Scientific Papers, Series B, Horticulture, Vol. LVI, 2012
ISSN Online 2286-1580, ISSN-L 2285-5653

ASIMINA TRILOBA (PAWPAW) GERMPLASM IN ROMANIA

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Abstract
In Romania the first reports on Asimina triloba came from a small village in Transylvania, north-western part of the country. At the beginning of the 20th Century, a Romanian immigrant brought from USA, some pawpaw seeds and from them few uncommon fruit bearing plants have been obtained. From the village of Pianu Nou, Alba County, some seedlings were sent to a private garden in Geoagiu, Hunedoara County and for nearly one hundred years, the specie remained unknown for the Romanian fruit scientists. It was around 2000, when the descendents of the first pawpaw plants introduced in Romania were planted in the Bucharest Faculty of Horticulture fields to be tested. Together with those, some other 10 pawpaw varieties and 3 hybrids were introduced from Italy in a small collection. The paper presents the characterization of the first Romanian found pawpaw genotype and of the other genotypes existing in Romania.

Keywords: *Asimina triloba,* history, genotypes, varieties, plant collection

INTRODUCTION

Northern banana (*Asimina triloba L.*) belongs to the Annonaceae Family being known in Northern America - its origin area, under the Indian name of Paw-Paw [1].
Asimina triloba or pawpaw is temperate fruit specie used by the local Indian population long before the colonization of the continent, but only in the last time was taken in consideration by specialists in the origin area and in few European countries [3].
After 1900 the plant was reconsidered as fruit specie and the first breeding works and researches on propagation, cultivation and fruit conservation and use initiated [7] [9].
Plant description
Asimina forms a high bush or can be grown as tree 3-7 m high. Foliage is thick, shining dark green, formed by obovate big leaves.
The solitaire flowers, formed from hairy flower buds at leaves axils, are hermaphrodites and have 3+3 brown-reddish petals (Photo 1). Pollination is ensured by flies, butterflies and other insects [4]. From each flower few fruits are formed but only 1-4 will reach the ripening stage [5]. Fruits are baccas with different shape and size: sferic or long, kidney shape having between 50 and 500 grams (Photo 2).

Photo 1. Flower of *Asimina triloba*

Fruit skin is thin, smooth, colored in pale green or yellowish green and covered with a typical white wax layer. Fruit flesh is yellow, sometime yellow to orange, fine, creamy, sweet, with an aroma that combines banana, pine apple and mango flavor [10]. In the fruit pulp there exist numerous brown seeds covered with a white tegument, kidney shape, disposed on two lines (Photo 3).

Photo 2. Fruits of *Asimina triloba*

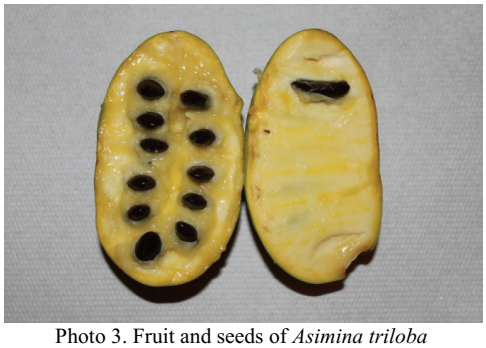

Photo 3. Fruit and seeds of *Asimina triloba*

Beside the exotic taste and flavor, asimina fruits are extremely appreciated for their high content in A and C vitamin, fatty acids (linoleic, palmitoleic, palmitic and oleic), essential aminoacids, minerals, especially Ca, Mg, Fe, K, P, Zn and Cu [6].

Asimina is winter hardy specie and can be successful cultivated in temperate areas. During the winter can resist to -25…-30°C. Even is well adapting to different soil types, it prefers well drained, rich soils with a neutral or slight acid reaction.

It needs around 160 vegetation days and grows well in areas with 700-800 mm precipitations per year. Water stress determine premature fruit drop and needs to be prevent by moderate irrigation.

The plant doesn't support the bare rooted planting and transplanting [8]. That's why these operations need to be done with root ball and the production of the planting material is made entirely in pots.

Asimina in Romania

Pawpaw (*Asimina triloba* Dunal) is a new fruit in Romania the first reports on *Asimina triloba* came from a small village in Transylvania, north-western part of the country.

At the beginning of the 20th Century, a Romanian immigrant family brought from USA, some pawpaw seeds in the village of Pianu de Sus, Alba County. The Suciu Family: Ioan, Maria and their son, Ioan Jr. left Toledo, Ohio, in 1926 and returned to Romania with few asimina fruits [11] (Photo 4).

Photo 4. Suciu Family just before their return to Romania in 1926

After their arrival they sow the seed in an angle of the typical Transylvanian courtyard protected by walls. The formed plant started to produce fruits even it had no pollinators. For many years the new plant was a curiosity for the locals but it was difficult to propagate it because of the lack of knowledge. During the time few seedlings have been spread in

nearby cities as Geoagiu and Orăştie, being planted in private gardens.
In 1978, the Suciu Family house was sold to the actual owner, Elena Voişan (age 85). In the courtyard the initial plant is still alive (Photo 5).

Photo 5. The initial plant in Pianu de Sus

Photo 6. The trunk of the initial plant in Pianu de Sus

No scientific studies have been done till recently on that plant.

The paper presents, beside the genotype from Pianu Nou, few other genotypes from Geoagiu and Bucureşti. In the same time an actual list of the asimina varieties and selections existing in Romania is presented.

MATERIAL AND METHOD

The recent improvement of the Romanian collection with asimina selections and varieties is presented as follows. In 2000, the author introduced 7 pawpaw varieties and 3 hybrids from Italy in three small collections: at the Faculty of Horticulture in Bucureşti and in two private collections in Argeş and Ilfov Counties.
In 2005, other 3 varieties received from USDA Corvallis Repository, USA, have been over grafted in the Faculty collection.
The last contribution to the collection was realized in 2012, by adding 6 new varieties from the American breeder Neal R. Peterson, Harpers Ferry, West Virginia, USA. Three of the pawpaw cultivars are patented by N.R. Peterson in the United States under the names Wansevwan (U.S. Patent PP 14,452), Levfiv (U.S. Patent PP 15,900) and Aidfievate (U.S. Patent PP 14,453), and sold under the trademarks Shenandoah, Susquehanna, and Rappahannock, respectively. The remaining three pawpaw cultivars have advanced selection identification numbers of 2-9, 1-7-2, and 4-2 respectively, and are sold under the trademarks Allegheny, Wabash and Potomac, respectively (Table 1).
After the first introduction in 2000 of asimina varieties and selections from Italy, several studies have been started at Faculty of Horticulture in Bucureşti. Different propagation methods were tested and the fruits physical and biochemical characteristics were analyzed.
In 2011, we have discovered the initial plant of asimina grown by Suciu Family from American seeds in the small village Pianu de Sus, Alba County (Selection PS). After that, a descendant seedling from that plant was identified in Geoagiu city, Hunedoara County (Selection LG). Leaves and fruit samples were collected to be studied. By comparison, another seedling from Geoagiu planted at the University of Agronomic Sciences and

Veterinary Medicine, Faculty of Horticulture in Bucureşti (Selection USAMV) and a plant from Bucureşti Botanical Garden (Selection GBB) were analyzed.

For the four genotypes the number of leaves per shoot and the single leaf area (cm^2) was calculated.

The fruit firmness (kgf/cm^2) was measured using a hand Effegi penetrometer with an 11 mm piston. The content in soluble solids (%) was determined with a hand refractometer BRIX 35 HP. Fruit average weight (g) was also calculated.

Table 1. The germplasm collection of *Asimina triloba* at the Faculty of Horticulture in Bucureşti

Variety	Trade mark	Year of introduction	Origin	Source
Sunflower		2000	USA	Domenico Montanari, Faenza, Italy
Selection 1216	Prima 1216	2000	Italy	Domenico Montanari, Faenza, Italy
Davis		2000	USA	Domenico Montanari, Faenza, Italy
Overleese		2000	USA	Domenico Montanari, Faenza, Italy
NC - 1		2000	USA	Domenico Montanari, Faenza, Italy
Ithaca		2000	USA	Domenico Montanari, Faenza, Italy
Prolific		2000	USA	Domenico Montanari, Faenza, Italy
Vitroplant 1		2000	Italy	Giuseppe Zuccherelli, Cesena, Italy
Vitroplant 2	Simina	2000	Italy	Giuseppe Zuccherelli, Cesena, Italy
Vitroplant 3		2000	Italy	Giuseppe Zuccherelli, Cesena, Italy
Taylor		2005	USA	Corvallis Repository
Wells		2005	USA	Corvallis Repository
Wilson		2005	USA	Corvallis Repository
Wansevwan	Shenandoah	2012	USA	Neal Peterson, Harpers Ferry, West Virginia, USA
Levfiv	Susquehanna	2012	USA	Neal Peterson, Harpers Ferry, West Virginia, USA
Aidfievate	Rappahannock	2012	USA	Neal Peterson, Harpers Ferry, West Virginia, USA
Selection 2-9	Allegheny	2012	USA	Neal Peterson, Harpers Ferry, West Virginia, USA
Selection 4-2	Potomac	2012	USA	Neal Peterson, Harpers Ferry, West Virginia, USA
Selection 1-7-2	Wabash	2012	USA	Neal Peterson, Harpers Ferry, West Virginia, USA

RESULTS AND DISCUSSIONS

Asimina collection

After 12 years of pawpaw (*Asimina triloba*) cultivation in Romania at the Faculty of Horticulture in Bucureşti all the varieties showed a good adaptation at the local conditions. During the first three years of growing, the plants were protected against direct sunlight by individual net shades. Even the hardest winters as 2005/2006, 2011/2012, with temperatures lower than -25 degrees Celsius, didn't affected the plants and the flower buds. All the varieties produced good quality fruits. The asimina plants haven't showed any pest and disease attack during their growth and no phytosanitary treatments have applied. In the same time, no chemical fertilizers have been applied during the trial.

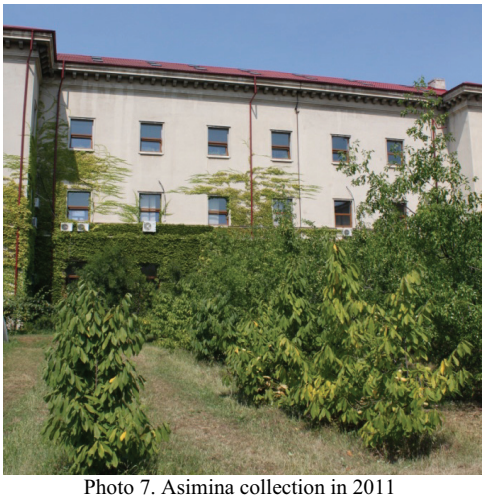

Photo 7. Asimina collection in 2011

Characteristics of pawpaw genotypes in Romania

After we found the first pawpaw plant introduced in Romania in Pianu de Sus (Selection PS) we tried to compare its

characteristics with two descendent genotypes: the Selection LG (planted in 1985) and the Selection USAMV (planted in 1998). Another genotype with unknown origin from the Bucureşti Botanical Garden (Selection GBB) was used as control.

The results are presented in table 2. As one can see, average number of leaves per shoot was similar at the four studied genotypes. The Selection PS had the highest leaf area (190.07 cm^2) while the Selection USAMV the smallest leaf area (106.07 cm^2). The biggest fruits were produced by the Selection USAMV (65.7 g), followed by the Selection LG (56.2 g). Even so, the fruits produced by the "Romanian genotypes" are smaller in comparison with the standard varieties. For example, the average fruit weight of the new variety Simina is over 200 g [12]. The fruit flesh firmness varied from 2.05 up to 7.50 kgf/cm^2. The values show some differences between the ripening moments, the Selection LG being later (Photo 8). Even so, the same selection showed the higher content in soluble solids: 23.6% in comparison with 18.2% at the original plant, the Selection PS.

Photo 8. The Selection LG in Geoagiu

Table 2. Pawpaw genotypes fruits and leaves characteristics

Genotype	Origin	Leaves/ shoot no.	Single leaf area cm^2	Fruit weight g	Flesh firmness kgf/cm^2	Soluble solids %
Selection PS	Ohio	9	190.07	36.7	2.93	18.2
Selection LG	Pianu de Sus	9	177.96	56.2	7.50	23.6
Selection USAMV	Geoagiu	9	106.07	65.7	3.00	20.4
Selection GBB	?	8	166.72	36.0	2.05	18.2

CONCLUSIONS

The "Romanian pawpaw genotypes" derived from the initial plant raised in Pianu de Sus are interesting for their resistance and adaptation to the local conditions. The fruit quality is lower in comparison with the bred varieties. It is important to mention that the Romanian genotypes seems to be self fertile, while in this moment it is know that Asimina varieties are usually self sterile with 2 single exceptions: Sunflower and Prima 1216 [2]. For the future, a genetic study of the Romanian genotypes and of the Ohio population parentage should be interesting.

After the first results obtained it is obvious that pawpaw is promising new fruit specie in Romania. Its high field resistance to pests and diseases recommend *Asimina triloba* for organic production. The nutraceutical fruit characteristics impose the pawpaws as some of the most valuable fruits in the market. For the future it is necessary to extend the trial plots in some other growing areas. In the same time, new varieties and selected hybrids need to be introduced.

Some new research on breeding, *in vitro* propagation [13], orchard technology and processing are necessary. Being a new unknown fruit specific marketing and consumer education activities are also recommended.

AKNOWLEDGEMENTS

Special thanks to the descendents of Suciu Family for the information and photo materials offered during the research.

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