

## POSSIBILITIES TO VALORIZE ARTICHOKE UNDER THE CULTIVATION CONDITIONS IN ROMANIA

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### ABSTRACT

*Generally, in Romania, farmers focused on an agriculture based on large field crops, cereal crops, being less inclined to grow aromatic and medicinal crops that have a newer history in our country. But there are plants that have made history in other countries and that for a while are starting to be valorized in our country in a therapeutic or prophylactic purpose. One of these plants is artichoke (*Cynara scolymus*), which due to its many uses has become increasingly valuable. In our country is known and used especially in the pharmaceutical and food supplements industry, but food industry and that of cosmetics are making progress in using this wonder plant, with many therapeutic, digestive, hepatic-protective properties. Newly, the problem was posed for its use as an energy plant, by obtaining oil from the seeds. This paper proposes to highlight the possibilities to valorize the artichoke crop in Romania's conditions, as a source of bioactive raw material for drug products, food supplements, cosmetics and ornaments. The results of experiments can be used by Romanian farmers to draw up plans to valorize all their land, even smaller surfaces.*

### INTRODUCTION

Artichoke is a very valuable plant, grown for its multiple uses, whose scientific name is "*Cynara scolymus*" and it has multiple popular names, depending on the area of origin, for example "angină", "anghină", "carcioafă", bitterness or Virgin Mary's gift. Originating from Ethiopia, the plant was brought in South Europe, crossing Antic Egypt, where it was recorded in the drawings of the old civilization. The Greeks and the Romans used artichoke to maintain the health of their liver and gallbladder. In the XVI century, in Europe, artichoke was considered a "noble vegetable", being consumed only by the members of the royal families and by very rich people. [4]

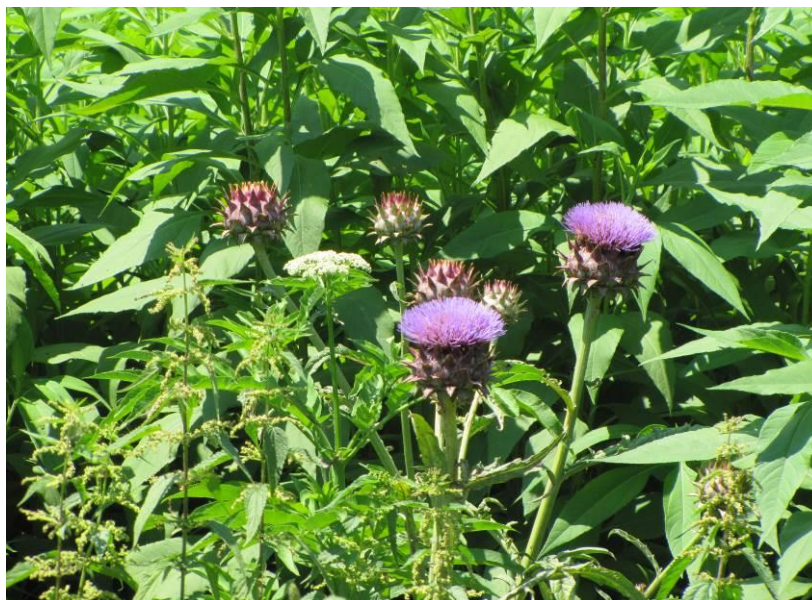
Artichoke is part of the Asteraceae (Compositae) family, *Cynara* genus, *C. scolymus* species [3]. It is a herbaceous perennial plant, (in crops it behaves as annual/biannual) with profound roots. The stem is thick, erect, heavily branched, tall of up to 2m. The base leaves are arranged in a rosette, are big, with a strong petiole and a thickened midrib. Starting with year, two alternate leaves appear. The upper face is light-green and the inferior one has dense long white-grey hairs. They have tubular flowers, red-violet, grouped in large, globular calathidiums. The fruit is an achene slightly flattened on the side, grey-brown with black spots.

The majority of varieties spread for culture have Italian, French or English origins: Luan Artichoke, "Vert de Provence", "Violet de Paris", "Violetta Italiana", "Mose de Bretagne" and others emerging in the last years. All these varieties are improved by local Italian populations, adapted and selected for certain cultivation areas. [5]

Artichoke crop is a valuable crop for the pharmaceutical industry, for food supplements, cosmetics, for the food industry, and also, more recently, for biofuel. It can also be very well considered as an ornamental plant. In our country, artichoke is almost unknown in food diet. [6]

In our country it is mainly grown in the south, in the counties close to the Danube (Ialomița, Ilfov, Giurgiu, Teleorman, Olt, Dolj), because it is a demanding plant in terms of temperature and light. Artichoke is not pretentious when it comes to applying fertilizers and valorizes well the nutrients coming from manure applied to the previous plant.

Recently, it is the subject of the conversion process of crops obtained from conventional agriculture into those obtained from organic agriculture. The conversion process is laborious and extremely demanding.



**Fig. 1** – Artichoke crop (*Cynara scolymus* L).  
Own organic crop, SC Hofigal Export Import SA, Bucharest

From this plant, in the pharmaceutical field, the leaves are used - *Folium cynarae* – which contain cynarine, polyphenols, bitter principles, inulin and potassium and magnesium salts.

From a therapeutic point of view, artichoke leaves are characterized by favorable effects on liver and kidney diseases, having the property to enhance biliary secretion and diuresis, simultaneously regulating the cholesterol forming process, as well as the level of carbohydrates.

The raw material of natural organic vegetal origin – artichoke (*Cynara scolymus* L), (fig. 1), coming from the crop of SC Hofigal Export Import SA, is the basis of obtaining the active ingredient, dry *Cynara scolymus* extract enriched with organic magnesium salts, easy to assimilate by the complexation of active principles in the final product MagAnghinar tablets.

The final product is part of the pharmacy-therapeutic group: Gallbladder and liver therapy, with colago-choleretic action = increasing biliary secretion and modifying the quality of gallbladder composition; diuretically – increasing the urine volume, eliminating urea and toxic nitrogenous substances; metabolically – stimulates the carbohydrate (favorable in cases of diabetes) and cholesterol metabolism; detoxifying and anti-allergic - stimulates the liver's anti-toxic function, improves allergic conditions, corrects the organic magnesium deficiencies.

Traditionally, *Cynara scolymus* (artichoke) is used to encourage the gallbladder secretion and to improve digestion, to favor the capacity to eliminate various substances from the body and eliminate water in urine, thus:

- In all cases where it is necessary to stimulate the biliary flow and diuresis;
- In case it is aimed to influence favorably the metabolism of cholesterol;

- Hepato-biliary disorders – sub-acute and chronic hepatitis of any etiology, biliary insufficiency, sub-acute and chronic cholecystitis, angiocholitis, biliary dyskinesia;
- Fights functional and metabolic disorders, consequences of chronic suffering of the digestive tract;
- Adjuvant in the treatment of stomach and intestinal diseases, intestinal dysmicrobism with excessive fermentation and flatulency, enteritis, spastic enterocolitis, cramps, acute indigestions and hemorrhoids;
- In anaphylactic conditions, urticaria, pruritus, allergic dermatitis, food allergies and other allergic manifestation having a liver background;
- Organic magnesium deficiency (lack of magnesium in the elderly, puberty, mal-absorption syndromes), atony and muscular cramps, spasmophilia, adjuvant in consolidating the treatment of coronary-myocardial diseases.

The plant is also extremely useful in food diets, especially for preparing salads and soups, but also in different types of pasta and minces. In some countries it is used as condiment or ingredient in certain types of dishes; Romanian cuisine does not have a tradition in this respect. By its polyphenol content with an antioxidant action, along with the proteins, fibers, fat, mineral salts, the artichoke fruit should not be missing from a healthy diet. Compared to the fresh product, the polyphenol concentration increases after heat treatment. Dishes containing artichoke fruits must be consumed immediately, because they alter rapidly and become toxic. From the leaves and flowers were isolated: aspartate, proteases (cardozyne or cynarine), enzymes used in the dairy industry for the coagulant effect. Traditionally, in Spain and Portugal, “vegetal rennet” is used to prepare some types of cheese. [7]



*Fig. 2 – Artichoke floral receptacle*

The receptacle and the fleshy part of the leaves are the main edible parts of artichoke.

Figures 2 and 3 present the floral receptacle and the artichoke flower.

It can be stated that artichoke is a type of miracle food that, in Romania does not receive the proper attention, a reason for which it is hard to purchase it in a fresh state. It can still be found, as tea or supplements containing it. From artichoke are also made some digestive drinks.



**Fig. 3** – Artichoke flower

According to a study made in the USA, artichoke is ranked 7<sup>th</sup> out of 100 foods with a high content of antioxidants. [8]

Another field where artichoke tries to impose itself is cosmetics, where we find it in tonic lotions, creams, cleansing milk and revitalizing masks, due to its antiseptic, anti-inflammatory and anti-allergic effects.

### **MATERIAL AND METHOD**

The physic-chemical study was conducted for the artichoke leaf. All the tests, the methods principle, the limits of admissibility, reagents, solutions, and reference substances are in accordance with the 8<sup>th</sup> edition of the European Pharmacopoeia, the edition in force.

The artichoke leaf contains: 1-2% polyphenols – chlorogenic acid; 0.5-1% flavonoids; bitter principles, sterols, tannin, mucilage, pectin, amino acids, carbohydrates, organic acids, enzymes. [9]

Taking into consideration that leaves are the most commonly used, for these parts of the plant, the conditions that dry leaves must fulfill are the following:

- maximum 5% brown or spotted leaves;
- maximum 0,5% organic foreign bodies;
- maximum 1% mineral foreign bodies;
- maximum 13% humidity;
- minimum 0,12% flavonoids content;
- minimum 0,9% cynarine content. [2]

The study to determine the macro/microscopic characteristics for the vegetal product dry artichoke leaves was performed using four batches grown by INMA Bucharest, respectively by Hofigal at Aroma Plant / Furculești, Teleorman County.

The analysis were conducted in the laboratories of S.C. HOFIGAL Export Import S.A., Bucharest, in accordance with the European Pharmacopoeia, the edition in force and the specialty literature, using as references [11] and [12].

The equipment used consisted of: UV-VIS spectrophotometer to determine polyphenols, atomic absorption spectrometer (AAS) to determine minerals (macro elements: calcium, magnesium, potassium, sodium) and microelements: manganese; copper, zinc, iron and heavy metals: lead and cadmium, analytical scales, calcinations furnace, drying oven.

### **RESULTS AND DISCUSSIONS**

In table are presented the results obtained for four samples of vegetal product represented by dry *Cynara scolymus L* leaves, consisting in macro/microscopic

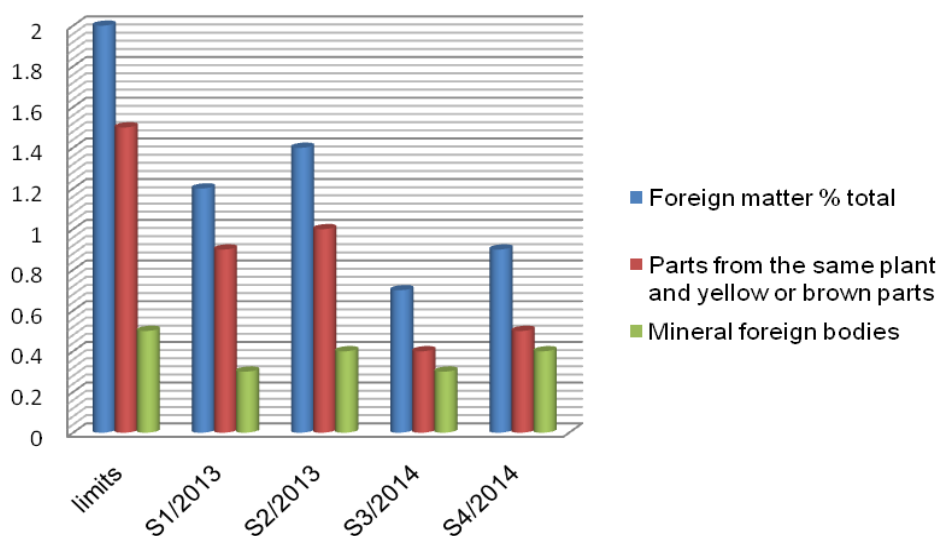
characteristics, foreign matter, heavy metals, losses on drying, ash content and polyphenols expressed in chlorogenic acid.

**Table 1**

**Analysis results – artichoke – dry leaves**

Crt. no.	Characteristics	Limits of admissibility	Results			
			S1/2013 Aroma Plant = Hofigal	S2/2013 Aroma Plant = Hofigal	S3/2014 Aroma Plant = Hofigal	S4/2014 INMA Buc. = Hofigal
1.	Macroscopic properties	according to ST* provisions	corresponds	corresponds	corresponds	corresponds
2.	Microscopic properties	according to ST* provisions	corresponds	corresponds	corresponds	corresponds
3.	Identifying: A: macroscopic B: microscopic C: luteolin-7-glucoside and chlorogenic acid	positive positive positive	corresponds corresponds corresponds	corresponds corresponds corresponds	corresponds corresponds corresponds	corresponds corresponds corresponds
4.	Foreign matter, total [%, max.]:	2.0	1.2	1.4	0.7	0.9
	a) Parts of the same plant: - yellow or brown fragments [%, max.]	1.5	0.9	1.0	0.4	0.5
	b) Foreign bodies: - organic - mineral (dust, sand) [%, max.]	missing 0.5	missing 0.3	missing 0.4	missing 0.3	missing 0.4
5.	Heavy metals: - lead (Pb), ppm, max.	5.0	<5.0	<5.0	<5.0	<5.0
	- cadmium (Cd), ppm, max.	1.0	<1.0	<1.0	<1.0	<1.0
6.	Losses on drying [%, max.]	12.0	10.0	9.0	2.3	2.0
7.	Total ash [%, max.]	20.0	14.3	13.0	8.7	11.3
8.	Content in: - total polyphenols expressed in chlorogenic acid (related to the dry matter) % min	1.0	1.01	1.11	2.7	1.5

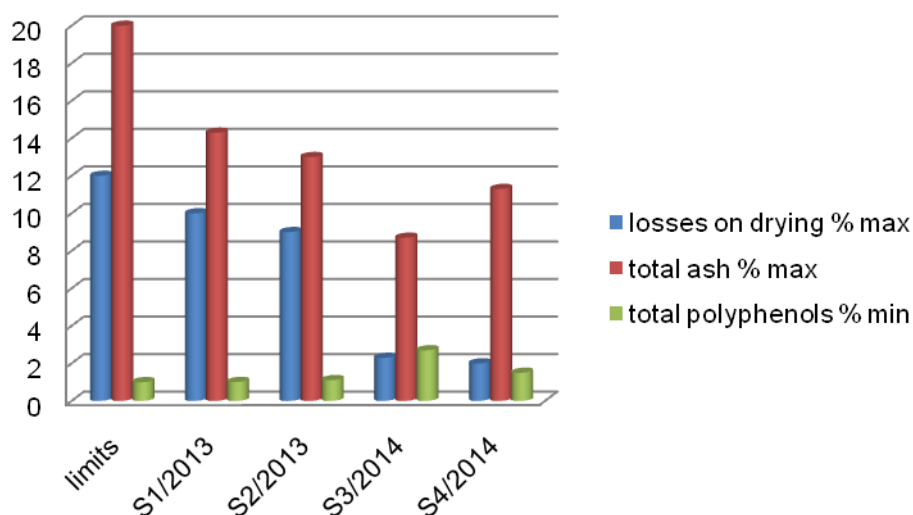
The graphs in figures 4 and 5 show the values of some parameters - indices or quality, expressed in percentages, compared to the limits of admissibility imposed by the legislation in force.



**Fig. 4 – Foreign matter content [%]**

a) Parts of the same plant: yellow or brown fragments [%];  
b) Foreign bodies: organic and mineral (dust, sand) [%]

From the analysis of the trend in the graphs a foreign matter content [%] can be observed: a) Parts of the same plant: yellow or brown fragments [%]; and b) Foreign bodies: organic and mineral (dust, sand) [%], losses on drying [%], total ash [%], much below the maximum limits of admissibility according to the pharmacopoeia; and for the parameter total polyphenols content expressed in chlorogenic acid (related to dry matter) [%], there is a very good content, higher by a percentage between 10% and 170% for the Hofigal samples and by 50% for the INMA samples compared to the minimum limit of admissibility.



**Fig. 5** – Losses on drying [%], Total ash [%] and Total polyphenols content expressed in chlorogenic acid (related to the dry matter) [%]

After conducting the analysis using the atomic absorption spectrometer (AAS) was determined the content of minerals and trace elements of dry leaves artichoke samples, calculated in milligrams per hundred grams of product (table 2).

**Table 2**  
**Content of minerals and trace elements of dry leaves artichoke samples coming from Hofigal and respectively INMA**

Product name	Microelements content [mg/100g]										
	Ca	Mg	Na	K	Mn	Fe	Zn	Cu	Pb	Cd	Cr
Hofigal Artichoke	1600	700	1900	5000	6	30	8	-	ND	ND	-
INMA Artichoke	1650	500	1900	4800	2	30	6	-	ND	ND	ND

From the data presented in table 2 it can be observed that artichoke leaves coming from both parts are, as was natural, richer in macro elements (Ca, Mg, Na, K), compared to the microelements (Mn, Fe, Zn, Cu). The content of minerals and trace elements is similar for the two samples with different origins, with differences in the content of magnesium and manganese.

It is found that there is a very good ratio between the content of sodium and potassium.

By the absence of lead and cadmium is added positively the safety in administrating the product, along with the quality aspect.

## CONCLUSIONS

After obtaining the results it can be observed that the maximum limits of admissibility were not exceeded for the quality parameters analyzed in the vegetal product dry artichoke leaves coming from the two sources.

The total polyphenols content expressed in chlorogenic acid (related to the dry matter) % is a very good content, higher by a percentage between 10% and 170% for the Hofigal samples and by 50% for the INMA samples compared to the minimum limit of admissibility. The polyphenol content for the sample from the experimental lot from INMA is an encouraging one, taking into consideration that this activity is new to the institute and still it can be positively compared with the results obtained by a company considered a benchmark in the field of activity in the last 25 years in Romania.

It also has to be noted that all the samples studied fall in the pharmacopoeia limits imposed regarding the content of heavy metals, respectively lead and cadmium, two metals with severe repercussions on human health.

Artichoke is a plant with multiple uses, whose cultivation brings enough benefits to farmers that will grow it. The fresh leaves production is about 200-250 kg / ha [10]. Besides this vegetal product coming from artichoke, very important is the receptacles used in alimentation and seeds, which can be used to obtain fat oil.

This plant has real chances to extend its culture, from the south to the west and the south-east of the country, where the climate is milder and there are proper conditions for healthy and economically advantageous crops.

Research on valorizing the artichoke crop in Romania may continue to find new possibilities to use artichoke, both in areas already mentioned, and why not, even in some areas unexplored until now, also pursuing the implementation of the business concept effectiveness by efficiency.

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