made from profile 7 30/30/3 mm and closed profile (jäckel) 40/20/2 mm. Galvanized cage constructions are fix anchored on concrete socle and covered up with net hood before sowing or planting. Each stabile isolation cage is equipped by the drop irrigation installation directly to the plants.

Perennial and/or wild species of MAPs are regenerated and/or multiplied in mobile isolation cages (Fig. 2). These mobile isolation cages have a dimension 2.00 x 3.00 x 1.70 m and they are constructed from closed profile (jäckel) 40/20/2 mm (roof part) and 3/4" tube with strength 2 mm. These isolation cages consist of demountable metal construction covered with the net hood which equipped with a wooden frame for its anchorage. Polyamide monofil textile is used to make the parts of isolation cages (the type No. 737968, vilament diameter 0.3 mm, mesh 0.6 – 0.8 mm, manufactured by TECHNOLEN, technical textile Ltd., Lomnice nad Popelkou).

Both types of isolation cages are equipped with incomplete honey-bee colonies (*Apis mellifera* L.) or bumble-bee (*Bombus terrestris* L., *Bombus lapidaries* L.) nests for plant pollination (DUŠEK et al., 2010).

Results

The regeneration of medicinal and aromatic plants is complicated by several factors. It is a category with very different demands on the cultivation and propagation. Many of these species are crosspollinated and entomophilous, in some of them still remain some attributes of wild species (e.g. covering by spines, which is typical for milk thistle, spiny rest harrow), other species produce the compounds, which cause skin and other problems in humans (e.g. common rue). In addition, perennial species produce relatively small amounts of seed (FAO, 1996) and its germination capacity is significantly lower in comparison with other crops.

Despite these complications the regeneration and/or multiplication of medicinal plants is successful in Olomouc. Stationary isolation cages are suited to most of MAPs due to a better ventilation and temperature regulation inside the cage compare to the glassed-in stationary cages, which are used for regeneration and/or multiplication of vegetable species in Olomouc. However, in rainy weather the plant stand inside the mesh cage is more subject to a pathogen damage, mainly to fungal diseases.

The isolation due to mobile isolation cages is suitable for field stands, especially for biennial and perennial cultures. When using portable isolation cages good results were observed mainly in regeneration of lavender, thyme, caraway, biennial coriander, digitalis, mallow, common rue, biennial as well as perennial savory etc. The advantage of this system is that the plants are isolated only for as long as the term of flowering and during the rest of the vegetation period they can grow in the conditions of the natural climate uncovered. Also the basic agronomic interventions (inter-row cultivation, pruning etc.) are possible to perform mechanized way before installation of isolation cages or after their removing. In addition to the simple installation there is also an advantage of possible multiple use of the constructions in the course of vegetation period when successive flowering of various plant species takes place from April until July. The folding construction allows an easy dismantling of vertical parts which helps for easy storage in non-flowering period.

The multiplication and/or regeneration of germplasm in both the stabile and/or mobile isolation cages is financially demanding, it requires technical equipment, time and well educated and experienced staff. Compare to the formerly used system, based on space isolation, it save the space and in case of regeneration of species which widely growing relatives could overcross the target genotypes, it is the only way to success.



Fig. 1 Stationary isolation cages



Fig. 2 Mobile isolation cages

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