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Ecology of elms in Romania

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Abstract

The resistance of indigenous elm species to Dutch Elm Disease (DED) has been studied since 1991 with emphasis on natural forests. The situation varies with altitude, local conditions, species and with stand origin. The variability in morphological characteristics is important and some varieties are described. The taxonomy of elms in Romania, as in the whole of Europe, seems to be confusing (*Ulmus ambigua* was described in 1952 by Beldie in *Flora of Romania*). Natural hybrids between field elm and mountain elm were observed both in natural and artificial stands, especially in border zones for the altitudinal distribution of the species. Seedlings from the natural provenances and open pollinated seedlings from hybrids produced in the Dutch breeding programme were artificially inoculated with *Ophiostoma ulmi*- Buism.. Most of the seedlings died, but results show an important number of surviving individuals from natural provenances. In some natural and artificial stands, it was observed that beside transmission of the disease by insects (*Scolytus spp.)*, it was spread through root sprouts especially in field elms, from the dead «mother tree» within a few years, as well as by root grafts to proximal healthy trees («biogroups»). Because of the genetic incompatibility of individuals in some cases, the grafting cannot succeed and neither can infection. In the natural forest where the ecosystem is in equilibrium and functions normally, DED is present but its damages are not so important. The study of elms in natural forests provides valuable information for the problems caused by DED.

Key words: glacier refuge, taxonomy, provenance, population, ecotypes, natural forest ecosystem.

Resumen

La ecología del olmo en Rumanía

La resistencia a la grafiosis de las especies nativas de olmo ha sido estudiada desde 1991, haciendo especial énfasis en los bosques naturales. La situación varía con la altitud, las condiciones locales, las especies y el origen de la población. La variabilidad morfológica es grande, habiéndose descrito algunas variedades. La taxonomía de los olmos de Rumanía, como en el conjunto de Europa, es confusa (*Ulmus ambigua* fue descrito en 1952 por Beldie en *Flora of Romania*). Se ha observado la existencia de híbridos naturales entre el olmo campestre y el olmo de montaña, tanto en rodales naturales como en artificiales, sobre todo en la franja altitudinal de contacto entre ambas especies. Se ha inoculado artificialmente con *Ophiostoma ulmi* Buism. Una serie de brinzales de origen natural y de polinización abierta de híbridos procedentes del programa holandés de mejora genética. Aunque la mayor parte de los brinzales murió, los resultados muestran que hubo un número importante de ejemplares supervivientes de origen natural. En algunos rodales, tanto naturales como artificiales, se observó que, además de la trasmisión de la enfermedad por insectos (*Scolytus* spp.*)*, hubo también, especialmente en olmo campestre, transmisión a través de rebrote de raíz, a los pocos años de la muerte del «árbol madre», así como por injerto de raíz con árboles próximos sanos («biogrupos»). Debido a la presencia en algunos casos de incompatibilidad genética de los individuos, el injerto no tiene éxito ni causa infección. En bosques naturales con el ecosiostema en equilibrio y que funcionan de una forma normal, la grafiosis está presente pero sus daños son poco importantes. El estudio de los olmos en bosques naturales proporciona información valiosa sobre los problemas causados por la grafiosis.

Palabras clave: refugio glaciar, taxonomía, procedencia, población, ecotipos, ecosistema forestal natural.

Introduction

Amongst the 30 or more elm species naturally distributed on three continents in the Northern hemisphere (Gil and Garcia-Nieto, 1990), three native species: *Ulmus minor* Mill.-field elm, «ulm de camp», *Ulmus glabra* Huds.- mountain elm, «ulm de munte» and *Ulmus laevis* -Pall., «velnis», are common in natural forests in Romania. Some varieties of *U.minor* and *U. glabra*, their hybrid *Ulmus x hollandica* Mill. and the introduced *Ulmus pumila* Pall. are largely used as urban trees.

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Elm culture has a rich and important history. Names derived from the word «elm» are common for many localities (Ulmu, Ulmeni, Vanjul Mare…) and also common for many people as surnames (Ulm, Ulmeanu). Elm species have been well known and soundly used by people in rural areas for centuries, being part of the local people's culture and civilisation. Historically, in Romania, as in the whole of Europe, the multiple use of elms for wood, for fodder and as an urban tree in very many localities led to the spread of elm species on a large scale by planting large areas with seedlings from the same parent tree. This is the same type of practice as for some other species affected by important diseases (five-needle pines and *Castanea dentata).*

The oldest references to elm species in Romania are from the Tertiary period: Paleogene (Muereasca-*U. braunii*), Oligocene (Valea Almasului-*U. longifolia*), Miocene (Balta Sarata-10% *Ulmacee*) (Pop, 1944). During the Pleistocene period the recorded elm pollen levels were low in Europe according to the analyses performed by Huntley and Birks (1983) (from Gil and Garcia-Nieto, 1990) for a 13,000 years period, after the last glaciations, supporting the hypothesis that *Ulmus spp.* were concentrated in the Southeast of Europe after the last glaciations. The hypothesis that the Danube gorge area was a refuge for some species, and that there was a warming of the glacier climate, is based on pollen diagrams presenting an inferior Quaternary association with *Ulmus,* as described by Pop (1944). There are also other reports (Petrescu, 1967) and some archaeological proof of the warming of the glacial climate here such as: the retreat of *Elaphus* earlier than Boreal, the existence of the horse and the appearance of the deer (Boroneant, 1971). Pascovschi (1967) considers that a glacier refuge occurred in the same area, along both sides of the Danube, and also considers *Ulmus glabra* as one of the species remaining here during the glaciations. The continuity of elms in *Quercetum mixtum* is remarkable in this area (Pop *et al*., 1971). Many authors describe a very large morphologic variability and very many species and varieties for the elm species in this area (Jancic, 1984; Beldie, 1952).

The study on the resistance of indigenous elm species to Dutch Elm Disease (DED) was carried out in a small research project started in 1991 and ended in 1996. It focused on the resistance of elm provenances (populations) from natural forests. It is estimated (Giurgiu, 1995) that 70% of the Romanian forests maintain their natural appearance and there still are important areas of untouched natural forests, where native elm species are still present (Borlea, 1998). The historical data about elms in the region could easily generate confusion because of the unelucidated taxonomy, the possibility of natural hybrids and different approaches taken.

The aim of this study was to identify and select elm populations with healthy individuals in order to use them in the breeding programme for resistance of native elms to the DED attack.

Material and Methods

A study based on available literature was done concerning the biology of elms in Romania (Beldie, 1952; Boroneant, 1971; Ceianu, 1963; Donita *et al*., 1990; Fekete and Blattny, 1913; Enescu and Enescu, 1957; Georgescu, 1957; Jancic, 1984; Paschovschi, 1967; Petrescu, 1967; Pop, 1944; Pop *et al*., 1971; Stanescu, 1979; Stanescu, 1984; Stanescu and Parascan, 1982). In the present study, Richens' (1986) approach of a two-species concept was adopted (*U. minor* Mill, was used for the field elm, *U. glabra* Huds. was used for the mountain elm).

The study of resistance of elm natural populations/provenances to DED started in 1991 as a small research programme of the Forest Research and Management Institute.

An essay of assessment of elm distribution in Romania was performed using the informational system for forests of the National Forest Administration (districtual management plans) combined with personal inventories in the selected area, with data from the Forest Monitoring Data System (the 16×16 km, 4×4 km and 2×2 km sampling plot networks) and with local information from different sources. The Forest Monitoring Data System in Romania established the first national systematic network of sampling plots for forest vegetation assessment (2×2 km) in 1991. This was abandoned and replaced in 1994 by a 4×4km network. The European plots network for Forest Monitoring Scheme (16×16 km) was also adopted in Romania in 1994.

The assessment of forests with elms and their present-day condition was performed in selected forest districts, mainly in the West and Southwestern part of Romania. The study was a difficult operation using, basically, the very poor data (for elms) from the informational system for forestry (established in 1986) of the National Forest Administration (managing 100% of the Romanian forests until 1990, and 95% of the Romanian forests until 1996). Local data provided by

Figure 1. Location of the selected elm provenances and populations for resistance to Dutch elm disease *(Ulmus minor:* 1-10; *Ulmus glabra:* 11-24, *Ulmus laevis:* 25-28, *Ulmus pumila:* 29-30).

forestry personnel and personal observations in the field were used as well.

An analysis of ecological conditions for the natural forests containing elms in Romania was performed according to type of flora, type of forest sites, type of forests and type of ecosystems. The present-day forest flora classification in Romania consists of 53 types, which was proposed by Beldie and Chirita (1967).

A new approach to the forest typology system based on the forest ecosystems concept was developed by Donita *et al.*(1990). This proposal realises a system of conversion of the old classifications (forest types and forest site types), on a new and more comprehensive conceptual basis for the natural forest classification.

The method used by Jeffers and Richens (1969) and Ipinza Carmona (1990) was adapted and used for the analysis of some elm morphological characters. The possible correlation between the resistance to DED and morphological characters was studied.

The assumption that DED was generalised in Romania in the past was admitted (Petrescu, 1967).

Mature elm trees, phenotipically resistant to DED (182 individuals), of different ages, were selected from 25 natural provenances/populations (8 *U. minor,* 14 *U. glabra* and 3 *U. laevis)* and from five different plantations (two *U. minor***,** one *U. glabra* and two *U. pumila)* (Borlea, 1996).

Provenance tests were performed with seeds obtained from open pollinations and controlled crossings of selected elm trees using polyester bags (Mittempergher and La Porta, 1991) and 30 seedlings/population were used in the experiment for each variant. The experiment included seeds received from the Netherlands and Slovakia, and grafts. A randomised experiment with seedlings (10 seedlings Q¥ 3 repetitions) and with grafts was conducted in the nursery of the Forest Research Institute-Timisoara branch, starting in 1991. Seedlings were inoculated with a local isolate of *O.ulmi* and the resistance was assessed 3 and 4 years after inoculation using the method proposed by Hans Heybroek (1957) and under his guidance.

Results

Location and structure of elms

The oldest reference found discussing elm distribution in natural forests in the region (Fekete and Blattny, 1913), mentions for *Ulmus montana* With. (*U. scabra* Mill.) the following altitude ranges of distribution: between 179 m and 1,365 m in Northeastern Carpathians, between 478 m and 1,440 m in Eastern Carpathians, between 375 m and 1,430 m in Southern Carpathians and for *U. campestris* L. (*U. glabra* Mill.) with maximum altitude: 708 m in Eastern Carpathians and 878 m in Southern Carpathians. The current observations (Borlea, 1996) show that the lowest altitude of occurrence for *U. minor* is 1 m in the Danube Delta and 200 m for *U. glabra* in Southwestern Romania (Herculane and Cheile Nerei), on limestones, with the maximum

altitude of 1,550 and 750 m in Southeastern Romania and in Retezat mountains respectively.

The structure of age classes for natural forests with elm species based on the forest informational system data show that of the forests containing elms almost 50% are under 40 years old, 24% are between 40-100 years old, and 22% are over 100 years old. Present and past (unique) records of areas containing elms in the Ceala-Arad forest district (first record of DED in Romania) indicate a decrease from 554 ha in 1954, before the second epidemic, to 35 ha in 1990 (Borlea, 1996). During this period the average age of field elm stands in the same forest district increased from 40 years in 1954 to 53 years after the epidemic (the most «affected» individuals being around 25-30 years), and then decreased drastically, because of the very intense mortality due to DED, between 1965-1989. This situation is quite typical for what has happened in Romania in the last 50 years concerning the elms. Trees of more than 100 (300,…700) years of age (> 2m diameter) are still alive in some areas (Izvoarele Nerei-Caras Severin district, Pojorata-Suceava district).

Elm taxonomy and morphology

Practically, the three native elm species are common in the natural forests in Romania in accordance with their ecological requirements:

— *Ulmus laevis* Pall, section *Blepharocarpus* Dum.

— *Ulmus minor* Mill.-field elm, section *Ulmus (Madocarpus)*, series *Nitentes* C. Sch., which is very frequent throughout the country, with important variable morphologic characters; relatively sensitive to DED, it was very affected in the past but there still are survivors in highly infected areas.

— *Ulmus glabra* Huds.-mountain elm, section *Ulmus (Madocarpus)*, series *Nitentes* C. Sch., with its main natural area of distribution occuring above that of field elm. The morphology of this species is also important, characterised by «hairy» leaves as in *U. wallichiana* and by sprouting and early rhytidom formation. This feature was observed in the National Park Retezat (Borlea, 1996).

The presence of the three native elm species in the same population was registered in Herculane, river Cerna valley (Borlea, 1996). The most renowned authors who described elm species variability in Romania were Beldie (1952), and Stanescu (1979). Beldie described for the section *Madocarpus*, the following taxa identified in the natural forests as *U. minor*:

— *Ulmus foliacea* Gilib., recorded from throughout the country in the mixed forests, from plain and hilly regions, with some varieties: *var. genuina*-Beldie *var. nova, f. sp. carpinifolia* C. Georg et Mor., *f. sp. corylifolia* (Host) C. Georg et Mor., *f. sp. tilifolia* (Host), *f. sp. suberosa* (Henry) Beldie comb. *Nova, var. stricta* (Lindl.) Rhed.Man (1934).

— *Ulmus procera* Salisb was found in all plain regions, with *var. typica* Beldie, *var. nova* (South of Romania, Poenari-Ploiesti, Jugureni-Mizil), *var. suberosa* (Mnch.) C. Georg et Mor., *var. australis* (Henry) Rhed. Man, *f. ellipticifolia* Beldie, *f. nova* (Gostinari-Bucharest) and *var. dalmatica* (Bald) Hayek Prodr.

— *Ulmus ambigua* Beldie sp. hybr. *Nova* (*foliacea x procera)* occurs in the whole country, with two varieties: *var. asperrima* (Simk) and *var. nitida* Beldie.

Beldie identified also one species as mountain elm:

— *U. montana* Stokes in some plain area of Southern Romania: Oltenia region and around Bucharest, adding some forms and varieties: *typica* Beck, f. *glabrata* (Soneder), *var. laevis* (Zapal.), *var. grandifolia* (Host)., and cultivated *var. pendula* (Lodd.) Loud. and *var. fastigiata* (Loud.).

The variability of morphological characters of elm species was analised. For the elm species, the ANOVA showed significances for the following variables: type of crown, basal leaf asymmetry, relative width of the leaves, and relative width of the primary leaf teeth.

Ecotypes

The ecotypic variation of different forest tree species was studied by many authors: Schmitdtvogt (1972), Parrot (1973), Burdon (1978), Stanescu (1979), Enescu (1985). In Romania, «ecotypes» were described as intraspecific units for some forest tree species, as influenced by local climatic conditions, for example: 1) the «high altitude beech» in the South-Southwest of Romania, the mountains of Northwest Oltenia, and the «high altitude spruce» *Picea abies* (L.) Karst, or 2) by soil conditions, thus the two ecotypes of *Fraxinus excelsior*-L: meadow and limestone, and those of *Abies alba* Mill., »the «sandy soils» and the «heavy soils», in Bucovina, Northern Romania (Stanescu,1979).

Stanescu (1979) described *U. minor* in Romania as a species with high adaptation ability concerning the soil humidity, with two ecotypes: 1) the «silvosteppe ecotype» typical of relatively dry, mellow, drained soils, appropriate for typical silvosteppe forest sites and supporting well drought conditions, recorded

mainly in the South-Southest of Romania but also found in the West of the country: Timisoara, Cenad, Arad, Ineu, (Borlea, 1996); 2) the «meadow ecotype», growing mainly throughout the country, disseminated in easily flooded areas, together with poplar, willow and *U. laevis*. Along river banks, in some meadows, there are some small pure, or relatively-pure field elm forests. In the Western part of Romania the diferentiation of the two above-mentioned ecotypes is difficult to make because many intermediate types exist (Borlea, 1995a). Also, the «clinal variation» described for elms (positive correlation between the size of elm leaves and geographic longitude) (Stanescu, 1984), was not statistically demonstrated for the elm species in Romania (Borlea, 1996). In sylvosteppe throughout the country, *U.minor* reacts to the dry climate by forming «*suber* wings» on twigs (Stanescu, 1979).

Ulmus glabra is well represented in undisturbed natural forests, mostly along river valleys and extends from hilly regions where it is diseminated in mixed oak-beech forests. Above high altitudes of 1100-1600 m it grows diseminated or in groups, in relatively pure beech stands or in mixed beech-coniferous stands (National Park Retezat, National Park Semenic-Cheile Carasului) (Borlea, 1996). In some cases, such as in river gorges or on limestone with rich soil, the mountain elm can grow and form pure or elm-sycamore-mixed stands in small areas. The mountain elm is very resistant to low temperatures, but is sensitive to drought and dry soils and requires productive forest site types; however, it does not tolerate a high level of soil humidity for long periods of time. *U. laevis* is very common along rivers in South-Southwest Romania, growing well in easily flooded areas and medium-poor soils. At some places the three native species grow together (gorges of Cerna river, on limestones, in Southwest of Romania).

Forest types with elms

The intense work on forest ecosystem classifications conducted in Romania has a long tradition. The first references to the forest type classifications in Romania are from Z. Przemetchi (1921) when he published «Forest types, the base of the scientific silviculture». The forest type was defined as a «systematic unit which includes all forests growing in similar site conditions and which are characterised by the same external form and by the same biological characteristics», a very simplistic and general definition (Donita *et al.*, 1990). Other authors developed a broader methodological basis (Georgescu, 1931, 1933, 1934, 1941, 1945, Pascovschi, 1935, 1943, Beldie, 1940, 1941, 1951, Georgescu and Constantinescu, 1945, from Donita *et al*., 1990). In 1938, the Forest Research Institute started, under the guidance of Constantin Chirita, the first general study of natural forest types in Romania as a future basis for refforestation works, and in 1948, Pascovski started systematic research for forest types as a basis of management planning. Results were presented and approved by the first «Conference on forest types» in 1955 (Donita *et al.*, 1989). The work on natural forest types continued over the next decades (1948-1980) developing into two directions: the forest types and the forest site types. Elms were always included as part of the natural types of forests in spite of very severe damages caused by DED.

An inventory of forest areas with elms, using the present-day informational system and the present-day classification systems for types and sites for forests was performed in the Western Romania selected districts (Timisoara, Lunca Timisului, Sebis and Gurahont). The results show some data concerning the ecologic conditions for the field and mountain elms.

U. minor: in the Timisoara forest district, elms grow on an area of 1863 ha in which 15 forest site types and 24 forest types were identified. In the Lunca Timisului forest district, elms grow on an area of 1670 ha in which 16 forest site types and 32 forest types were identified.

U. glabra: in the Sebis-Moneasa and Gurahont forest districts, where mountain elm grows together with field elm on an area of 2533 ha and 3021 ha, respectively, 18 forest site types and 28 forest types were identified in the first, with corresponding figures of 18 and 28 in the second.

U. minor, being less sensitive to humid conditions, covers areas which are typical for *Q. cerris* and *Q. frainetto,* and to some extent, also the rich soils from meadows bordering rivers. *U.glabra* covers mainly areas with rich soils. The predominant flora types for field elm are : *Brachipodium-Geum-Pulmonaria* (over 30% from the total), *Carex-Poa pratensis* and *Asarum-Stellaria,* mountain elm is mainly associated with *Asperula-Asarum* (over 70% of the total area).

Forest ecosystem types with elms

More complex studies of natural forest types in Romania taking into account the ecosystem concepts we-

re begun in Romania around 1970. Forestry was by that time in the position to reconsider the previous classifications of natural forests (Stanescu and Parascan, 1982).

Elms are present in 51 different types of natural forest ecosystems in Romania (Borlea, 1995a), but only in two forest ecosystem types where elms are the main species, i.e.: 0212 with *Hiphophae rhamnoides* and *Calamagrostys epigeios* and 0217 with *Rubus caesius-Gallium aparine*. The other 49 types include native elm species either disseminated or occurring in small groups (Borlea, 1995a).

Phenology and crossability of native elms in Romania

Because native elms in Romania are generally protogyne species, flowering and pollen dissemination for field elm and mountain elm overlap, the distance for elm pollen transport by wind is relatively widespread, favouring both natural hybridization and selfcompatibility in nature. There are two barriers against normal pollination: low temperatures affecting pollen viability (possible explanation for the high rate of empty seeds of mountain elm) and the washing-off of pollen from flowers by rain. These barriers and the possible «selfing» factor hinder the pollination between widely spaced individuals, especially concerning mountain elm. The low temperatures and rains recorded between 1992-1996 in Timisoara, during the pollen dissemination period, severely affected seed set and viability (Borlea, 1995a).

The field elm seeds obtained from open pollination were viable in a proportion of 71,7% and those obtained in plastic bags from «selfing» were 13% viable. Corresponding figures for mountain elm were 34% and 0,5%, respectively. Possible natural hybrids (related to the typical species morphological characteristics of leaves, twigs, buds, seeds and flowers) between field and mountain elm were observed in mixed forests along the rivers in the hilly regions (Bozovici, Gurahont, Moneasa, Savarsin, Resita, Brasov, Cluj) (Borlea, 1995a). Sprouts (over 24% of the total) and «clumps» (12% of the total) are important when the total number of young field elm individuals is estimated in Padurea Verde-Timisoara (Borlea, 1996).

Elm withering

The withering of elms in Romania is caused mainly by DED, but the problem has been little studied here, in spite of the general importance of the species and the very important damages attributed to the disease. Natural disasters, DED and human activities are reported as being mostly responsible for the damages caused to the forest in Romania. The first symptoms of DED caused by *Ophiostoma ulmi* in Romania were reported in 1922 in Western Romania (Pecica-Arad district), but dying elms with typical DED symptoms were recognized before 1910 (Georgescu, 1957).

Two important periods of high rate elm mortality (epidemic) were recorded: the first as occuring between 1925 and 1935 and the second one between 1955 and 1965, mainly located in the Northeastern part of Romania. The first report about dying elms and DED in Romania was presented at the International Congress on the Plant Protection-Bucharest in 1949. In 1959, after very important damages, the elm situation was analysed and important decisions were taken to cut down all elms that were damaged or infected with DED. In 1959, more than 102 ha of pure elm forests were clear-cut and numerous elm trees in other areas were extracted in «hygiene operations» (Petrescu, 1967). Important eradication of elms affected by DED took place in Romania for decades after the Second World War. The possible transmission of the disease into the numerous sprouts produced from diseased trees might hinder the efficacy of sanitation measures.

The disease intensity presently continues at low levels, DED being also present. As well known, the disease is also transmitted by root grafts, a feature which was observed in Timisoara (Borlea, 1995a), between proximal individuals («biogroups»-Otto, 2000). Also, possible mycoplasma symptoms (Ploaie, 1973) were observed in Bucharest and could be considered relevant in some cases when an accelerated (one year) elm dying was recorded.

A small research project on native elm trees and their resistance to DED started in 1991 with an elm inventory carried out in selected areas. Seedlings and clones of selected elm trees from natural provenances/populations, as also open pollinated seedlings and clones from hybrids produced in the Dutch breeding programme were artificially infected with the local race of *Ophiostoma ulmi*-Buism. The operations of obtaining seedlings and grafts from selected populations and clones as well as the inoculation procedures were performed under the guidance of Mr. Hans Heybroek. Results of resistance of the tested populations/provenances of the field and mountain elm species were variable. Repeated inoculation heavily affected most se-

edlings and some populations/provenances of native elm species survived and are still in good health and vitality as of today (*U. glabra:* Retezat provenance, populations Gura-Zlata and Rotunda). Some good results were recorded for *U. minor* (provenance Timisoara), but meanwhile, some of the parent trees were affected by DED and died. No relations were recorded between the studied morphological characters and resistance to DED for the tested elm populations/provenances.

Discussion

Data on the relatively reduced percentage of elm species in the composition structure of the Romanian forests, as shown by current inventories and their reduced dissemination, point to the reduced importance of elm in the Romanian sylviculture nowadays. Field elms are better represented in the young age classes than mountain elm, mainly due to the occurrence of their layering habits after harvesting mature elms but also due to their frequent sprouting, as well as to the better climatic conditions in the plains (more favourable for pollination than for the mountain elm).

Also a kind of resignation of our foresters is observed concerning elm sylviculture. After a «good period», until around 1960 when elms were cultivated and used in plantations, especially in shelterbelts in the plain area, elms were not investigated any further and no elm tree plantations were recorded in Romania for more that 35 years. Elms were considered a disappearing species, due to the general occurrence of DED in Romania (Petrescu, 1967). In spite of all the abovementioned problems, there are still many healthy individual elm trees in our natural forests which resisted the successive disease attacks due to their natural genetic variability.

Elm species show a large morphological variability, and new elements were described for the mountain elm natural populations in the Retezat National Park (Borlea, 1995a). A «hairy form» of *U. glabra* with morphologic characteristics similar to *U. wallichiana* was also described in the National Park Retezat (Borlea, 1995a, 1995b).

Beldie described the elm species variability in Romania in *Flora of Romania* (1952), but their taxonomy is still confused. However, the approach of considering three native species, *U. minor*, *U. glabra* and *U. laevis*, is appropriate. Natural hybrids were reported in the literature and also observed in forests and plantations in Romania (Borlea, 1995a). Crossability between mountain and field elm species and selfing for the abovementioned species were mentioned by Mittempergher and La Porta (1991) and in the present study.

Field elm like other forest trees species, living naturally in very large areas and in different ecological conditions, is represented not only by varieties and forms, but also by «ecotypes». Two ecotypes were described for *U. minor* in Romania (Stanescu, 1984), the «silvosteppe ecotype» and the «meadow ecotype» but these are not easy to recognize in the field because of the very many intermediate existent forms (Borlea, 1995a). The large «polymorphism» of elm species is shown by the outstanding variability of morphological characteristics, by the nearly general distribution of elms in the country in a very broad spectrum of ecological conditions and also by the coexistance of all three native species in the same populations.

Major damages caused by patogens to forest tree species concerned broadly planted species using seedlings obtained from seeds collected from limited numbers of trees. Yet, in spite of very serious damages, resistant individuals may survive and elms in this respect may not be an exception.

In natural forests a state of equilibrium between tree resistance and disease incidence may be more easily maintained. However, «natural forests» in Europe nowadays are not widespread, but the facts in Romania show that the more undisturbed a forest is, the less important are the damages caused by DED. In Romania, 70% of the forests maintain their natural appearance due to the management performed during the last century, when less emphasis was placed on replacing the native species with «fast growing species».

The preliminary study on the selected natural indigenous elm populations in view of assessing their resistance to DED shows promising results, especially for *U. glabra.* The number of healthy *U. glabra* in similar types of forests is positively correlated with the undisturbed conditions of the forest stands concerned. The undisturbed natural forests, especially those in the Retezat National Park and in the Semenic-Cheile Carasului National Park, could be better studied in order to understand the natural resistance of *U. glabra* to DED, in parallel with or included within other international projects. The ecological potential of the elm extension in Romania is very important in the context of the large areas still available for afforestation, of the adequate legislative framework and of the international programmes.

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