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Importance of investigations carried out by Professor Bolesław Suszka in population genetics of forest trees

Abstract: Modern forest selection programs concern natural and protected populations of trees characterized by a great genetic variability and also production stands frequently deformed by human activity. In the latter, artificial regeneration is prevailing. Forest nurseries working in the organizational structures of State Forests can guarantee the proper provenance (genotype) of seeds and the quality of seedlings obtained from them. The condition, however, is a close uniformity in the conservation of forest gene resources, and selection breeding of forest trees. The success of the program depends also on the development of modern infrastructure for forest nurseries and applied technologies. The latter task was the field of activity of Professor Bolesław Suszka, Ph.D., and his many-year research and organizational and didactic activity in Poland and abroad. The methods in long-term storage and their pretreatment in case of dormant seeds, developed by Professor Suszka, created the theoretical and practical basis for the conservation of forest gene resources not only in Poland.

Additional key words: selection programs, forest seed science nurseries, gene banks

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Modern forestry has to take into consideration the continuity of forest utilization and longevity of stands, ensure their numerous functions and their complex protection, and to manage forests according to the principles of pro-ecological, economically balanced, multi-functional forest economy (Poznanski 2000). On the other hand it is indispensable to ensure the realization of selection programs and the conservation of forest gene resources on the basis of genetics. The current tendencies of forest management on ecological principles are frequently – though unjustly – contradicted by the so-called plantation or clonal forestry. In either case the most important point is how and with what regeneration material progeny generations will be produced. In primary populations of trees natural regeneration is obvious though in the case of forests inflicted by pillage exploitation and of distorted genetic structure the self-improvement of

their breeding value through natural regeneration in further generations seems to be impossible. The genetic and breeding value of such populations can be improved only by artificial regeneration with materials of known genotype value.

The specific trait of forest nurseries in Poland is that the production infrastructure is established in forested areas and the accepted production profile is adapted to the regeneration tasks of the basic administration units of State Forests, i.e. forest districts. The nurserymen are therefore obliged to produce various assortments of the planting material, this increasing the unit cost of seedlings. In modern forestry the nursery production is a part of selection programs, not a separate element of silviculture in a general sense. Apart from the selection of stands and testing of their progeny, nursery production is the last link of these programs, i.e. the propagation of elite

populations of the recognized genetic and breeding value. Therefore the in planning nursery production should be taken into consideration to a greater and greater degree the diversity of the assortment, the possibility of using the local seed basis, the principles of transferring with respect to the vertical and horizontal regionalization, and the genetic plasticity of seedlings (Sabor 1998). For meeting the requirements of modern forestry it is necessary to establish nurseries whose infrastructure would ensure the use of modern technologies in processing storing seeds, treatments and in the production of high-quality planting material. The feasibility of evaluating the genetic and breeding aspect and the conservation of forest gene resources is also indispensable.

Also the endangerment of nature and the excessive, frequently exploitation of forests associated with insufficient care about their natural regeneration led to the development of new ideas in the protection of nature resources. The program of collecting gene resources of forest tree species widens the previous policy of passive nature protection. The aim is to reproduce the declining plant ecosystems.

The new ideas is the construction of specialized objects for the programs of multifunctional forestry respecting by the biodiversity and based on a complex application of new technologies in the storage and testing of seeds. Professor Boleslaw Suszka developed the idea of combining the problems of seed harvest, extraction, and storage with the simultaneous valuation of the regeneration material. The complementary realization of principles of forest tree selection and population genetics in the practical activity of forest management units is involved in the method. The indispensable condition is the establishment of specialized objects equipped with the newest technologies. Up to recently harvest and storage of seeds consisted in the mass extraction of seeds from cones of forest trees. During the harvest campaign and the collection of cones and seeds it was impossible to preserve the original provenance and to evaluate the quality of the sawing material. Currently the seeds are tested in the Laboratory and Field Stations of Seed Testing in Sękocin (Central Laboratory of Seed Testing) and Kłosnów (Toruń Regional Directorate of State Forests), Bedoń (Łódź RDSF), Olsztyn (Katowice RDSF), Białogard (Krosno RDSF), Biłgoraj (Lublin RDSF), Olsztyn (Olsztyn RDSF), and Dukla (Krosno RDSF). The laboratories for seed quality control in the seed stores supplement the work of the field stations mentioned above. The seed quality control stations estimate the quality seeds stored there for the current use in forest districts. The following units should be mentioned: in the Katowice RDSF the stores in Bielsko and Rudy Raciborskie, in Poznań RDSF the stores in Jarocin, and in Gdańsk RDSF in Kaliska-Wirty. The establishment of the above seed

stores was suggested by Professor Boleslaw Suszka and was based on the results of his research.

Different tasks are to the stations equipped with technological lines elaborated by Professor Suszka for storage of seeds of various tree species, chiefly deciduous ones difficult in processing and storage i.e. the oak and beech. The stations are adapted to the collection of larger amounts of seeds for years of seed crop failure and also to the production of qualified regeneration material. The planting materials are produced here under controlled conditions in containers. The stations in Białogard (Szczecinek RDSF), Bielsko (Katowice RDSF), Siedlisko (Zielona Góra RDSF), Swierczyna (Szczecinek RDSF), and Dukla (Krosno RDSF) are prepared for the realization of this program.

The stations destined for conservation of forest gene resources and selection breeding of forest trees work within the structure of regional gene banks (Sabor 1998). The idea of the program is to combine the conservation of local high quality stands in the given natural forest region both in the form of long-term storage of seeds and in the *in vivo* form of living gene banks. The latter element of the program is realized in the form of comparative plantations in varied habitat conditions *in situ* and *ex situ*, permitting the conservation of living gene resources and at the same time the evaluation of the genetic-breeding value and plasticity of protected populations of selection trees. These new stations, i.e. the field stations of regional gene banks, are characterized by the high quality of their work, which combines modern methods of harvest and storage with the estimate of the genetic value of seeds. The stations not only store seeds but also contribute to the optimization of the breeding management of protected stands and their transformation on genetic basis. The stations determine the marketing policy with respect to seeds and planting materials in Poland and abroad. An example of such objects is the First Field Station of the Carpathian Gene Bank in the Wisła Forest Inspectorate (Sabor 2001).

On the basis of current experience Professor Suszka presented general principles of storing seed resources in field stations of the Regional Carpathian Gene Bank. His lecture was given during the Scientific Conference on "Genetic Protection of Partial Populations of Forest Trees in the Carpathian Gene Bank". The Conference held on June 29, 2001 in the Ustroń and Wisła Forest Inspectorates of the Katowice RDSF (Suszka 2001) was connected with the opening of the First Field Station "Wyrchczadeczka" of the Carpathian Gene Bank.

The particularly valued activity of Professor B. Suszka is noted in the development of the program and organization of infrastructure of the Forest Gene Bank at Kostrzyca. Professor Suszka is member of the

Scientific Council of the Bank appointed by the General Director of State Forests. On July 25–26, 1996 during the first meeting of the Board at Kostrzyca Professor Suszka was elected its Vice-President. He was particularly active in a team elaborating the guidelines for the technical procedure of processing seeds and adapting genetic materials for low temperature storage. Professor Suszka also took part in elaborating the concept of the position of the Scientific Council in the projected seed act. The preliminary guidelines concern the procedures of treating silver fir seeds (order No. 5 from December 18, 1998) and beech nutlets and also methods in collecting seed stocks and reserves at the Kostrzyca Forest Gene Bank.

Professor Suszka takes an active part in advanced courses for professional foresters, giving lectures on seed physiology during long-term storage, methods in thermotherapy of forest tree seeds, their storing, stratifying, and pre-sowing preparation.

In 1998 during a meeting of the scientific councils of the Forest Gene Bank and the Radzikow Institute for Plant Breeding and Acclimatization, Professor Suszka presented the results of his studies on an important problem in the practical protection of gene resources, i.e. the storage of seeds of deciduous trees, undershrubs, grasses, perennials, and bulb plants from the areas of nature reserves and parks.

Professor Suszka takes an active part in scientific conferences in Poland and abroad chiefly on problems of modern seed science. I would like to mention the conferences in which I also had the honour to participate: 1996 in Kevelaer a meeting on seed science,

1997 in Nordrhein-Westfalen on the occasion of appointing the German gene bank there, or 1999 in Teisendorf, Germany. In 1998 we had the opportunity of entertaining a group of German scientists and foresters interested in forest seed science, nurseries, and selection. Professor Suszka actively participated in conferences organized by the Department of Seed Science, Nurseries, and Selection of Forest Trees of the Krakow Forestry Faculty. The discussions concerned selection management of Carpathian forests and the development of nurseries in montane and sub-montane regions. The suggestions and practical conclusions forwarded by Professor and his lectures were always accepted with the greatest attention (Figs. 1–3).

The widely known works published by Professor Suszka concern the biology of seeds and processes occurring in them during storage. The works are taken into consideration in monographs of our native forest trees. His *opus magnum* is the manual written in collaboration with C. Muller and M. Bonnet – Masimbert of INRA in France, entitled “Seeds of Deciduous Trees. From Harvest to Sowing”. The manual was translated into several languages and re-edited in Poland. Recently Professor Suszka published a review on “New Technologies and Techniques in Forest Seed Science”. It presents the application of the results obtained by Author and the achievements of other Polish scientists in this field. The publications only are a part of Professor Suszka’s activities. I should mention his outstanding role in teaching young scientists in post-graduate courses on the Genetics of Forest Trees.



Fig. 1. Participants of the conference “Evaluation of Genetic Value and Problem of Selection and Management of European Beech Stands in the Carpathian Mts.” Cracow–Krynica, October 20–22, 1999



Fig. 2. Professor Suszka during coffee-break with participants of the conference “Problems of Management of Admixture Species in the Carpathians”, Kraków–Brzesko – Ustroń–Bielsko, October 19–20, 2000

In 1999 Professor Suszka wrote: “State Forests realize important tasks within the scope of economy (wood production), ecology (transformation of stands by supplementing them with deciduous species), and protection (conservation of precious native ecotypes and provenances of forest trees). It would not be possible unless the genetic progress in our forests were not based on the results of scientific research. The

fact that our studies, projects, and extension service contribute to the realization of these tasks is highly gratifying for us, research workers”.

The Cracow Forestry Faculty is currently celebrating the 50 anniversary of its scientific and didactic activity. The Faculty is deeply connected with the old academic tradition of the 110-year-old Agricultural Faculty and the 600-year-old history of the Restored Jagiellonian University. Professor Suszka belongs to the renowned alumni graduated from this University and he always stresses it, wearing the University badge.

“The 600th Anniversary of the Jagiellonian University Restoration is celebrated by the edition of Golden Books of all the Faculties supplemented by the two which traditionally belonged to our community though were once separated from it, i.e. the Papal Theological Academy and the Agricultural Hugo Kołłątaj University. The Golden Books sum up the output of Polish scientists working in the University and their contribution of the global achievements. This highly humanistic way of presentation illustrates the activity of the University through people who have contributed to its history and importance” (Walecki 2000).

Dear Professor, in the history of Polish science your achievements are among the most outstanding ones and will remain so in the future. It seems that the scientific activity of Professor Suszka, the graduate of the Jagiellonian University, forms further pages of the Golden Books of the University and of the Polish science in general. *Ad multos annos*, Dear Professor!



Fig. 3. Meeting of the scientific councils of the Forest Gene Bank Kostrzyce, May 29, 1998

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