SUMMARY

Key words: hybrid elites, fruits, quality, physical and chemical attributes, pollen, autofertility, hybridization.

The researches taken for the Thesis preparation had as aim the study to obtain within SCDP Iaşi, new qualitative competitive cherry cultivars, with genetic resistance to diseases, pests, stress factors (drought, frost), reduced vigour of the trees and superior quality fruits in terms of commerce, technology and chemical attributes, with ripening ages at the extremities of the cherry ripening season, for which have been established the further **objectives**:

- The study of the hybrid elites in comparative microcrops next to a witness.
- The promotion of the most valuable hybrid elites by registering them for homologation at ISTIS Bucharest.
- The release on the market of the most valuable creations, qualitative competitive with increased resistance to biotic and abiotic factors.
- The elaboration of some recommendations concerning the use of the cultivars studied for further researches and for production.

This study targets the improvement of the cherry assortment for the N-E of Romania by promoting the new cultivars created at SCDP Iaşi.

The PhD thesis with the title „Research concerning the obtaining of new cherry cultivars within S.C.D.P. Iaşi" has the next structure: introduction, seven chapters, bibliographic references and annexes.

The work is structured in two parts that include 85 tables and 49 figures.

The first part, entitled **„The current stage of the research concerning the cherry crop worldwide and in Romania"**, contains three chapters.

The first chapter, entitled „The importance and the economy of the cherry crop", contains two subchapters in which there are described the nutritional value of the cherries, a short history and the current position of the cherry crop.

The second chapter, entitled „The cherry breeding program", contains five subchapters in which there are presented:

• the importance of collecting, of study and of using the germplasm sources for cherry assortment breeding;

• the origin, the genetic diversity and the gene sources for cherry breeding;

• citogenetic and biological particularities of the *Prunus avium* species;

• programs, objectives and cherry breeding methods;

• aspects concerning the transmission in descending $F_1 - F_n$ of some characters and attributes.

The third chapter, entitled „The current stage of the achievements in the cherry breeding domain", contains two subchapters, where are presented results obtained in the cherry assortment breeding domain worldwide, in Romania and at SCDP Iaşi.

The second part of the PhD thesis is entitled **„Own contributions concerning the obtaining of new cherry cultivars"** and it contains four chapters.

In the fourth chapter, entitled **„The natural, organizational and institutional environment where the research took place",** there are listed the geographical settlement, the relief, the hidrology, the soil, the agro-climatic characterization and the institutional environment of the Research and Development Station for Pomiculture Iaşi.

In the fifth chapter, entitled „**The aim, objectives, biological material and the research method"**, there are four subchapters, where are presented the aim and the research objectives, the used biological material, the research method and the documentation preparation for homologation.

In the sixth chapter, entitled **"The research results",** there are presented the own data obtained (in 2011-2013) and their statistical interpretation, structured on four subchapters.

In the 6.1. subchapter there are presented the results concerning **the behavior in competition crops of the new cherry cultivars obtained at SCDP Iaşi,** namely the growing vigour of the trees, the cherry cultivars resistance at the limiting factors of the production, the growing and fructification phenophases, the production and the fruits quality (the physical and biochemical attributes).

Following **the growing vigour of the trees,** the studied cultivars can be included in two vigour groups: middle vigour cultivars and low vigour cultivars, all the cherry cultivars being suitable for intensive plantings (500-600 trees/ha).

The cherry trees resistance to frost is a complex polifactorial attribute, that varies depending on species and cultivar, but also depending on the interaction between the genotype and the environment conditions. In the winter of 2012 there were registered the lowest values from the last fifty years; the minimum temperature of -24,3^{o}C in the air was registered on 12-th

of February, but on soil it got to -32°C. The extended time of these extremely low temperatures made some of the cherry cultivars suffer. In these conditions, the extent of damage for the flowering buds of the 24 cherry cultivars created at SCDP Iaşi varied in relatively low limits, between 1,0 % - 28,0 %, the most affected by frost cultivars being *Alex* with 28% and *Marina* with 24%.

Because 2013 was a rainy year (in the first 6 months of the year there were accumulated 446,5 mm), a favorable year for the pests evolution, especially monilioza and anthracnose, all the studied cultivars manifested a slight sensitivity to *Coccomyces hiemalis* and *monilioza* attack.

In Iaşi area conditions, ***the cherry flowering*** takes place in the II-III decade of April and it lasts on average for 6-13 days. The cultivars *Cetăţuia* and *Cătălina* manifested an early flowering and the cultivars *Margo, Alex and Anda* manifested a late flowering. ***The maturation age*** of the fruits begins from the III-rd decade of May with the cultivars *Cetăţuia* and *Cătălina* and it ends in the first decade of July with the cultivars *Marina* and *George*. The average number of days from the end of the flowering to the harvesting maturity was between 31-33 days for the early cherry cultivars (*Cetăţuia, Cătălina*), between 40-50 days for the cherry cultivars with average maturity and over 50 days for the cherry cultivars with late and semi-late maturity (*George, Marina, Galata, Margo, Anda*). The vegetation period was between 201-217 days, in 2013, this period being shorter with 20-26 days compared to 2011 and 2012. The allocation of the fruits harvesting for the cherry cultivars studied in 2011-2013, guarantee a varietal conveyor on a period of 42-46 days.

Under the ***productivity*** aspect, there were noted by the average productions on 3 years (the XXII-XXIV years since planting) the cultivars: *Bucium* (34,1 kg/tree), *Marina* (31,1 kg/tree), *Radu* (31,1 kg/tree), *Iosif* (27,7 kg/tree), *Galata* (27,0 kg/tree), *Oana* (25,4 kg/tree), *Maria* (24,9 kg/tree), *Maxut* (23,9 kg/tree) and *Tereza* (22,0 kg/tree), recording positive differences compared to the regional witness *Boambe de Cotnari*.

Also, there were noted by the average productions on 3 years (the XII-XIV years since planting) the cultivars: *Margo* (30,9 kg/tree), *Ludovic* (19,9 kg/tree) and *Andrei* (17,7 kg/tree) recording positive differences compared to the cultivars average.

Under the aspect of ***fruits weight (g)*** and of ***equatorial diameter (mm),*** there were noted the next cultivars: *Alex* (9,6 g and 24,8 mm), *Ludovic* (8,8 g and 24,1 mm), *Andrei* (8,8 g and 23,9 mm), *Lucia* (8,4 g and 23,9 mm) recorded very significantly positive differences compared to the regional witness *Boambe de Cotnari, Cociu* (8,2 g and 23,9 mm), *Paul* (8,0 g and 22,9 mm), *Bucium* (7,5 g and 23,1 mm), recorded significantly positive differences compared to the

witness and *Maria, Tereza, Marina, Ştefan, Cătălina, Oana and Margo* recorded positive differences compared to the witness.

From the bitter cherry cultivars, the most valuable cultivar was *Galata* (3,7 g with 17 mm), which registered a positive difference compared to the witness cultivar *Amara.*

The fruits color was from yellow (*Anda, Margo*), double colored (*Marina, Galata, Paul*), shining red (*Maria, George*), dark red (*Bucium, Radu, Iosif, Oana, Lucia, Golia, Cetăţuia, Cătălina, Tereza, Ştefan, Iaşirom, Ludovic, Alex, Mihai*) to black (*Maxut*).

The majority of the cherry cultivars presented a good resistance to the ***fruits cracking*** phenomenon, the registered values being between 0,3% (*Maxut*) and 16% (*Cetăţuia*).The cultivars: *Bucium* (34%), *Ştefan* (23%) and *Marina* (19,3%) manifested a sensitivity to fruit cracking.

Concerning ***the revaluation destination***, the early cultivars fruits are destinated for fresh consumption (*Cetăţuia* and *Cătălina*), the bitter ones are destinated for industrialization (*Maxut* and *Galata*) and the cultivars with average and late maturation are destinated both for fresh consumption and for industrialization.

The most apreciated cultivars concerning ***the sugar/acidity ratio*** were *Andrei, Radu, George, Alex, Iaşirom, Mihai, Ludovic, Anda, Ştefan, Maxut, Paul, Maria, Lucia, Margo, Cetăţuia, Golia, Tereza, Iosif, Oana, Bucium* and *Cociu*.

Among the studied genotypes there were noted 12 ones with a very high content of polyphenols (*Maxut, Iaşirom, Cociu, Mihai, Cătălina, Ştefan, Lucia, George, Maria, Cetăţuia, Alex* şi *Anda*).

In the 6.2 subchapter there are presented the results concerning **the artificial hybridization for cherry**, namely the evaluation of the viability and of the pollen germination capacity, the cherry cultivars and the cherry hybrid elites fertility, the setting of the best pollinator and the artificial hybridization.

In 2011-2013, for the studied cultivars, ***the pollen viability*** recorded values between 70,62% (*Golia*) and 95,73% (*Maxut*), for the cherry hybrid elites, the values of this index varied between 95% (*HC. 872509*) and 99,32% (*HC. 841703-2*), registering a small variation coefficient. All the cherry cultivars and the hybrid elites can be used from this point of view as genitors in artificial hybridization works.

In the same period, appreciating ***the germination capacity***, 15 cultivars and hybrid elites from the 33 that have been taken in study, registered values above 40% (*Cetăţuia, Maria, Ştefan, Radu, Oana, Paul, Galata, Lucia, Andrei, Margo, Alex, Mihai, Ludovic, HC. 871102, HC. 871304*), a percent considered by some authors (Cheung, 1996; Sharafi & Bahmani, 2010)

as a satisfactory one for a normal fructification for the cherry species and they can be utilized as potential genitors in breeding works.

Concerning the studied cherry cultivars and hybrid elites fertility indexes, there can be distinguished three groups (the average of 2011-2013): ***self-fertile*** (*Maria* with 52 %); ***partially self-fertile*** (the registered values were between 1,9 % for *HC. 841703-2 and 12,6% for Marina);* ***self-sterile*** (*Cociu*).

According to ***the behaviour in the pollination-fertilization process*** of the cherry cultivars created at SCDP Iaşi and to the setting of the best pollinators, there are recommended the interfertile groups that registered values of above 20% resulted fruits. The highest values have been registered by: the *Margo* cultivar with the pollinator cultivars *Cociu, Anda, Iosif, Mihai;* the *Paul* cultivar with the pollinator cultivars *Ludovic, Iosif, Andrei*; the *Tereza* cultivar with the pollinator cultivars *Maria, Cociu, Mihai, Andrei*; the *Maria* cultivar with the pollinator cultivars *Tereza, Bucium, Cociu*; the Bucium cultivar with the pollinator cultivar *Andrei* and the *Andrei* cultivar with the pollinator cultivars *Tereza, Maria, Bucium, Cociu, Mihai*.

The dossier with the required documentation was prepared to be registered for examination, in order ***to homologate four hybrid elites*** and to be handed in at I.S.T.I.S. Bucharest in December 2013 (*HC. R5.P10, HC. 841703-2, HC. 872509, HC. 885302*) and other five elites with homologation perspective are under observation (*HC. 871102, HC. 870501, HC. 871703, HC. 871304 , HC. 920402*).

The new cherry cultivars, created at SCDP Iaşi, got remarked by extra-earliness (*Cetăţuia*), earliness (*Cătălina*), self-fertility (*Maria*), low vigour (*Ştefan, Lucia, Iaşirom, Golia, Tereza*) productivity, fruits particular quality (*Bucium, Radu, Cociu, Ludovic, Anda, Alex, Margo, Paul, Iosif, Andrei, Mihai*), tardiness (*Galata, Marina, George*) and the disponibility for industrialization (*Maxut, Galata*).

In the 6.3 subchapter there are presented the results concerning **the behaviour in competition microcrops of some cherry hybrid elites obtained at SCDP Iaşi**, namely the growing vigour of the trees, the ressistance of the cherry hybrid elites to production restrictive factors, the growing and the crop phenophases, the production and the fruits quality (physical and biochemical attributes).

According to ***the growing vigour of the trees***, the hybrid elites taken in study can be placed in two vigour groups: the hybrid elites of middle vigour and the hybrid elites with low vigour, all the cherry hybrid elites being adapted to intensive plantings (500-600 trees/ha).

The frost ressistance of the cherry trees is a trait that varies depending on the cultivar and on the interaction between genotype and environment conditions. In the conditions of the winter

from 2011-2012, the affecting degree of the flowering buds from nine cherry hybrids varied in relatively small limits, ranging between 0% at *HC. 841703-2* and 12% at *HC. 871703*.

2013 was a rainy year, an advantageous year for the pests evolution, especially monilioza and antrachnose; all the hybrid elites taken in study manifested ***a light sensitivity*** to *Coccomyces hiemalis* and the *monilioza* attack.

The hybrid elite *HC. R5.P10* manifested an early ***flowering*** and the elite *HC. 885302* manifested tardiness to flowering.

The maturation age of the fruits begins from the II-nd and III-rd decades of May (*HC. 871102, HC. 870501, HC. 871703, HC. 871304, HC. R5P10*), the II-nd decade of June for the elites with average maturation (*HC. 920402, HC. 872509, HC. 841703-2*) and it ends in the first decade of July with the elite *HC. 885302*.

The average number of days from the end of the flowering to the harvesting maturity was between ***26 - 39 days*** for the early hybrid elites (*HC. 871102, HC. 870501, HC. 871703, HC. 871304, HC. R5P10*) and ***after 50 days*** for the hybrid elites with middle and semi-late maturation (*HC. 841703-2, HC. 872509, HC. 920402, HC. 885302*).

Under ***the productivity*** aspect, there were remarked through the average productions on 3 years (the years XI-XIII since planting), the elites: *HC. 841703-2*, that realized an average production of 21,3 kg/tree (10,7 t/ha), *HC. 871304* with 18,8 kg/tree (9,4 t/ha), *HC. 885302* with 17,7 kg/tree (8,9 t/ha), *HC. 872509* with 17,4 kg/tree (8,7 t/ha) and *HC. 920402* with 17,2 kg/tree (8,6 t/ha), registering positive significant differences compared to the variants average.

Under ***the fruits weight (g)*** and ***equatorial diameter (mm)*** aspect, there were remarked the next hybrid elites: *HC. 872509(9,4 g) and HC. 885302 (9,1 g)* registered very significant positive differences compared to the regional witness *Boambe de Cotnari*, *HC. 841703-2 (8,9 g)* registered distinct positive significant differences compared to the witness and *HC. 920402 (7,8 g)* registered positive significant differences compared to the witness.

Also the ***bitter cherry*** hybrid elite, *HC. R5.P10 (4,8 g)* recorded distinct positive significant differences compared to the witness cultivar *Amara.*

Under the aspect of some fruits ***physical and organoleptic features***, all the hybrid elites have the fruit of a dark red colour, with short peduncle (between 2,9 – 4,2 cm) and sweet taste, exception being the elite *HC. R5.P10*, which has the fruit with bitter taste.

All the elites manifested a good ressistance to fruit crack: *HC. R5.P10* (0,3%), *HC. 841703-2* (2,7%), *HC. 872509* (3%), *HC. 871703* (3,7%), *HC. 871102* (5%), *HC. 920402* (7,3%) and *HC. 870501* (8,6%).

Concerning the ***revaluation destination***, the fruits of the early elites with sweet taste are destinated for fresh consumption (*HC. 871304, HC. 871102, HC. 870501, HC. 871703*), the bitter ones are destinated for industrialization (*HC. R5.P10*) and the cultivars with middle and semi-late maturation are destinated both for fresh consumption and industrialization.

The most appreciated cherry hybrid elites, concerning ***the sugar/acidity report*** were *HC. R5.P10, HC. 885302, HC. 841703-2, HC. 871703, HC. 870501* and *HC. 920402.*

Between the studied genotypes, there got remarked seven hybrid elites with a very high content of polyphenols (*HC. 872509, HC. 870501, HC. 841703-2, HC. 871304* and *HC. 871703, HC. R5.P10, HC. 885302*).

The cherry hybrid selections with homologation perspectives, created at SCDP Iaşi, got remarked through extra-earliness (*HC. 871102, HC. 871703, HC. R5.P10, HC. 870501, HC. 871304*), low vigour (*HC. R5. P10, HC. 870501, HC. 920402*), productivity, fruits particular quality (*HC. 920402, HC. 872509, HC. 841703-2*), tardiness (*HC. 885302*) and disponibility for industrialization (*HC. R5.P10*).

In the 6.4 subchapter there are presented results concerning **the preparing of the homologation documentation of some cherry cultivars (hybrid eltes) obtained at S.C.D.P. Iaşi.** There were registered the cherry elites *HC. R5.P10* (name proposed by *ALMARIS*), *HC. 872509* (name proposed *MOLDAVIA*), *HC. 841703-2* (name proposed by *ELAIAŞI*) and *HC. 885302* (name proposed by *ISCHERRY*).

In the conditions from Iaşi, the new cherry cultivars (hybrid elites) with fruit "of type Van" as aspect, got acceptable dimensions and organoleptic qualities (size between 22,6-24,5 mm, with the fruit average weight between 8,9-9,4 g, attractive colour and a high sugar/acidity report, properties that give them a very appreciated taste and a high acceptance from the consumers for a cultivar with average maturation, with equatorial diameter of 19,8 mm, with the fruit average weight of 4,8 g, attractive colour and a high sugar/acidity report for a bitter cultivar with early ripening), reason for the registering of the four selections for homologation.

The VII-th chapter of the PhD thesis, presents the conclussions and recomendations that resulted from the experimental data analysis.

The PhD thesis ends with the bibligraphical references that contain 210 books and scientifical works, both in country and abroad, with two annexes.