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Pinus strobus: past and future in Europe. A page of silvicultural history and international scientific cooperation

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Abstract. The author presents a short overview concerning eastern white pine (*Pinus strobus* L.) introduction in different European countries, including the period of early extension in forest culture until the first blister rust crisis occurred. The species rehabilitation at the European level and the new extension between 1927 and 1972 years period in different countries, particularly in Romania, was presented. Most of the data incorporated here were taken over from the monograph of the senior author's of this paper. However, parts of the newly acquired results in our country were taken in to account, as well. Finally, the fruitful international scientific cooperation, in favor of *P. strobus*, including that with I.U.F.R.O was highlighted

Keywords: *Pinus strobus*, European introductions, extension, blister rust crisis, rehabilitation, breeding, monograph, scientific cooperation

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Motto

We can usefully borrow trees from other lands, in order to grow them in our country. But, it is necessary to know beforehand what kind of tree should be borrowed, where and how each species must be grown.

Dr. Marin Drăcea, 1937

Short foreword

A few sentences about Professor Marin Drăcea (1885-1958), the greatest Romanian silviculturist of the past century, it worth to be inserted here; this is because his scientific advises and publications continue to keep their stringent actuality, even at present. He founded our modern forest science and established in 1933 the Romanian Forest Research Institute which in the year 2008 celebrates its 75 years of activity. He was, for a long time, the Institute director and President of the "Progresul Silvic" Society. He obtained his Ph. D. title in Münich, Germany with the doctoral dissertation on black locust (*Robinia pseudacacia* L.) in Romania. In the year 1927, he benefited of a one year Rockefeller grant at Yale University, Ashville and at the famous Madison Wood Laboratory. Professor Drăcea was a great scientific personality and a fervent supporter not only for our natural forests and for their clever management, but also for the introduction of some valuable North American species

(Drăcea 1922, 1926, 1937).

Species Introduction

The pine subgenus *Haploxylon* (white pines, five needled pines) is represented in the northern hemisphere by a group of 33 species (Mirov, 1967). However, in Europe, only two are native, at high elevations: *Pinus cembra* L. naturally distribute in the Alps and Carpathians and *P. peuce* Grisseb in the Balkan Mountains. This situation has generated a special interest for the introduction of others white pines, in gardens at beginning and, after a long time, in forests.

Among other five needle pines originated from North America, the eastern white pine presented, certainly, the biggest interest. Its rapid growth rate, high wood quality and yield, large adaptability to different site and climate conditions, as well as nice ornamental value were the main reasons for its introduction (Radu, 1974).

In Europe, eastern white pine was first recorded already in 1553 in the Royal Garden of Fontainbleau, France (Lanier 1961), but the following mentions concerning its introduction in parks and forests appear, by far later, at the beginning of 18th century. In 1705 it was planted by Duchess de Beaufort at Badminton, Great Britain and after few years at Longleat (Kent) on the Lord Weymouth domain (Mac Donald et al. 1957).

Successive introduction in other European countries were reported by different authors as follows: 1770 in Germany (Schenck 1949); 1773 in former Czechoslovakia (Musil 1969); 1850 in Switzerland (Litscher 1908); in 1876 in Poland (Bialobok 1960); 1886 in Austria (Cieslar 1901) and in 1903 in Bulgaria (Ruskoff 1936) (Radu 1974, Blada & Popescu, 2004a).

In Romania, eastern white pine was first mentioned by Iuliu Barasch (1861) in his botanical handbook for silviculture and then by Eleutherescu (1881) under the *Pin Weymouth* name. But later on, in the Romanian forest literature, it received a lot of different common names, as follows: "pinul (lordului) Weymouth"; pin alb (white pine); "pin moale (soft pine)" according to the wood quality; "pin american" and "pin neted" (smooth pine) (Radu 1972)

In different European countries, eastern white pine took its common name mainly from the early introduction of this species on the Lord Weymouth's domain at Longleat, Kent. For a long time it was known as follows: "the Weymouth pine" in Great Britain and English literature; "le pin Weymouth" in France, Belgium and Switzerland; "die Weymouth kiefer" or "die Strobe" in Germany and Austria; "il pino strobo", "strobo", or "pino del Lord Weymouth" in Italy; "vejmutovka" - in Czech and "borovica Weymutovska" in Slovak; "weimutovaia sosna" in Russian; "vejmutov bor" - in former Yugoslavia ; "veimutov bor" - in Bulgarian and "Sima fenyö (smooth pine)" in Hungarian (Radu 1972).

It can be thus assert, that the standard common name of eastern white pine it has an official character only for scientist, being used particularly in its natural range. However, the eastern white pine name was used in this paper, as well.

Early extinction and first major crisis

The species expansion including its growth potential and pronounced adaptability were assured by the site and climate favorable conditions from the introduction areas. Also, the seed trade facilities and the unsophisticated seedlings production have contributed to its use in forestry. However, during the late 18th and 19th centuries, only small trial plantations were made in Europe although the Neuwaldegg nursery (Austria) has produced and delivered about 136,000 white pine seedlings in the 1886-1892 period (Revista Pădurilor, 10, 1893). In the first decades of 20th century, the eastern white pine had a rapid dissemination, particularly in Germany, where the species appears to become one of the most important trees for reforestation; the outgrowing all local coniferous species and keeping a dominant position in stands for many years were the major reasons for the species high utilization in Germany (Schmitt 1972). Thus, the eastern white pine generated in time "the greatest expectations", later on followed by "the greatest disappointments" due to the white pine

blister rust damage caused by *Cronartium ribicola* J.C. Fisch. in Rabenh. (Mayr 1980). In Europe, the blister rust was first mentioned early 1865 in Estonia (Leppick 1934). Then the pathogen was soon spread in France and Germany and after a few years it crossed the Atlantic Ocean to New England (1909) and Canada (1914) (Kriebel 1972). Due to its destructive effects on the eastern white pine, the German Forest Congress held (1927) in Frankfurt am Main took the decision to ban the white pine plantation in this country. Owing to this situation, Schenk (1949) noted: "for this species was planed an 1st class funeral ceremony and Freiher von Tubeuf pronounced the funeral speech"(Tubeuf 1927). Similar measures were taken in other European countries. A few years later inventory (Wappes 1935) reported that white pine was planted on 20,657 hectares. In Bayern, this tree was present in all forest districts and the blister rust injured more than 90% of plantations.

White pine "rehabilitation" and the new extention

After the historical decision from Germany in 1927 to ban the white pine plantation, at the forestry congress held in 1934 in the same country, Münch and Wappes brought arguments against that exaggerated interdiction. As a result, for the white pine a new and sustained period of extension started not only in Germany, but also in many other countries. Dr. Theodor Rădulescu, a Romanian scientist, who in 1934, has prepared his doctoral thesis in Germany, had significant contribution at this rehabilitation. The two of the most dangerous tree diseases at that time, i. e. white pine blister rust and Dutch elm disease (*Ophiostoma ulmi* (Schwarz) Nannf. was the subject of his doctoral thesis. Published in Forstwissenschaftliches Centralblatt (1937, vol. 21), his scientific conclusions promoted the opportunity to resume the white pine culture. His report was quoted by forest journals in Germany, Great Britain, USA and other countries.

The new period of expansion took advantage of the fact that, in the central part of the USA and the warmer parts of Europe, the damage caused by the white pine blister rust was greatly reduced; the warmer climatic conditions during the growing season was presumably, the cause of that damage reduction. On the contrary, in the cool humid regions of eastern North America and in central and northern Europe the blister rust became a serious danger and a limiting factor for the white pine culture (Kriebel 1983, Radu 1972, 1976).

According to the survey made by Radu (1974) and Blada & Popescu (2004a) the eastern white pine was planted on large areas after the second World War across the entire territory of Europe, such as: 25.000 ha in Germany, 1.500 ha in Czech Republic, 1.500 ha in Croatia, 1.360 ha in Romania, 1.174 ha in Slovakia and, on smaller areas, in other countries, as well.

These new waves of expansion, after centuries of extensive cuttings in natural forest, were the result of the period of "man-made forest" consisting in the triumph of conifers (Douglas fir, eastern white pine, other pines) and broadleaved fast growing species (poplars, black locust) instead of local European beech and other broadleaved species. This was the period of so-called "ligniculture", using agricultural technologies and "mini-rotation" in forests, mainly for pulp production.

The new ecological orientation to a "close to nature" silviculture, with promotion of native (local) species through natural regeneration, applying the classical shelter wood or selective systems, promoted by "Pro Silva", started to get advocates in European forestry only in the last two decades of past century.

The eastern white pine expansion was associated with the development of investigations in ecology, growth, genetics, resistance and wood utilizations of this tree in many European countries (Radu 1974, Kriebel 1983). For instance, special institutes like Instituto per Piante da Legno Giacomo Piccarolo (in Torino, Italy) and Institut za Cetinjace (in Jastrebarko, Croatia) were established. Also the eastern white pine was studied in different research units from Germany, France, former Czechoslovakia, Romania and other countries. The great interest for *P. strobus* in that period was certified by numerous studies and publications and by seven doctoral thesis accomplished on this subject, such as: Ch. Otto (1956) in Germany, Şin-Ţin-Si (1961) in Kiev-Ukraine, I. Repşis (1961) in Kaunas, Lithuania, S. Radu

(1972 a, b) Braşov, Romania, N. Pismennîi (1967a, b) Voronej, Russia and after 1972 Ivan Musil in former Czechoslovakia.

A Romanian monograph in *P. strobus*

In 1966 the senior author of this paper has started a complex research program in eastern white pine, namely the doctoral work; it was accomplished in the 1972 year through the doctoral dissertation entitled Silvicultural study of *Pinus strobus* L. (424 p., 71 tables, 93 figures, 325 references). Then, as monograph, it was published in 1974 year under the title "Silviculture and use value of eastern white pine", Ed. Ceres, Bucharest, 304 p. The study included: a review of silvicultural characteristic of the species in its natural range (USA and Canada) and its history and performances in the European countries. In Romania, the field investigations involved: (i) site characteristics, yield, stem and crown form and health of 63 mature stands distributed across the country; (ii) a nursery provenance study covering North American and, European and local provenances (Radu 1971); (iii) mechanical and pulping properties of wood grown in Romania, compared with other locally grown softwoods.

More than 50% of the mature *P. strobus* plantation from Romania were made in the European beech (*Fagus sylvatica*) range. On a volume or dry-matter basis, the eastern white pine proved to be the second most productive species in range, after Douglas fir. When grows on the best sites, the total yield average increment was 20.2 m^3/year/ha at 50 years absolute exploiting age. In the 1970 year, the species has covered 1360 ha but only 70.5 ha were older than 41 years.

The oldest isolated tree was 130 years; it grows in the Baia Mare city park. A *P. strobus* tree of 40.5 m in height, being considered as one of the highest living in Europe, was found along a small river from Breazova (Văliug) location.

The species had the least variation in annual radial ring increment which means a high stability and growth in average site conditions, but, on the other hand, a low wood specific gravity (0.29-0.45). It was recommended to be planted for saw timber in rotations of 80 years. At that period the stands showed good health condition and not affected by blister rust (Radu 1972, 1974).

The main conclusions of the study were presented at the following IUFRO World congresses held in Gainesville (1971), Oslo (Radu 1976) and Kyoto (Radu 1981); on my behalf, these latest two papers were presented by H. Kriebel also, between 1969 and 1974 eight papers were published in several Romanian publications, including Revista Pădurilor.

The previously mentioned monograph was extensively reviewed in: Lesnictvi (Musil 1975), Lesnicki casopis (Holubcik 1976) and Gorsko Stopanstvo (Zahariev 1976). In Allgemeine Forst und Jagdzeitung 147, 1976, Professor Rainhard Schober, referring to the monograph, has noted "the very profound and solid Romanian monograph represents a valued completion concerning the white pine cultivation in Europe".

Again the blister rust danger

The biological cycle of *Cronartium ribicola* is connected with white pines and currant (*Ribes* species) as compulsory hosts. In order to avoid the past negative experiences, the scientists' attention was directed to these species. Nine spontaneous currant species are growing in Europe but *Ribes nigrum* L., *R. petraeum* Wulf, and *R. alpinum* L have the largest distribution which overlaps with that of eastern white pine extension area (Flora Europaea 1964). However, the cultivated *R. nigrum, R. rubrum* L. and *R. grossularia* L. are the most frequent host for blister rrust (Petrescu 1967).

Before 1970 year, the potential danger of blister rust in Romania was well known, but the disease was noticed only sporadic, without significant economic losses. However, in order to increase revenues obtained through exporting forest fruits, the communist leadership forced the Romanian Forest Service to create black currant cultures in forest lands, neglecting the well known danger of these measures for the eastern white pine (Radu 1972). As a result, after 1970 year, the blister rust invaded almost all young stands, promoted by the simultaneous culture of eastern white pine and black currant (Blada 1982, Blada and Popescu 2004 a, b). Because the blister rust can not be controlled by conventional methods (Bingham

et al. 1953), in 1977, a genetic improvement program, which included both intra- and interspecific crossing, was launched in Romania (Blada 1982). Several progress reports on this subject were previously published or presented in symposia (Blada 1982, 1987, 1989, 1992 a, b, 1994, 1997, 2000 a, b, 2003, 2004, 2007) and Blada and Popescu (2004 a, b, 2006 a, b, 2007). It should be stressed that the Romanian program considerably benefited of accumulated results in the North American one, namely that conceived for western white pine (*P. monticola* Dougl.) at Moscow, Idaho by R. Bingham, R. Hoff and G.I. McDonad

A durable international scientific cooperation in favor of eastern white pine

In the meantime, a few tree species, including eastern white pine, have benefited by a strong international scientific cooperation. In spite of the communist iron curtain and many other difficulties established after the Second World War in Europe, such cooperation existed among East-West European-North American-Canadian scientists. The dictatorial regimes were not able to interrupt completely the free exchange of scientific conceptions, publications and of biological materials, mainly small seed lots for trials. For instance, senior author of this paper has received a lot of useful publications and seed lots from many foreign personalities and institutions involved in white pines research. Using this way, it is acknowledge the great help the great help received from many scientists, such as: J.W. Wright, H. kriebel, Carl E. Ostrom, J.B. Genys, D.T. Funk, Fr. C. Coch, J.F. Rhody, W. Carmean, E. Thor and Herbst Brothers Co. (USA), L. Zsuffa (Canada), J.F. Lacaze, M. Versepuy (France), W. Vivani (Italy), Fr. Kluger, H. Egger (Austria), Martin Renz, H.G. Rahte, Otto Martens (Germany), F. Mrva (former Yugoslavia), I. Cijek (former Czechoslovakia).

The IUFRO Working Party 2.02.15 Breeding and Genetic Resources of Five-Needle Pines had and continue to have a leading part in this cooperation. The periodical conferences brought each time new scientific results and promoted a large and lucrative exchange of ideas and experience breeding materials. Also, IUFRO has organized host-parasite investigations and researches at molecular level.

For a long period of time, Professor Howard B. Kriebel, a great scientist and distinguished personality was for a long time period the leader of the IUFRO Division 2 and WP.2.02.15. His researches and publications had a great contribution to the knowledge concerning the eastern white pine breeding at world-wide level. Three times he visited our Country, our forests and our trials establishing strong relationship with the Romanian scientists involved in white pines breeding, namely Drs. V. Enescu, S. Radu and I. Blada.

In September 2006, in Văliug, Romania, Southern Carpathians, the IUFRO Working Party 2.02.15 has organized an international conference where participants from nine countries presented papers and posters and debated on breeding and genetic resources of five needle pines from their countries. During the three days after conference excursion, the participants had the opportunity to visit part of the field trials established in the frame of the Romanian breeding program (Blada 1982) in five needle pines, such as:

(i) *P. strobus* x *P. wallichiana* F.1 hybrid trial 20 years old planted in the Văliug Forest District;

(ii) *P. strobus* x *P. peuce* F.1 hybrid trial 20 years old planted at Vălişor, Caransebeş Forest District;

(iii) *P. strobus* x *P. wallichiana*; *P. strobus* x *P. peuce* F.1 hybrid trials 20 years old planted at Coşteiu, Coşava Forest District:

(iv) *P. peuce* clonal seed orchard, 18 years old; clones originating in Rila Mountain, Balkan Mountains Range, Bulgaria; planted at Coşteiu, Coşava Forest District;

(v) *Pinus cembra* provenance and half-sib trials, 10 years old planted in the Şurian Mountain range, Cugir Forest District;

(vi) *Pinus cembra* diallel trial, 10 years old, planted at Muncel in the Cindrel Mountain area, Răşinari Forest District, former Valea Sadului Forest District .

Presenting the previously mentioned trials, the Romanian contribution to the genetic improvement of five-needle pine for growth and blister rust resistance was successfully proved.

In the invitation addressed to me, to attend the IUFRO-Văliug Conference, Ioan Blada wrote that *in spite of its ferocious blister rust enemy, this great pine (strobus) can successfully be saved through selection and genetic improvement and through silvicultural intelligence, as well as*. My short report is only a page of this century long history and struggle to save the great pine. And we must not forget that this struggle took place not only in this country and in Europe, but with the same insistence in North America and Canada, as well.

Conclusions

Growth potential and other silvicultural features justified the early introduction and a periodical expansion of eastern white pine in different European countries.

Blister rust was and continues to be the major limitative factor for introduction and expansion of this species.

The encouraging results obtained in selection and genetic improvement in the struggle against this ferocious enemy have proved that the disease can be controlled by genetic way; thus the extension of this valuable pine can be continued.

In addition to the genetic method, the classical silvicultural protective methods should be applied, as follows: clear-cut currant bushes in the proximity of the new plantations; avoidance of pure white pine stands on large areas and promote mixed other species stands; when plant the main species, alongside the upper storey do not forget to simultaneously introduce the middle- and the understorey including shrubs plantation; their crown have the capacity of limiting the blister rust spores migration.

Permanently promoting the international scientific cooperation in breeding blister rust resistance and growth in eastern white pine

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Autorul prezintă o scurtă trecere în revistă a acțiunilor de întroducere a speciei *Pinus strobus* L. în diferite țări europene; inclusiv a perioadei timpurii de extindere în cultură până la prima prima criză produsă de rugina veziculoasă. De asemenea sunt evidențiate reabilitarea speciei la nivel european precum și noua perioadă de extindere în cultură din perioada anilor 1927-1972, în diferite țări și îndeosebi în România. Majoritatea datelor icluse în lucrarea de față au fost preluate din monografia pinului strob a cărei autor este semnatarul respectivei comunicări. În plus, au mai fost luate în considerare și rezultatele obținute de alți autori din țara noastră. În final s-a evidențiat colaborarea științifică internațională fructuoasă cu IUFRO în favoarea pinului strob, în principal prin intermediul Profesorului Howard Kriebel.
Cuvinte cheie: *Pinus strobus*, introducerea europeana, extinderea, rugina veziculoasa, reabilitare, monografie, cooperare științifică
(Tradus de I. Blada)