European plum was, and it will continue to be, an important temperate fruit species for Romanian growers. It is difficult for Romanian rootstock breeders to release a new rootstock with large acceptance in plum industry, for multiple reasons, out of which the most important one is the easiness for nurseries to use local myrabalan biotypes (spread all over the country), in obtaining seedlings to be grafted. But one of the important reason to look more attentively at the rootstock, it is the fact that majority of released Romanian plum cultivars having like female parent ‘Tuleu gras’ cv. has low compatibility when grafted on myrabalan seedlings. Of course, like all over the world, Plum pox virus is a permanent threat also and for Romanian growers. In the 1999 year, RIFG Pitesti released two plum rootstocks, selected from myrabalan (Prunus cerasifera Ehrh.) native flora, Mirobolan C5 and Mirobolan dwarf, to be used like seed source for seedlings (generative rootstocks). Mirobolan C5 has a high vigor and was intended for heavy soils (a lot in Romania), replanting sites, or for plum orchards to be mechanically harvested. Mirobolan dwarf has a low vigor and was intended for intensive orchards with cultivars for fresh marketing. Both rootstocks can be clonally propagated by cuttings but, there is a problem with Mirobolan dwarf establishment in the nursery field given to abundant coming into blossoming of the cuttings. A more recently released vegetative rootstock for peach, Adaptabil (2000 year), but polyvalent, began to be used successfully for grafting plum varieties other than those derived from Tuleu gras or Reine Claude parental lines. Adaptabil is very easy to be propagated by softwood cuttings, has a medium to low vigor (female parent is Prunus besseyi Bailey), and is resistant to Plum pox virus. Three advanced plum selections: Redutabil (Adaptabil x Prunus cerasifera pisardii), Mirodad 1 and Mirodad 2 (both from Adaptabil x Mirobolan dwarf crosses), with improved grafting compatibility versus Tuleu gras and Reine Claude offspring’s, are very promising clonally propagated rootstocks for future intensive orchards.

**Key words:** Prunus, rootstock, cuttings, compatibility

**Cuvinte cheie:** Prunus, portaltoi, butaşi, compatibilitate

1. Introduction

Plum is one major temperate species grown on Romania’s territory. Majority of existing plum orchards has planting densities around 500 trees/ha. The main used rootstock to graft plum varieties in the nurseries is myrabalan seedling, from native biotypes, even if there were introduced some clonally sources for seed. The first plum rootstock vegetative propagated by cuttings was released in 1978 by Research Station for Fruit Growing Geoagiu: Corcodus (myrabalan for English) 163 (Casavela, 1979). This rootstock, like many others, was not extended on commercial scale propagation because of poor technical facilities in the Romanian nurseries. Research Institute for Fruit Growing (RIFG) Pitesti, released its rootstocks in 1999 (Mirobolan C5 and Mirobolan dwarf), like generative rootstocks (parent plants for seed source). Both rootstocks responded positively to clonally propagation by cuttings (Dutu,1999).

Adaptabil rootstock, released for peach in 2000 year, proved to be a polyvalent one regarding its grafting compatibility, accordingly being tested for European plum and apricot cultivars. Another 3 selections resulted from breeding program were obtained, by crosses where Adaptabil was used like female parent. They seem to be promising for future intensive orchards.

2. Material and methods

Having in the view the richness of the wild myrabalan native flora in Romania was absolutely normally for breeders to focus their aims in that direction. Sonea (1957) mentioned that in 1957 year there were over 3 millions individual myrabalan biotypes all over Romanian territory.
In 1978 was selected from Cluj county a myrabalan with dwarfing habit, called for study like CPC (an abbreviation from Romanian for *corcodus pitic de Cluj*). It was studied at RIFG Pitesti for 21 consecutive years and released in 1999 under the name of *Mirobolan dwarf*.

Another direction for rootstock aims was based on positive clonally selection upon millions of myrabalan seedlings grown in Romanian nurseries in 1970\(^3\). one of the individuals selected at RIFG Pitesti in 1977 year was coded for study like C5 (it was number 5 out of 18 individuals selected and quoted from 1 to 18). After 22 consecutive years of study it was released like *Mirobolan C5*, in the same year (1999) as Mirobolan dwarf.

In 1983 we obtained a diploid selection coded for study like B83/1, by an "half – free open pollination" of *Prunus besseyi* (female parent) with mixed pollen collected from 4 species: *Prunus armeniaca, Prunus cerasifera, Prunus domestica* and *Prunus persica* (Dutu,1998). B83/1 was one out of 9 hybrid plants selected from the bulk material.

In 2000 year B83/1 was named *Adaptabil* and released as first Romanian vegetative rootstock for peach.

Adaptabil was, and it is a genitor used in diverse crossings aiming to obtain progenies with improved grafting compatibility versus all European plum cultivars. Crosses of Adaptabil (female plant) with *Prunus cerasifera var. pisardii* and Mirobolan dwarf (both of them male parents) conducted to selection of 3 valuable hybrids from 1988 year crosses (Redutabil) and from those of 1992 year (Mirodad 1 and Mirodad 2).

### 3. Results and discussions

*Mirobolan C5* (Fig 1), has a high vigor, late blossoming, and very late ripening of the fruits (at the end of September). On its own roots does not give suckers, is resistant to waterlogging, and has a very good anchorage in the soil. The resistance to drought is medium.

- Fruits, of yellow light color, are small (4.2-4.3 g), with 16-17% dry mater at complete ripening. The stone cling to the pulp and is 8.3% from fruit weight. One kilo of stones has 2,860 pieces.
- The yield in the 4\(^{th}\) year after establishment in plantation is 37 kg/tree.
- The stones spring very well in the nursery bed (84%) and give uniform seedlings, resistant to foliar diseases. The harvested seedlings in the autumn give a yield of 600,000 pieces / ha (at a space between the rows of 90 cm).

*Mirobolan C5* gives good results at vegetative propagation by cuttings, both by hardwood (74%) and softwood (90%) cuttings.

*Mirobolan C5* has a good compatibility when grafted with peaches cultivars (not and with nectarines), especially when vegetative propagated.

In the orchard, as a rootstock for plum varieties should be planted at a minimum distance of 5x 4 m (500 trees/ha), and recommended on heavy soils (rich in the clay), for mechanically harvesting of the trees.

The influence regarding the size of the fruit is good.

The profitable yields are obtained in the 5\(^{th}\) year after establishment in the orchard and full yields begin with the 6\(^{th}\) year at a rate of 20-25 t/ha, depending on the cultivar and agricultural practices.

*Mirobolan dwarf* (Fig 2), has a low vigor, at about less than 50% of that of Mirobolan C5. In the 9\(^{th}\) year the tree is maxim 2.5-2.8 m in height and 2-3 m in the canopy diameter.

On own roots the rootstock does not give suckers, has a good anchorage in the soil, but it is not resistant to prolonged drought (better results in irrigated orchards).

The coming into blossom is early, but there is in the second half an overlapping with beginning of Mirobolan C5 blossoming.

*Mirobolan dwarf* tree begin to bear fruits in the 2\(^{nd}\) year after establishment (about 0.5 kg/tree). Beginning with the 4\(^{th}\) year bearing is already abundant.

The fruit has a bright yellow color and ripen in the second half of August. At the full ripening fruit has about 16% dry mater, medium weight (6 g), with a stone of 8.8% from fruit weight. One kilo of stones has 1,923 pieces.

The stones spring pretty well in the nursery bed (68%) and give uniform seedlings, resistant to foliar diseases, and of lower size compared with Mirobolan C5 seedlings. One hectare of nursery bed, sowed at 90 cm between the rows in the bed, give a medium yield of 400,000-450,000 pieces.

*Mirobolan dwarf* can be vegetative propagated, especially by softwood cuttings, with a rooting percentage of the cuttings above 80. But, unfortunately the establishment of rooted cuttings in the nursery field is poor because of their abundant coming into blossom before the full contact of the roots with the soil. Therefore, we consider that is needed an extra year of fortification in a separate field, at high densities, before their use in the nursery field to be grafted.

*Mirobolan dwarf* is a good rootstock also for apricot cultivars, some congenital apricot cultivars excepted.
In the orchard, grafted with plum cultivars, may be planted at higher densities, between 600 and 1,200 trees/ha, depending on the cultivar (for example, Stanley cv. grafted on Mirobolan dwarf, vegetative propagated, can be planted at 4 x 2 m). Vegetative propagated this rootstock can be successfully used in high density plum orchards. According to density and agricultural practices the yield is around 20 t/ha, but it is possible to exceed.

Adaptabil (Fig 3), tested as a rootstock for plum varieties proved to be not compatible to cultivars pertaining Tuleu and Reine Claude groups.

This rootstock is very easy to be propagated by softwood cuttings (over 95% rooting), and has a good establishment in the nursery field even the cuttings come into abundant blossoming (like Mirobolan dwarf). But unlike Mirobolan dwarf, the very abundant roots of Adaptabil cuttings take full contact with the soil very quickly, and feeding of the plants is normal.

Adaptabil is waterlogging extremely resistant, but in infested soil with germs of *Agrobacterium tumefaciens* the infection of the roots is possible to happen.

Adaptabil is resistant to winter frost, but not in those springs when in March month the negative occurrence of the temperature at the soil level is under -10 -15°C for more than 2 days (is possible that Adaptabil, which is a diploid, to be a *Prunus bessey x Prunus persica* progeny, resulted from that mixed pollen: see material and method).

Redutabil (Fig 4) advanced selection is propagated by softwood cuttings, and has a good grafting compatibility with all plum cultivars tested, excepted for Romanian cultivar Centenar (Tuleu gras progeny). Its vigor is medium to low.

Mirodad 1 (Fig 5) advanced selection has phenotype likeness to male parent (Mirobolan dwarf), included yellow fruit color. It is acceptable propagated by softwood cuttings, and has a low vigor.

Mirodad 2 (Fig 6) advanced selection has an intermediary phenotype likeness to both female and male parent, red fruit color, and medium to low vigor. Its ability to vegetative propagation by softwood cuttings is better compared to Mirodad 1.

All the 3 advanced selection seem to be promising rootstocks for plum intensive orchards.

4. Conclusions

The rootstocks released at RIFG Pitesti have a wide range of usability, from high density plantings and up to orchards with trees to bi mechanically harvested (Mirobolan dwarf, vegetative propagated, is proper for high density plantings).

Adaptabil, released for peach cv. rootstock, needs further tests for large acceptance like a dwarfing rootstock for high density European plum cv. orchards.

Both, Adaptabil and Mirobolan dwarf, are valuable genitors to be used in breeding for future high density plum orchards rootstocks.

5. References

Figures

Fig 1. Mirobolan C5 fruits

Fig 2. Mirobolan dwarf, for seed source

Fig 3. Adaptabil, plants for cuttings
Fig 5. Mirodad 1 (Adaptabil x Mirobolan dwarf)

Fig 6. Mirodad 2 (Adaptabil x Mirobolan dwarf)