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Autor: Tsitsin, N.V.
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The system of botanical gardens of the USSR and it's role in investigating vegetable resources of the country [1]

N. V. TSITSIN

The development of scientific research on the wild flora for the purposes of selection and practical utilisation of the most valuable botanical species has gained much attention in the Soviet Union. Botanical gardens and dendrological parks are principally responsible for this work. The number of these institutions has been considerably increased: if before 1917 there were only 20 botanical gardens in Russia, at present we have more than 100 botanical gardens and dendrological parks. The considerable attention paid to the development of the introduction and acclimatization of plants is explained, first of all, by the great diversity of nature, and by the rich vegetable resources of the USSR. In the vast areas of our country one can find, in it's various geographic zones, cold tundra, hot deserts, and regions of damp, warm climate with evergreen subtropical vegetation. Siberian taiga occupies a very big territory. Mountain regions with peaks reaching 5000-7000 m also dominate on very large areas.

Therefore the problems of a more complete and rational exploitation of the wild flora are of vital importance. It's also necessary to enrich the wild flora of large areas by means of the introduction of plant species from other geographic zones.

It is essential for this big and important work that in the post-war period our botanical gardens and dendrological parks, even belonging to different departments, have been arranged in a rather harmonious system of scientific research and main organization activity. At present all the botanical gardens of the Soviet Union work according to the common coordination plan made for 1966-70. The Council of the Botanical Gardens of the USSR, set up in 1952 at the Main Botanical Garden of the USSR Academy of Sciences, includes the most competent and experienced scientists from the different botanical gardens and from similar scientific institutions, and coordinates all the activities of botanical gardens.

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[1] Conférence prévue pour le Symposium, mais qui ne put être lue en raison de l'absence de l'auteur.

We were convinced by actual practice of the fruitful results of collective work, and therefore gave our full support to the idea to organize an International Association of Botanic Gardens; at present we take an active part in it's work.

Besides the Main Botanical Garden of the USSR Academy of Sciences, we have a central botanical garden in each Soviet Republic, which acts as a regional scientific institution and directs methodically the scientific research in a particular phytogeographic zone. This led to the organization of regional councils of botanical gardens, which gave the whole system a still better organized character.

The scientific research at the botanical gardens and dendro-parks of our country may be summarized to the following principal points:

- the elaboration of general rules in using species of the wild flora for introduction and acclimatization;
- the exological, physiological and biochemical investigation of the introduced plants;
- the artificial form and species creation by remote hybridization;
- the detection of the most efficient scientifically founded methods of reproduction of introduced plants;
- the protection of the plants from diseases and pests;
- the establishment of a scientific basis for the creation of botanical gardens and dendro-parks.

Of course, the activity of every botanical garden does not cover all these points, but the whole system of botanical gardens works in accordance with the program mentioned above.

Since the instauration of the Soviet State, the flora and vegetable cover of the Caucasus region, Crimea, central Asia, the Carpathian mountains, Siberia, the Far East and some foreign countries (India, south-east Asia, North America, the Mediterranean region, etc.) have been studied. As a result of this extensive work, many of our botanical gardens at present have very rich plant collections (10,000 species or sorts, or more). Now we concentrate our attention on taxonomic research, and on the investigation of new plants respective to their importance for national economy, applied medicine, and decorative gardening.

We have in our country some outstanding scientific institutions in the field of plant introduction and acclimatization. In this respect, I would like to mention the Main Botanical Garden of the USSR Academy of Sciences, which is one of the largest gardens of the world; the Polar-Alpine Botanical Garden of the Koljsky branch of the USSR Academy of Sciences, situated 120 km behind the polar circle (about 4000 species from various regions of the world have been introduced and tested, and the scientific foundations of landscape and shade gardening in the towns of the polar circle have been elaborated there); the Central Siberian Botanical Garden of the Siberian Branch of the USSR Academy of Sciences, which heads the investigation and the practical exploitation of the very rich flora of Siberia and the Far East; and the Alpine Garden of the Tajik Branch of the USSR Academy of Sciences, making unique research work on the adaptation of plants under mountain conditions. We also have some large botanical gardens working on problems of landscape and shade gardening in the desert regions of central Asia. Work has already been started to establish a botanical garden on the desert peninsula Mangyshlak on the Caspian Sea.

I would like to draw your attention to some particular investigations made by the scientists of our botanical gardens during the last few years. In my opinion this research work is interesting not only for us Soviet botanists, but for our colleagues abroad as well.

The staff of the Botanical Garden of the Komarov Botanical Institute has completed a 6 volume publication on "The trees and shrubs of the USSR (native and cultivated)" and on "The results of the introduction of trees and shrubs on the Black Sea coast, in the Krasnodar region". Soon, "The distribution of the arboreal exotics of the USSR according to their winter hardiness" will be ready for publication. This work analyses the cultivation of trees and shrubs in the whole USSR area. Basing on various data from physical geography and on new results of introduction, the division of the USSR into dendrological districts will be undertaken.Of no less interest is, in my opinion, the 3 volume atlas on the areas of various trees and shrubs of the USSR, with distribution maps and explanatory notes. It is worth mentioning that many of our botanical gardens pay more and more attention to the mapping of vegetation, and to the problems of flora. This applies to the botanical gardens of the Ural, Volga, and Caucasus regions.

The Far East is one of the richest floristic regions of our country. More than 3000 species of higher plants grow there. I would like to mention, in this context, the "Flora of the Soviet Far East" written by Dr. V. N. Voroshilov, of the Main Botanical Garden of the USSR Academy of Sciences at Moscow.

In spite of the general tendency to create botanical gardens within each main geographic zone, we still have not enough scientific institutions in the north and north-east. Therefore we are always impatiently waiting for the publications from the Polar-Alpine Botanical Garden and from the botanical gardens of Siberia. Valuable treatises, such as "The introduction of plants behind the polar circle", "The vegetable resources of Siberia, the Ural region and the Far East", "New useful plants", and "The trees and shrubs of the Tuva Autonomous Republic" have been published.

For a more efficient exploitation of the vegetable resources of our country, we intend to create new botanical gardens in the north and east. This will permit the execution of more detailed experiences, under various geographic conditions, on the systematical introduction of plants. All these problems, and especially the foundation of new botanical gardens in the north and east of our country, were discussed at a scientific meeting held at Kirovsk. To intensify the introduction and acclimatization of plants in Siberia, the Far East, and the extreme north of the European part of the USSR, we intend to enlarge the existing botanical gardens in Yakutsk, Vladivostok, Petrozavodsk, Syktyvkar, and to create new ones in Magadan, Sakhalin, Kamchatka, and probably in Norilsk. To realize our plans, it will be necessary to make new botanical expeditions to distant regions, and to study in detail the historical and phytogeographical conditions of the new scientific centres of introduction and acclimatization.

In general, it is hardly possible to work at a botanical garden without undertaking an extensive study on the flora and vegetation of various regions of the world. The work achieved at the Polar-Alpine Botanical Garden is a striking example to confirm this idea. The results obtained have demonstrated that it is possible, under the climatic conditions of the polar circle, to grow with good results many plants from the Caucasus, Crimea, the Himalayas, the Andes, and other regions as

well: *Heracleum sosnowskyi* Manden., *Campanula tridentata* Schreber, *Orchis amblyoloba* Nevski and *Scilla rosenii* C. Koch, from Caucasus; *Saxifraga irrigua* M.B., native to Crimea; *Aquilegia glauca* Lindley and *Potentilla purpurea* Hooker, from Himalayas; *Potentilla andicola* Bentham and *Anemone decapetala* Ard., native to the Andes.

Therefore we pay great attention to the organization of scientific expeditions. Thus in 1961 a Soviet-Indian botanical expedition was arranged. The members of this expedition collected more than 10,000 living plants, seed of more than 800 species, and more than 7000 herbarium specimens. The organization of such a type of expedition, basing on the principle of mutual exchange, is a good example of international scientific cooperation of botanists, and will contribute greatly to the benefit of science. I shall not dwell here on the importance of the botanical expeditions and excursions within our country, which are organized every year by the Council of the Botanical Gardens of the USSR.

Basing on the results of the scientific research of the botanical gardens and dendro-parks, many new plants have been introduced, and many of them are now cultivated in a completely new environment. Thus various fruit trees, berries, and grapes studied at the Nikita Botanical Garden in Crimea are now widely cultivated in the arid regions of Ukrainia. And what is more, at present we have hundreds of varieties of apple, cherry, pear, and plum trees, created at the Nikita Botanical Garden, which are adapted to the specific conditions of these southern regions.

Selection under the climatic conditions of Siberia is of particular interest. 700 species and sorts of fruit trees and berries grow in the collections of the Central Siberian Botanical Garden at Novosibirsk. The botanists of Siberia have made a most valuable contribution in succeding to grow creeping forms of fruit trees under severe winter conditions.

Several botanical gardens in Ukrainia, Byelorussia, and Komi SAR perform extensive research work to discover and to introduce new fodder plants. Quite a few species of *Crambe, Heracleum,* and *Polygonum* are widely grown at present. In Bukovina plants of *Alcea rosea* L., *Crambe cordifolia* Steven and *Cynara scolymus* L. are studied and cultivated with good results.

Special studies in *Leguminosae* have been made at the Ashkhabad Botanical Garden of the Turkmen Akademy of Sciences. Productive and hardy species and forms have been tested and recommended for agricultural production. Many species of *Leguminosae* will be extensively grown on the new virgin soils of the Karakum canal.

Many of our botanical gardens and dendrological parks work in cooperation with forestry. Thus in Adjar (Botanical Garden of Batumi) 15 wood species were selected for cultivation, and Georgian scientists think it will be possible to increase the productivity of forests in a comparatively short period of time.

Important results have been obtained in studying the biology of bamboo plants in the Caucasus region (Black Sea coast). Experimental felling has shown that an average plantation of some bamboo species yields 7-8 times the organic mass of a native forest. Used for pulp, paper and chemical industries, the bamboo plants will be profitably cultivated in large areas of the Black Sea coast, in the Caucasus and in east Georgia, Armenia and Azerbaijan. We shall try to grow experimentally the hardiest species and forms of bamboo in the Krasnodar region.

Speaking about the role of the botanical gardens in enriching the flora, it is necessary to mention that only with the help of botanical gardens new tropical and subtropical plants (*Thea sinensis* L., *Citrus* species, *Persea americana* Miller, *Feijoa sellowiana* Berg., *Diospyros kaki* L., etc.) could recently be introduced. At present we are searching for the most effective winter protection for such plants as *Carica papaya* L. and *Theobroma cacao* L. The importance of mass plantings of *Eucalyptus* for the marsh-ridden regions of Kolkhida is well known. *Eucalyptus* species native to Australia now grow in the Caucasus region and have been studied both ecologically and biologically.

The good results obtained, through our botanical gardens, in enriching the flora are explained, first and foremost, by the very serious investigation of theoretical problems. Recently biochemical, physiological and genetical problems, as well as the intraspecific variability of plants, were given particular attention in our work. All these investigations yield the scientific, theoretical and experimental foundation essential for plant introduction and acclimatization on a modern scientific base. Therefore it is very important to have well equipped laboratories providing thorough scientific research.

Having no opportunity to report even the hundredth part of the investigations which, afford the theoretical base of introduction, I would like to mention only a few facts. Not long ago a monograph on "The biochemical evolution of flowering plants" was published at the Main Botanical Garden. This monograph summarizes the results of many years' experiments, leading to the theory that the evolution of plants is connected with the evolution of proteins and ferments.

Interesting work on the physiology of introduced plants has been done at the Central Siberian Botanical Garden. The physiological bases of the adaptation of plants being acclimatized in west Siberia have been studied. A certain regularity in the accumulation of amino acids, depending on the phase of vegetation and on ecological conditions, has been stated. One also studied the influence on plants of new activating and inhibiting chemicals. Several botanical gardens in Ukrainia, Siberia and Byelorussia investigate the influence of various kinds of radiation and of ultra-sound waves on plants. The γ-ray resistance of the seed of several introduced species has been tested at the Central Botanical Garden in Byelorussia.

The problem of landscape and shade gardening in big cities is of great importance for the Soviet Union, as for many other industrial countries. Our botanical gardens study the ecology of plants in big cities with the purpose to find out the most resistant species. In Sverdlovsk, for example, a symposium on "Vegetation and industrial impurity" was held, whose proceedings have been published. An assortment of plants for industrial areas (open ground and indoor culture) has been compiled.

In conclusion, I would like to mention that our international cooperation has been increasing year after year. Besides the traditional exchange of seeds lists and seed, we have active contacts with scientific institutions abroad.

About four centuries ago the first botanical gardens appeared in Europe. The start was timid but very important. The Geneva Botanical Garden, founded last century, was one of the first to start the introduction of plants. At present, when the flora of the world has been considerably enriched owing to the success of introduction, we are glad to thank those people who initiated this work—including the founders and staff of the Geneva Botanical Garden.

Life gives many convincing examples that introduction and acclimatization of plants have become a new field of scientific study and a part of experimental botany, investigating rules and methods of the transformation of vegetation organisms, principally of the native flora, and of their subsequent cultivation in a new environment. These investigations are concentrated at the botanical gardens and dendrological parks, and it is hardly possible to study and exploit the vegetable resources of any region without the aid of such institutions.

Adresse de l'auteur: Dr N. V. Tsitsin, Jardin botanique central de l'Académie des sciences de l'URSS, rue Botanique 4, Moscou I-276 (URSS).