SUMMARY

RESEARCH ON THE BIOLOGY, PROPAGATION AND CULTURE OF SOME SPECIES AND PEONY CULTIVARS

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The peony, being one of the most cultivated flowers, since ancient times presents an important reason for the doctoral thesis that brings news about the in-depth knowledge of the origin of the herbaceous peony, the in-depth knowledge of biology, the in-depth knowledge and improvement of reproduction, the knowledge and improvement culture technology as well as the use of herbaceous peony in different fields.The present work proposed to study some aspects regarding the biology, propagation and culture technology of the herbaceous peony, but also aspects related to use as well as aspects regarding the importance, significance, uniqueness and value of the peony, bringing and offering new information to peony growers, landscapers and to the general public as an ornamental plant as well as to lovers of traditional culture.

The research undertaken is of current importance, because peonies have a significant importance, having a decorative purpose regarding the floral stems of the flowers, but also through the organization of the garden plot, providing clarifications on the peony culture.The researches presented and carried out in this paper were carried out in two locations, namely: within the University of Agricultural Sciences and Veterinary Medicine in Bucharest and in Singureni, Giurgiu county in their own garden during the years 2016-2019, with the following objectives:

- Research studies regarding different planting periods of the herbaceous peony;
- To analyze the growth and flowering phases of the peony;
- research on the propagation of the herbaceous peony;
- To analyze on the behavior of some species or cultivars in different culture technologies;
- requests regarding forcing to obtain flowers in the off-season (forcing in pots, solar, use of chemical products, thermal treatments);
- research studies regarding the duration of keeping flowers in pots;
- Expansion of the peony collection within the University of Agricultural Sciences and Veterinary Medicine Bucharest

The structure of the work includes 10 chapters, of which the first 2 chapters form part I - Bibliographic study and the remaining 8 chapters form part II - a - Own research. *Chapter 1* includes documentary studies on the origin of the peony, the biology and systematics of the peony, the assortment, the ecological requirements of the peony, culture technologies. *Chapter 2* includes research on the propagation of the herbaceous peony, both by classical first methods and by modern methods.

Part II - to include the research conducted in several experiments carried out in the two experiment locations.The locations of the research presents as well as the research material and methods. The experiments took place during the years 2016 - 2019 in two research locations: at U.S.A.M.V. Bucharest and in Singureni, Giurgiu county. The experimental material for the present research is composed of peony varieties from the peony flower garden of the university and from the varieties from one's own home as well as from the bringing

of new peony varieties. The research methods used are: biometric determinations, determinations and observations regarding the phases of growth and flowering of peony varieties during the vegetation period, but also on the planting material used during the 3 years of research.

Chapter 3 presents the experience regarding the influence of the planting season on the growth and flowering of some herbaceous peony varieties in the field.The experience was carried out in two locations, namely:

- At U.S.A.M.V.B in the research field of the floriculture laboratory as well as in the botanical garden of the university "ION TODOR";
- In the town of Singureni, Giurgiu county

The studies took place during two years of research, namely:

- In 2016/2017 at the U.S.A.M.V.B. and in the town of Singureni with research material from the peony collection of the university plus varieties from its own garden;
- In 2017/2018 at the U.S.A.M.V.B. and in the town of Singureni with research material from the peony flower garden of the university and the varieties from the native town plus the peony varieties procured.

The plants used in this experiment come from peony varieties from the peony collection of the university and from the varieties from our own garden as well as from the procurement of new peony varieties. The research material consists of the following peony varieties: *Festiva maxima, Dorren, Roz scented by Singureni, Pink Giant, Kansas, Miss America, Daydream, White Sarah, Raspberry Sundae*. Planting was carried out with plants from 3-4-year-old and 7-year-old bushes in the form of divided bushes and undivided bushes. The plantings took place in the fall of the 2016 and 2017 study years at U.S.A.M.V. Bucharest and in Singureni. Data being analyzed using biometric determinations and observations made during the years 2017 and 2018. As research methods, measurements were used biometrics and visual observations on the growth and flowering phenophases of herbaceous peony cultivars, during the 2 years of research.

Research shows that herbaceous peony varieties can be planted in a period other than August or September, thus increasing the peony planting period in the fall. These researches led to the following conclusions: a. The percentage of initiation into vegetation for all variants was over 50%, respectively 66.66% for the Festiva maxima cultivar up to 94% for the Pink giant cultivar from the U.S.A.M.V. Bucharest collection. b. The percentage of shoots is the same as the percentage of initiation into vegetation. c. The percentage of floral shoots in two variants were below 50%, respectively in the Pink giant cultivar from the university collection with 29.78% and 22.85%, and the rest of the variants above 50%, starting with the Dorren variety, having 53.19 % to 88.05% in the Kansas cultivar in the university collection. d. The percentage of plants with floral shoots is over 50% in all variants, of which two variants with 54.54% and 71.42% in the Pink giant cultivar from the university collection, and the remaining 7 variants of 100% respectively in cultivars Festiva maxima, Kansas from the university collection and Dorren from Singureni.An early start in vegetation was evident in the plants two years after planting, but also an increase in the number of shoots both on the plant and on the variant.

An early start in vegetation was highlighted in plants two years after planting, but also an increase in the number of shoots both per plant and per variant. The initiation into vegetation and the percentage of shoots is 100% for all variants in the 2 planting stages. An increase in the percentage of plants with floral shoots, but also in the number of floral shoots and flower shoots in bloom, an increase in the percentage of flowering in all the varieties and varieties of herbaceous peony studied, and a decrease in the duration of both the phenophases of growth as well as in the flowering phenophases, thanks to a warm spring with temperatures above 20°C. The earliest cultivars to bloom were Miss America on May 6, Daydream on May 2 and Raspberry Sundae on March 6 among the new cultivars.

In Chapter 4, the research studies carried out were regarding the particularities of growth and flowering of some peony varieties under conditions of containerized and forced culture. Research was conducted at the U.S.A.M.V.B. using as biological material divisions of plants with white, pink and red flowers from U.S.A.M.V. Bucharest and Singureni, Giurgiu county. The plant divisions were planted in pots with an opening of 30 cm, in autumn in October 2016. After planting, the pots were kept in cold conditions for a variable

number of weeks after which they were brought to the university greenhouse for the actual forcing. For each of the forcing stages, observations were made regarding the following growth and development phenophases: initiation into vegetation, shoot number, shoot growth, flower bud emergence, flower opening, flower withering, flowering duration, flowering percentage. The following herbaceous peony cultivars were used as research material: Festiva maxima, Dorren, Pink Giant, Kansas.

The introduction of plant pots into the greenhouse for actual forcing was carried out on four different dates: 14 February, 21 February, 28 February and 7 March 2017. The research undertaken led to early flowering compared to the field culture by almost two months . In the containerized and forced culture of herbaceous peony varieties, the research and observations made led to the following results and conclusions: the earlyness of the growth phenophases was highlighted in all herbaceous peony varieties studied; the University's Pink Giant and Kansas varieties had the earliest onset of vegetation, compared to Singureni's Festiva maxima and Dorren varieties; the University's Pink Giant cultivar stood out with a 100% percentage of initiation into vegetation compared to the other varieties studied; early flowering and early flowering phenophases were highlighted in the Festiva maxima and Dorren varieties; the cultivar Festiva maxima was highlighted by a percentage of flowering of 100% compared to the cultivar Dorren; early flowering was highlighted in the cultivar Festiva maxima (20.03), compared to the cultivar Dorren (22.03).

In Chapter 5, an experience is presented regarding the preservation in the climatic chamber of pots with some herbaceous peony cultivars on growth and flowering. The present experience is of great importance in the culture of the herbaceous peony both for cut stems and in the decoration of green spaces, bringing new contributions regarding the extension of peony flowering in the off-season, especially a late flowering that brings many benefits both to cut flower producers and to landscapers being current affairs.

The research studies for this experience were carried out at U.S.A.M.V. Bucharest, in the experimental field of the floriculture department, more precisely in the shed next to the floriculture laboratory and at the university's research center, Hortinvest. The research studies were carried out during 2018/2019. during the research, the space in the shed was organized as well as the space at the research center of U.S.A.M.V. Bucharest, Hortinvest, regarding the climate chamber. As experimental material used in the given experience being composed of peony cultivars used from the native home plus ordered peony varieties.

The experience was carried out during 2018/2019 in three stages, namely:

• Stage I: planting peony roots in pots and storing them outside (in the shade) until March;

• Stage II: removing the pots from the shade and storing them in the climatic room of the research center of U.S.A.M.V. Bucharest, Hortinvest until June;

• Stage III: removing the pots from the climatic chamber and placing them outside in the shade.

Planting of the potted divisions was done in October and they were stored outside in the shade on shelves until March 9, 2019 when they were stored in the climate chamber at the Hortinvest research center until June 11 for 3 months , after which they were stored outside in the shed.

The conditions in the climatic chamber were: temperature between 0 - 3 °C and humidity of 80 - 85%. The research methods used are biometric measurements, determinations and observations of the phases of growth and flowering of peony varieties, during the experimental stage. Research from this experience led to the extension of off-season flowering in some herbaceous peony cultivars. The observations and determinations made during this experience led to the following results and conclusions: the appearance of the plants in vegetation was characterized as normal, only in some cultivars some buds became necrotic and others did not open; the appearance of floral shoots in some cultivars; extension of flowering in the off-season by 3 weeks after peony flowering in gardens and parks; the percentage of initiation into vegetation and the percentage of shoots was not affected, remaining at 100%; the percentage of floral shoots was between 15.38% in the cultivar Anemoniflora and 61.53 in the cultivar Patio Moscow; the percentage of plants with floral stems being 33.33% in the cultivars Anemoniflora and Patio London and 100% in the cultivars Patio Dublin, Patio London and Patio Moscow; the percentage of plants with flowering flower stalks being observed only in the

cultivar Patio Moscow having the value of 100%, as well as the percentage of flowering having the value of 62.50%.

Chapter 6 presents a research study and experience on the propagation of herbaceous peony cultivars by root cuttings. The present research proposes to bring observations, contributions and new information regarding the propagation of the herbaceous peony by root cuttings, the percentage of rooting, the substrate used for rooting but also different substances used for rooting the root cuttings as well as for making the root cuttings in order to their rooting. As experimental material used in the given experience, being composed of peony cultivars from the native home plus those from the university collection. Making and planting the cuttings in pots was done in September - October and they were stored outside until the frost. The substrate used for planting is a mixture of 60% peat and 40% perlite with a grain size of 4 mm. After planting the root cuttings, the substrate was watered with a rooting solution consisting of the following products: Rootip Basic 50 ml + Kerafol Evo 25 ml + 10 ml Fighter Phos per 10 l of water. Watering with that solution was done every 10 days for a month. The experimental methods used are biometric determinations, measurements and visual observations on the growth phases of herbaceous peony varieties, during the experimental stage.

The present research through the observations, determinations and measurements carried out brought to the following results and conclusions: the percentage of rooting of the root cuttings was over 75% in all the cultivars studied; root cuttings from cultivars *Pink Giant and Kansas had a rooting percentage of 75%; root cuttings from cultivars Festiva maxima, Dorren, Sarah Bernhardt, Dr. Alexander Flaming* had a rooting percentage of 100%; the rooting solution used increased the rooting rate as well as the formation and development of roots; from the results obtained from the research we can say that the propagation of the herbaceous peony by root cuttings is an alternative to the other propagation methods; by the results obtained regarding the rooting percentage we can recommend this method of propagating the herbaceous peony without problems.

In Chapter 7, the experience of propagating the herbaceous peony through green shoot cuttings is presented. This experience brings new information on peony propagation by different methods. It contributes to the scientific enrichment of the culture technology and propagation of the herbaceous peony through the studies carried out on this method of propagation. It brings contributions and benefits to herbaceous peony growers regarding the propagation rate, rooting percentage, rooting substrate, the use of different solutions and rooting substances but also on peony cultivars that can influence the rooting percentage. The research was carried out at U.S.A.M.V. Bucharest, in the experimental field of the department of floriculture, in the botanical garden of the university as well as in the greenhouse and in the greenhouse, during 2018. The research material used in the experiment was composed of peony cultivars used from the native home plus those from the university collection. Making and planting the cuttings in alveolar pallets was in April-May. The substrate used for planting the cuttings is a mixture of 60% peat and 40% perlite with a grain size of 4 mm. After planting the shoot cuttings, the substrate was watered with a rooting solution consisting of the following products: Rootip Basic, Rootip Mix, Kerafol Evo, Fighter Phos and Atonik. Watering with that solution was done every 10 days for 2 months. After rooting, the cuttings were planted in pots.

The research methods used are biometric measurements, determinations and visual observations, during the research period. The material is represented by the cultivars: Festiva Maxima, Dorren, Pink Giant, Kansas. Alveolar pallets with cuttings were stored in the greenhouse under arches covered with gauze to maintain humidity. The present research through the observations, determinations and measurements carried out led to the following results and conclusions: the multiplication rate is high between 10 cuttings/plant in the Kansas cultivar and 26 cuttings/plant in the Dorren cultivar; the rooting solution from variant V3 had the best rooting effect of green peony shoot cuttings; although at the first experience the percentage of rooting was below 30%, this propagation method cannot be neglected but improved in the future; the method can be recommended having a high multiplication rate; the maximum root length of the cuttings was obtained in the V3 variant; the maximum diameter of the parcel and the bale of formed roots was also obtained in the V3

variant; the best percentage of young roots was also obtained with the V3 variant; from the partial data obtained so far, this method can be recommended for the propagation of the herbaceous peony.

Chapter 8 presents an experiment conducted on the longevity of herbaceous peony cut flowers in pots using different solutions. This research study brings to light the results regarding the use of traditional solution recipes in pot water for keeping flowers in pots as long as possible. The researches were carried out in Singureni township, Giurgiu county, in their own household, during 2019. A space for research was organized to carry out the experience. The research material used in the experiment consists of peony flowers of peony cultivars originating from the native location plus those from the university collection. The experience was carried out during 2019, in May. The material is represented by the cultivars*: Festiva Maxima, Dorren, Pink Giant, Kansas and Celebrity.*

The research methods used are biometric measurements, determinations and visual observations, during the experimentation stage. biometric determinations being made by using indicators: the phenophase in which the buds are located; the diameter of the buds; the diameter of the floral stem; the length of the flower stalks. Visual observations were made through the following indicators: flowering phenophases; due to keeping flowers in vases (days). The research undertaken in this experiment led to the following conclusions: in the cultivar *Festiva* the maximum minimum duration of flower storage was at V5 of 5 days, and the maximum duration of flower storage in pots was observed at V4 of 11 days, followed by the variants V7 and V8 for 10 days. in the *Dorren* cultivar, the minimum duration of keeping flowers in V1, V4, V11, V12 was 7 days, and the maximum duration of keeping flowers in pots was observed in the variant V7 of 11 days, followed by the variants V13, V15, V16 of only 10 days; in the cultivar *Pink Giant,* the minimum duration of keeping flowers was for the variants: V6 and V12, of 8 days, and the maximum duration of keeping flowers in pots was observed for the variants V5, V8, V9, V10, V11 and V15 of 11 days followed by variants V2, V4, V13 and V14 of only 10 days; for the *Kansas cultivar,* the minimum duration of keeping flowers was 7 days for the V7 variant and a maximum duration of keeping peony flowers of 10 days for the V10 and V12 variants; in the *Celebrity* cultivar, the minimum duration of keeping the flowers was in the V1 variant of 6 days, and the maximum duration of keeping the peony flowers was observed in the V3 and V6 variants of 8 days, followed by the V2 variant of only 7 days; the best solutions for keeping flowers in pots were those from variants V11, V10, V7, V8, V13, and V15; on a smaller scale, these traditional solutions for keeping flowers in pots as long as possible can be recommended.

Chapter 9 presents the expansion of the university's existing herbaceous peony collection. Making extensive herbaceous peony collections at the university's current collection. it was done in two stages. At the first stage, the creation of an extensive collection took place in the second year of research in the fall of 2017 by planting new herbaceous peony cultivars in the number of 4 with 3 copies of each variety. In the second stage, the realization of an extensive collection took place in the 3rd year of research and will be planted in the fall of 2018, new herbaceous peony cultivars in number of 4 with 1, 2, 3 and 5 copies of each cultivar. The cultivars are represented by *Miss America, Raspberry Sundae Daydream, White Sarah Bernhardt, Hermione, Joker, Bartzela, Command Performance, Gardenia, Angel Cheeks, Felix Crousse, Celebrity.*

In chapter 10, the general conclusions and recommendations are presented.

The present work includes 29 tables, 392 photographs of which: 112 photographs in the first part; 280 original photos in the second part of which: 34 graphics and 246 photos; and 156 bibliographic titles.