Sweet chestnut (*Castanea sativa* Mill.) forest in Romania: distribution, current state, management and research activities

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1. Distribution

1.1. Global area at national level

▪ Total area: 3160 ha;

- Natural *forest* area (including natural regeneration and artificial plantation with local genotypes): 3090 ha (Bolea, 1987; National Forest Administration Inventories, 1993-94);

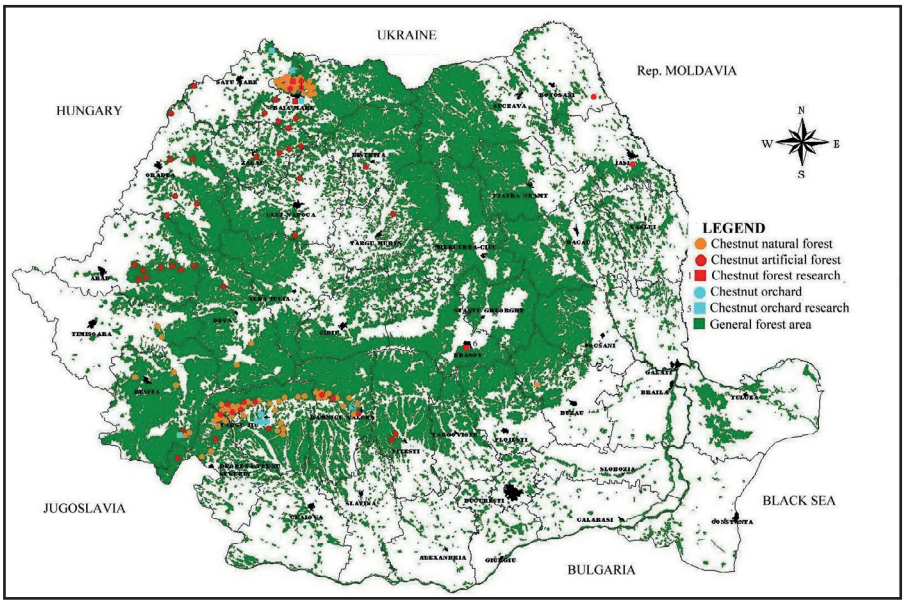

Fig.1 Chestnut distribution in Romania

- Artificial *forest* area: about 70 ha (Bolea, 1987);
- *Orchards*: 538 ha intensive orchards were planted till 1990, out of them 288 ha in Maramures County and 250 in Gorj County (Cociu, 1990), less then 100 ha remained in 2001 (SCDP Valcea estimate, 2001).

▪ Type of forest:
- *Forest*: high forest exclusively;

▪ Management:
- *Forest*: managed as regular forest;
- *Orchard*: managed for fruit production.

1.2. Regional area

In Romania, chestnut has discontinuous area, formed by long strips situated on the Carpathian piedmonts in the west part of Romania, where the general moderate-continental climate has some Mediterranean influence.

■ ***Natural distribution***. There are two principal centres (Maramureş and Oltenia) and other several small areas:

▪ *Hilly piedmonts of Baia Mare* (Maramureş Region)

Chestnut occurs grouped in a relative compact zone (2590 ha) of high forest, in northwest of Transylvania (northeast of the Oriental Carpathians). Trees and stumps of 500-800 years were found in sessile and European beech level (220-600 m elevation – Sparchez et all., 1960; Cociu, 1967; Gabor, 1976; Bolea, 1987).


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Fig. 2. Multi-centenary chestnut trees in Maramureş (1 I. Iorgu, 2. V. Bolea) and Gorj (Dl. Nereaz, Dl. Pocruiei – 3. V. Mariş; 5. E. Juveloiu)

▪ *Subcarpathian hills of Oltenia* (Gorj, Mehedinţi and Vâlcea Counties)

Chestnut has a discontinuous distribution (300 ha of pure or mixed stands and about 200 ha with sparse chestnut trees) in northwest of Valachia (southwest of the Transylvanian Alps). Chestnut occurs in sessile oak (rarely in European beech) level, at 160-770 m elevation. Some old trees of assumed 500-1000 years and 5-8 m circumference were mentioned in literature (Conea, 1931; Chiriţă, 1934; Cociu, 1967).

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Fig. 3. Multi-centenary chestnut trees in Vâlcea County (Horezu – 1. M. Botu, 2. G. Achim; Bistriţa – 3. G. Achim, 4. I. Manthos)

▪ *Other areas*:

-Southeast of the Oriental Carpathians: on the lap of Siriului Mt. (Morariu, 1942).

-Northwest and southwest of Transylvanian Alps: several forests on the lap of the following mountains: Retezat (7 m in circumference – Stefan, 1962), Poiana Ruscă, Semenic (Conea, 1931; Chiriţă, 1934; Cociu, 1967; in Bolea, 1987).

■ ***Artificial distribution***

▪ Piedmonts and lowlands of the Occidental Carpathians (Pădurea Craiului, Codru-Moma, and Zarand Mts.): chestnut

has high production and natural regeneration.
▪ Pannonian Field (150-160 m elevation): good results on rich soils and bad on sandy ones.
▪ Transylvanian Plateau: plantations with natural regeneration but low-medium production.
▪ A great part of the chestnut forests from natural area is artificial, but there was generally used local seed material.

1.3. Ownership and property distribution

- *Forest*: public, rare private;
- *Orchard*: private, public (collection).

2. Management
2.1. Actual status / Treatments

Protection / Conservative status. Sweet chestnut is protected (Law no. 348/2003) and its habitat (9260 *Castanea sativa* woodlands) is considered with high conservative value in Romania (Doniţă et al. 2005). The most important chestnut forest are integrated into protected areas:
- "Chestnut forests of Baia Mare" in Natura 2000 site ROSCI0003 and Reservation 2581 (2360 ha);
- "Tismana-Pocruia Forest" Natural Reservation (51,6 ha); Reservation *Cornetu Pocruiei*, Tismana FD – Gorj (121,6 ha);
- "Century chestnut forest" of Polovragi – Polovragi FD, Gorj;
- "Chestnut Reservation, Ileanda FD - Sălaj (20 ha).

According to evaluation guide (Combroux and Schwoerer, 2007) the habitat 9260 "*Castanea sativa* woodland" has a total unfavourable conservative status both in Maramureş and Gorj Counties.

Due to its small natural area and the mass dieback caused by invasive pathogen *Cryphonectria parasitica* chestnut habitat is very serious threatened in Romania.

Sanitary state / Treatments. In Maramureş region, between 1984 and 2002, *C. parasitica* have infected 73.7% of chestnut stands, but only 22.8 + 12.3% were severely + high infected. In 2005, 85% of stands had week vitality (management plan 2005). In 2012 all mature forest trees (from untreated stands) have been destroyed by *C. parasitica* (some old trees still survive only by several epicormic branch / sprout). Chestnut forest survived by natural regeneration of stool-shoots and (in lower rate) seedlings. Between 2005-2008 biological control of *C. parasitica* has been tested in Baia Mare region (Chira et al. 2005, Chira and Chira 2007, Bolea and Chira 2006, 2009). Natural regeneration of chestnut is generally healed in parcels subject of three years consecutively treatments (3-5 treatments), in other parcels healing process is intermediate (Chira et al. 2013). Untreated forests are dead and their regeneration is successive killed by the invasive fungus.

Fig. 4. Dying of chestnut forest and orchard produced by *C. parasitica* (Maramures)

Fig. 5. *C. parasitica* vc tests (up), treatment (down)

Fig. 6. Healed treated chestnut (up) and sessile oak (down) (Tautii Magheraus, Maramures)

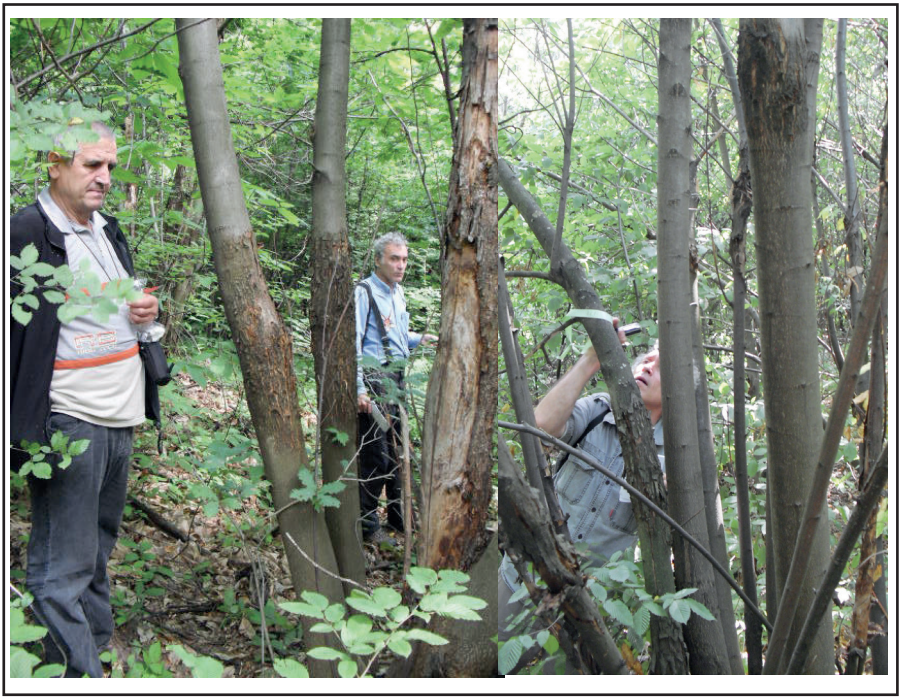

Fig. 7. Healed cankers – healthy chestnut forest (Baia Mare, Maramures)

In Tismana Forest District (RNP Romsilva, Gorj County), in 2013 *C. parasitica* have severely infected all the chestnut stands, the dying process being in rapid evolution (it is presumed in the next few years all the mature chestnut trees will die). In the summer of 2013 ICAS team (D. Chira et al.) has started the biological treatment of *C. parasitica* in relative young regenerated stands of Tismana F.D. (project Life+ 11NAT/RO/825).

Fig. 8. Chestnut forest in Pocruia Reserve (Tismana F.D., Gorj, Oltenia), in 2004 (up) and in 2012 (down), before the Life+NAT/RO/825 reconstruction project

2.2. Silviculture

▪ **For timber.** In mixed stands, chestnut has generally a second importance, the stands being managed especially for sessile oak or European beech wood production. Pure chestnut stands have timber as principal aim, fruit production being secondary. Special measures for increasing the fruit yield have been seldom taken. Anyway, after 1990's pure stands with chestnut were no more planted in Romanian state forest.

The main characteristics of chestnut silviculture in Romania are the following:

- *Area of utilization*: sessile oak and hilly European beech sites from the northwest and southwest regions of Romania.
- *Type of stands*:

a). Mixed stands with sessile oak or European beech as principal species;

b). Pure chestnut stands (in the past).

- *Silvicultural system*: only high forest system.
- *Regeneration felling*:

a) Group shelter-wood system with natural regeneration and artificial planting as complementary for mixed stands;

b) Clear cutting with artificial regeneration for substitution of the damaged (polluted) stands.

- *Regeneration*.

a) Northwest: plantation with 5000-7000 seedling/ha (rarely seeding 5000 blocks/ha with 2-5 seed/block). In mixed stands chestnut is planted in groups of 25-50 seedlings for minimize the competition in mixed

stands.

b) Southwest: plantation with 1250-2500 seedlings/ha.

- *Rotation*: 120 years in both pure and mixed stands.
- *Weeding*: only in mixed stands, especially for sessile oak.
- *Cleaning*: in dense forests – mixed stands (NW, SW – periodicity of 3-5 years) or pure stands (NW).
- *Thinning*:

a) Mixed stands: managed for sessile oak and European beech – 4-6 intervention with periodicity of 5-6 (8) years (first interventions), then of 8-10 (12) years; starting when the trees have about 10 cm diameter;

b) Pure stands: higher periodicity (4-6 years).

- Pruning: only natural.
- Fertilizations: none in forest.
- Type of products / assortments: timber (panel), rural construction (pillar), farm use (vine / vegetable prop).

▪ **Timber production** varied with site characteristics, stand composition and age (north area - Bolea, 1987):

- Mull floraed - chestnut stand of high productivity*: from 397 m^3/ha (30 yr) to 664 m^3/ha (130 yr) (*after Romanian classification);
- *Festuca drymeia* / *F. heterophylla* - chestnut or mixed stands (with European beech or sessile oak) of medium productivity: from 297-350 m^3/ha (50 yr) to 416-450 m^3/ha (60-100 yr);
- *Luzula albida* - chestnut or mixed (with sessile oak) stands of low productivity: from 263 (60 yr) to 301 m^3/ha (100 yr – stands affected by pollution);
- *Ericaceae* - chestnut or mixed (with sessile oak) stands of

very low productivity*: from 125 m^3/ha (60 yr) to 203 m^3/ha (75 yr).

2.3. Fruit Orchards

- **Orchards management**.

Fig. 9. A 120 - Years old orchard in Dăeşti – Vâlcea.

Fig. 10. A 15 - Years old orchard at SCDP Vâlcea.

Chestnut orchards have been established since 14th Century around the monasteries from Oltenia, in the SW part of Romania (North of Gorj and Vâlcea counties). Parts of old chestnut orchards are still existing at Tismana, Polovragi (Gorj County) and Horezu, Bistriţa, Turnu – Călimăneşti (Vâlcea County).

Due to the sweet chestnut environmental requirements spreading of chestnut as fruit tree crop was limited to the favourable microzones. As consequence, sweet chestnut was considered as a minor fruit crop.

As result of selection work carried out by Fruit Research Stations of Baia Mare and Tg. Jiu several cultivars have been named and used for establishing up to 600 ha of orchards mainly in Maramures, Gorj and Vâlcea counties. Orchards were established with grafted material on seedling rootstocks usually at 8 by 6 m planting distances.

▪ **Fruit production** in chestnut forest varied with the type of culture (forest or orchard), site characteristics, stand density and age, chestnut genotype, management, etc.:

- *Forest*:

a) Northwest: 82 t/yr in Baia Mare Forest District (F.D.), that means 117-888 kg/ha and 0,8-10 kg/tree. In the stands managed for fruit production too, nut yield was higher and differed with genotype: 40 kg/tree for f. *sativa*; 25-30 kg/tree for f. *elongata*, f. *polycarpa*, and sf. *racemosa*; 5-8 kg/tree for f. *brevispina*; and < 1 kg/tree for f. *javorkae* (Bolea, 1984).

b) Southwest: 20 t/yr in Tismana F.D. (on 166 ha, 35 years medium age stands).

Till 1990 up to 300 t/year of chestnut fruits were collected from Gorj and Vâlcea counties, a major part of it was processed.

Kind of utilizations: self-consume, selling of fresh / cooked fruit or sweet cream.

- **Honey production**: 50-220 kg/ha (northwest).

3. Importance of chestnut

At present chestnut is more and more used in silviculture and people's farms, for ecological reasons, wood and fruits. Both in northwest and southwest, natural chestnut forest are protected as seed or natural reservations.

Ecological and cultural characteristics. As a forest species chestnut has regional interest (in its natural centres of the distribution) especially for its ecological and cultural proprieties. Chestnut is very appreciated as a secondary (helping, complementary) species in sessile oak and hilly European beech stands, for its role in soil protection, stands vertical structure and diversity, site amelioration in polluted areas, etc. (Chiriţă et al., 1934; Ceuca and Spârchez, 1960; Haralamb, 1967; Lupe, 1975; Bolea, 1975, 1977; Savu et al., 1977; Bolea et al., 1995).

Wood. Chestnut sprouts are the best as wood support for plants or fences in vegetable farms and vineyards (south-west). After 1990 natural wood furniture had a very strong increasing in house decoration in Romania. Chestnut wood is very appreciated in this kind of furniture because its special colour and resistance.

Fruits. In Baia Mare (capital of Maramureş region) every

year in autumn the "Chestnut festival" is organized. From 2013 "Chestnut festival" is organised in Tg. Jiu (capital of Gorj County, Oltenia) too. Before 1989 the chestnut fruits were used only for export or as a present for communist authorities. In the last period the fruits are more and more commercialized in agricultural markets.

In southwest chestnut became more important as a new fruit tree in people's gardens. Orchards have a short period of decreasing because of the changing of the propriety. Old state farms were split between the former / new owners. Therefore, the technological process for fruit production was temporary stop.

4. Research activities

4.1. Recent programs / projects

▪ **Forestry**

- Integrated (biological and silvicultural) control of chestnut blight in Maramureş (2004-2009: RNP Romsilva);
- Integrated biological control of chestnut blight and management of the new situation in the region of Maramureş, N. Romania (2007-2008: *bilateral project Romania-Greece*);
- Study on chestnut habitat reconstruction in protected area of Maramureş (CE - POS Environment – 2012-2013);
- Reconstruction of chestnut habitat (biological control of *C. parasitica* followed by cultural methods) in Gorj (Tismana FD) (2013-2017: Life+ 11NATRO825).

▪ **Fruit research**

- Valuation of genetic variability of walnut, hazelnut and

chestnut through obtaining competitive elites adapted to different ecological areas of Romania (2004-2006: Contract 301/AGRAL).
- *Ex situ* conservation of original genetic resources of *Prunus, Juglans, Corylus* and *Castanea* based on genetic and agrobiological evaluation (2006-2008: Contract 101/ Biotech CEEX);
- Obtaining high productive, resistant to diseases and with quality fruits genotypes of nut crops (walnut, hazelnut and sweet chestnut). (2006-2008: Contract 7/Biotech CEEX).
- Study of genetic resources of selected nut crop species in Slovakia and Romania (2011-2012: *bilateral project Romania-Slovakia*. SK-RO-0024-10, ANCS – SRDA).

4.2. Research area

▪ ***Forest***

- Ecology (site and stand characterization, soil and pollution influence) of chestnut (1. Baia Mare, 3. Tismana, 6. Braşov);
- Fruit / timber production of chestnut genotypes in different site conditions (1. Baia Mare, Genetics (chestnut forms and varieties - 1. Baia Mare);
- Chestnut blight control (biological control, factors influencing the natural resistance to blight - 1. Baia Mare, 6. Braşov);
- Mycobiota of *Castanea sativa* Mill. in Romania (1. Baia Mare, 6. Braşov).

▪ ***Fruit crop research***

- Genetics: selection work carried out since 1953-1955 into the spontaneous and semi-cultivated flora, (Cociu V., 1990).

Germplasm collections were established in 1975-1977 at Fruit Research Stations of Baia Mare and Tg. Jiu and in 1998 at Fruit Research Station (SCDP) Vâlcea.

Breeding programs were launched in 1979 at Fruit Research Station of Baia Mare (Popa Ispas et al. 2006) and 1998 at SCDP Vâlcea. Main breeding objectives were: high productivity, precocity, adaptability to environmental conditions, low and medium tree vigor for intensive growing, quality and large size of fruits, resistance or tolerance to pest and diseases, etc (Popa Ispas et al. 2006).

Interspecific controlled crosses were carried out using mainly *C. sativa* and *C. crenata* genitors, up to 3100 hybrids have been obtained.

As results of selection work into spontaneous and semi-cultivated flora the following cultivars were named since 1979: Polovragi, Hobiţa, Gureni, Tismana, Prigoria (Fruit Research Station Tg. Jiu), Mara and Iza (Fruit Research Station of Baia Mare) and Romval and Casval (SCDP Vâlcea).

- Chestnut canker control (2. Baia Mare, 5. Râmnicu Vâlcea).

LIFE+ NORTHWESTGORJ Conservative management for 4070* and 9260 habitats of ROSCI0129 North of Western Gorj

LIFE NORTHWESTGORJ project is developed by the Gorj Environmental Protection Agency within the site ROSCI0129 North of Western Gorj administrated by Romanian-Japanese Chamber of Commerce and Industry as Associated Beneficiary and with an important scientifically contribution of ICAS – Forest Research and Management Institute, Brasov Station.

ROSCI0129 includes a large ecological and biological diversity, containing 6 types of ecosystems – forests (woods and bushes), meadows, saxicoles, aquatics, riparians, and caves.

Despite the Site ROSCI0129 North of Western Gorj represents one of the fewest territories with high value of biodiversity, parts of this protected area are at degradation risk or already destroyed. Lack of habitats management targeted activities has resulted with degradation and loss of natural habitats with high ecological value.

Given this situation, this project aims to come up with solutions to address some of the issues before, as follows:

- Restoration of destroyed 4070* bushes with *Pinus mugo* and *Rhododendron myrtifolium* - plantation with *Pinus mugo* of the area destroyed by inappropriate management of pastures, methods used already with success in other protected areas
- Restoration of destroyed 9260 *Castanea sativa* woods – based on European experience in develop and implement the biological control of sweet chestnut blight, caused by Asian fungus *Cryphonectria parasitica*, as well as Where the high infections of *C. parasitica* have compromised the efficacy of biological control (25 ha with chestnut forests destroyed by the alien fungus), consists in plantation with *Castanea sativa* (after the felling of the old forest) using the nursery trees created within the project.
- Establishing the conservative measures for restored habitats
- Raising awareness by public participation in nature protection related to decision making process and conservation of habitats of Community importance will be consolidated through a lot of events and meetings undertaken during the project implementation - Chestnut Festivals and round tables with large participation of the local communities and tourists will be annually organized.

  Categories of target groups will be considered at the end of project for further dissemination actions: public authorities/stakeholders from Gorj ; public authorities/ stakeholders from other counties which could be interested to replicate the project; potential tourists, including travel agencies and local public from the North of Western Gorj protected natural area; large public from other locations with protected areas.

Project budget: 1.987.742,20 euro
50% LIFE contribution, 50% contribution of project partners

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