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THE CORRECT ASH NATIVE SPECIES IDENTIFICATION: APPLICATION TO MIXED ASH FORESTS OF ROMANIA

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Abstract: There are 5 native ash species in the forest flora of Romania (the **common ash** *Fraxinus excelsior*, the **narrow-leaved ash** *F. angustifolia*, the **manna ash** *F. ornus* and the **hairy ashes** *F. palisae* and *F. corriarieifolia*), besides the American ashes accidentally introduced in the natural forests. The **common ash** and the **narrow-leaved ash** can be rather easily mistaken for one another, leading to troubles in the seed collection for afforestation.

Although the distribution areas of the two species, as well as their ecological requirements, are different, they can still grow mixed in the same woods: either in the riparian forests of the big rivers, where the seeds of *F. excelsior* are transported by the water stream from the hilly regions, or also in the planted stands, the latter because of their previous grounding upon wrong seed collection.

The focus on the Romanian ash species and populations was due to the partnership of Romania in the EU-funded FRAXIGEN project, during the 2002-2005 period. The aim of this project was the definition of ash populations from the point of view of genetic diversity, phylogeography, mating system and phenology.

We found that in management studies, the species *Fraxinus excelsior* and *F. angustifolia* have not been treated apart, but together, as “**ash**”. This fact has caused the collection of mixed seed samples and the plantation of ash seedlings in non-suitable areas.

In order to avoid these problems in the future, a practical guide for the correct identification of the ash species was produced, based on the most valid identification criteria: mating system, type of inflorescence, color and shape of winter buds. In order to estimate the identification criteria validity, the wide variability among most of the morphological traits, as well as the presence in both species of some phenotypes having features of the other species were considered.

Keywords: ash, *Fraxinus*, species identification, discriminant criteria, morphological traits, variability, seed collection.

Introduction

The correct identification among Romanian native ash species and populations was brought forward by the partnership of Romania in the EU-funded FRAXIGEN project, during the period 2002-2005. The purpose of this project was the definition of ash populations, based on genetic diversity, phylogeography, mating system and phenology.

The aim of this paper is to provide a background for the correct seed collection in ash, avoiding the mistakes caused by the incorrect species identification, especially in seed stands where the species *Fraxinus excelsior* and *F. angustifolia* co-occur.

The common ash (*Fraxinus excelsior*) and the narrow-leaved ash (*F. angustifolia*) are normally distributed in different areas of Romania: the common ash mostly on hilly regions and the narrow-leaved ash mostly, in riparian forests. Despite of their different ecological requirements, the two species can grow together in floodplains along most of the big rivers, because seeds of *Fraxinus excelsior* are waterborne from upstream hills in *F. angustifolia* habitats.

Nowadays, in the Romanian forest management studies, the two most widespread ash species *Fraxinus excelsior* and *F. angustifolia* are not separatedly considered. Even some seed stands may contain both species. Therefore, the harvesting of seeds allows the mixing of species

and the planting of both ash species in ecologically unsuitable areas: *F. angustifolia* in hilly regions and *F. excelsior* in floodplains. In some areas, the situation becomes more complicated because of the invasion of planted stands by American ash.

A practical guide for the correct identification of ash species in the field was provided, in order to avoid the usual misidentifications between *Fraxinus excelsior* and *F. angustifolia*, and also between *F. excelsior* and *F. americana*.

Materials and Methods

The observations were made in 15 ash populations distributed all over Romania and Moldavia Republic, mainly in stands containing different ash species. In each population, more than 60 individuals were observed during the vegetation period. The morphological features of winter buds, floral buds, inflorescences, branches, leaves and fruits were recorded.

The ash species, sub-species and varieties were identified according to the Flora Europaea, vol. 3 [1] and Dendrologia [3], and the forms of *Fraxinus angustifolia*, according to the Flora of Turkey, vol. 6 [2]. Supplementary informations from other sources [4, 5] have also been considered in the determination of the distributional area of ash species [4] and in the description of the reproductive system of *Fraxinus excelsior* [5].

The practical guide of species identification was drawn on the basis of the morphological observations mentioned above.

Results and Discussion

Five native ash species occur in Romania:

- Fraxinus excelsior* = Common ash
- Fraxinus angustifolia* = Narrow-leaved ash
- Fraxinus ornus* = Manna ash
- Fraxinus pallisae* = Hairy ash
- Fraxinus coriariaefolia* = Hairy ash

Besides, the American ashes *Fraxinus americana* and *Fr. pennsylvanica* are rather widely spread in planted stands because of their occasional occurrence in the planting material.

The most important ash species are *Fraxinus excelsior* and *Fraxinus angustifolia*, both belonging to the section *Fraxinus* – *Fraxinus* of the *Fraxinus* genus, that means plants with naked flowers.

Both species contain several subspecies and forms that make the taxonomic classification (even more) difficult.

We will stress only the forms that are most likely to create confusion in species identification:

- *Fraxinus excelsior* f. *acuminata* (narrow leaves)
- *Fraxinus angustifolia* f. *rotundifolia* (wide leaves). The common ash populations are usually composed of trees of three genders: male trees, female trees (rare) and hermaphrodite trees. The flowers (and fruits) are grouped in panicles.

In the narrow-leaved ash, all trees are hermaphrodites and all of them bear samaras, grouped in racemes.

In both species, the flowering buds flush before the vegetative buds, and the flowering occurs early in springtime (March – April). The flowers are naked, composed only of stamens and/or pistils.

There are many morphological criteria for discriminating among the ash species, but their weight in actual identification is quite diverse: some criteria are very weak because of high intra-specific variations. Some of these variations, such as that of leaf form, have become stabilized in particular morphological forms, like *Fraxinus excelsior* f. *acuminata*, with leaves like those of *Fraxinus angustifolia*. This form is widely spread in the eastern part of Romania

and also in Moldavia Republic, occurring in common ash stands, and usually being misidentified as narrow-leaved ash.

The *rotundifolia* form of the *Fraxinus angustifolia* was also found mostly in the eastern part of Romania, in proportion up to 50% of the ash trees.

As for the colour of winter buds, the most commonly used identification criterion, it was found that the brown colour of *Fraxinus angustifolia* winter buds widely varies, from red-brown to very-dark-near-black brown; moreover, sometimes, the colour of buds on the sprouts is different of that of the buds from the upper crown (on the same tree).

Finally, it was found that the only powerful discriminating criterion is that of inflorescence type (panicle in *Fraxinus excelsior* and raceme in *Fraxinus angustifolia*); but even this criterion may be misleading, in the case of dominantly male common ash trees (Fig. 1).

Species Criteria	<i>Fraxinus excelsior</i>	<i>Fraxinus angustifolia</i>	Validity of criteria
Winter buds	 <p>Color: black to dark brown Terminal buds with flattened node, forming a “snake-head”</p>	 <p>Color: brown (variable) flattened node does not form “snake-head”</p>	<p>weak, because of the variability of bud color in FAN</p> 
Stem (Stalk)			<p>Indifferent (Non hairy)</p>
Leaves			<p>Slightly discriminative, because of the leaf variability and atypical forms (see comments¹)</p>
Flowering apparatus	<p>Sex separation – male trees,</p>  <p>Hermaphrodite and female trees (rares)</p>	<p>Hermaphrodite trees only</p> 	<p>Very powerful only in the case of pure male FEX trees</p> 
Inflorescences and fructifications	 <p>panicle</p>	 <p>raceme</p>	<p>Very powerful, with the exception of predominantly male FEX, that form fruits only on the main axis of panicle (see comments²)</p>
Fruits (samaras)	 <p>Flattened, distally winged</p>	 <p>Flattened, distally winged</p>	<p>indifferent</p>

Fig. 1: A practical guide for the discrimination of *Fraxinus excelsior* and *Fraxinus angustifolia*. FAN = *Fraxinus angustifolia*; FEX = *Fraxinus excelsior*

Comments to the guide:

1. The narrow-leaved FEX (*Fraxinus excelsior* f. *acuminata*), with leaves like those of *Fraxinus angustifolia*, was found large areas in the eastern part of Romania (Iași county) and also in Moldavia Republic (Fig. 2).

The wide-leaved FAN (*Fraxinus angustifolia* f. *rotundifolia*) is present in 10 – 50 % of the individuals of the population in almost all FAN forests in Romania, more frequent in the eastern part of country (Fig. 3).



Fig. 2: Narrow-leaved FEX



Fig. 3: Wide-leaved FAN

2. The inflorescences of pistillate FEX trees containing hermaphrodite flowers only on the main axis of the inflorescences and only male flowers on the secondary axes (PAT), can be mistaken in the stage of fruit formation with the FAN inflorescences, having the appearance of racemes after the shedding of male flowers (Fig. 4).

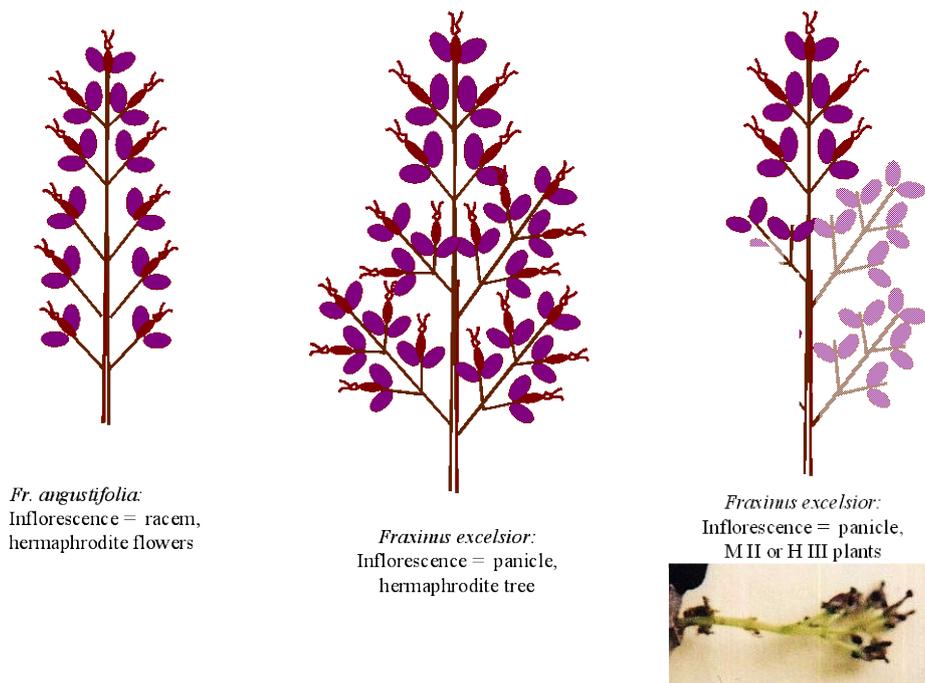
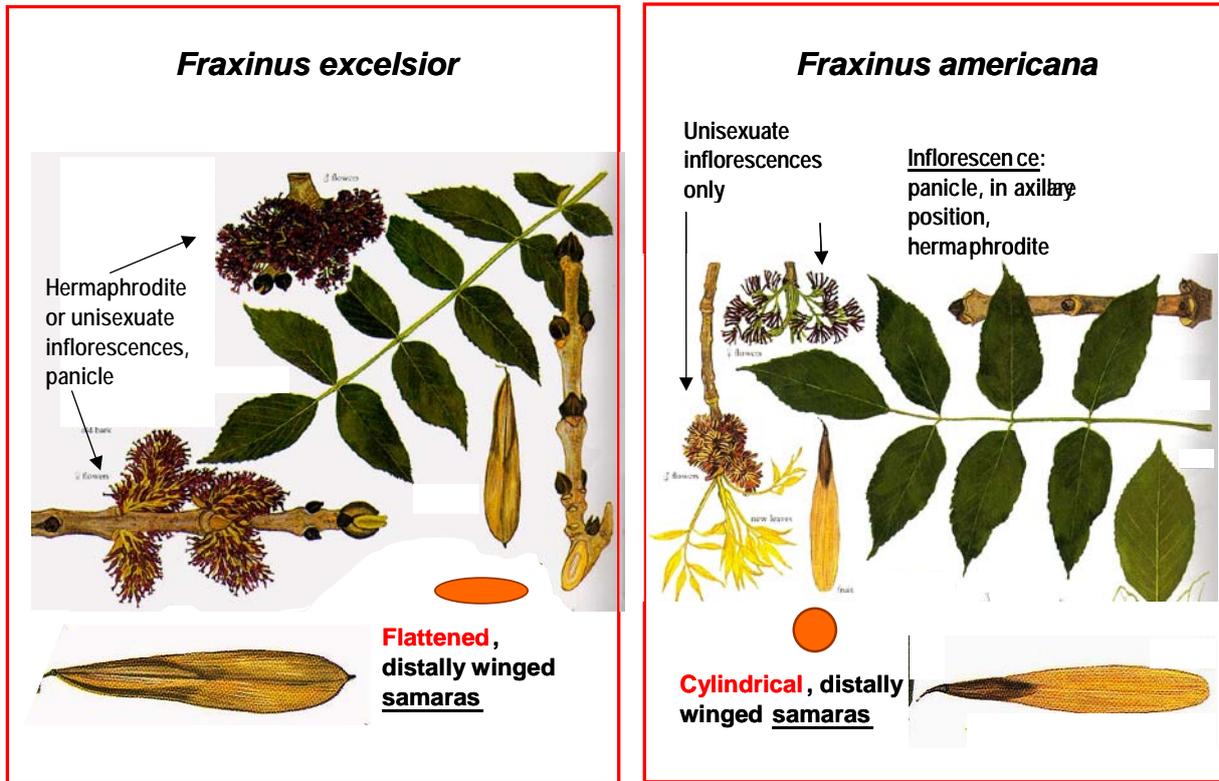


Fig. 4 - Possible confusion between *Fraxinus excelsior* and *Fraxinus angustifolia*

3. Another dangerous mistake: common ash versus American ash



Species Criteria	<i>Fraxinus excelsior</i>	<i>Fraxinus americana</i>	Validity of criteria
samaras	 Flattened, distally winged	 Cylindrical, distally winged	Very powerful

Conclusion

The importance of correct identification of ash species and of reliable seed collection and planting material production was welcomed by the end-users that adopted the following measures:

- The revision of correct ash species identification in seed orchards and seed stands, especially in the areas of mixed ash forests.
- Establishment of distinct seed stands for *Fraxinus excelsior* and *F. angustifolia*
- The introduction of different codes for *Fraxinus excelsior* and *F. angustifolia*, and the revision of species identification in the forest districts in which the management studies are now in progress.
- Use the planting material respecting the ecological requirements for each species that means planting *F. angustifolia* only in plain regions and in river valleys.

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**IDENTIFICAREA CORECTĂ A SPECIILOR AUTOHTONE DE FRASIN
ÎN PĂDURI CU AMESTEC DE SPECII****(Rezumat)**

În flora forestieră a României există 5 specii autohtone de *Fraxinus*, la care se adaugă frasinii americani introduși accidental în fondul forestier. Dintre acestea, frasinul comun (*Fr. excelsior*) și frasinul de câmp (*Fr. angustifolia*) pun probleme de identificare care se reflectă negativ în colectarea semințelor pentru împăduriri. Arealul natural al acestor specii de frasin este diferit, de asemenea și cerințele ecologice, dar amestecul lor este posibil în luncile râurilor mari (prin semințe de *Fr. excelsior* aduse de ape din zona de deal) și mai ales în parcelele plantate, datorită confuziei de la recoltarea semințelor.

Preocuparea pentru speciile și populațiile autohtone de frasini a fost ocazionată de proiectul cu finanțare europeană FRAXIGEN, care s-a desfășurat în perioada 2002-2005 și la care țara noastră a fost partener. În cadrul acestui proiect a fost cercetată diversitatea genetică la nivel inter- și intra-populațional, filogeografia, dar și fenologia și sistemul reproducător la frasini.

Întrucât s-a constatat că speciile *Fraxinus excelsior* și *Fr. angustifolia* nu fuseseră separate până în prezent în amenajamentele silvice, dând astfel posibilitatea colectării semințelor amestecate și în consecință, raionarea greșită a materialului de plantat, a fost elaborat un sistem de identificare a speciilor pe baza criteriilor morfologice celor mai valide: sistemul reproducător, tipul de inflorescență, forma și culoarea mugurilor de iarnă. În evaluarea validității criteriilor morfologice s-a ținut seama de variabilitatea intraspecifică a majorității însușirilor morfologice și de existența unor forme stabile cu caractere morfologice ale altei specii (în special în privința formei frunzelor).