

THE MARKET OF EDIBLE MUSHROOMS FROM THE SPONTANEOUS FLORA OF ROMANIA

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RESEARCH ARTICLE

Abstract

Edible mushrooms from the spontaneous flora of Romania are characterized by special attention on the internal and European market. This attention is due primarily to the nutritional qualities that they contain, but also because they are harvested from an environment of a natural nature, free of pollutants. In general, edible mushrooms derived from spontaneous flora, are seasonal mushrooms, which by their nutritional value contribute both to the economic circuit and to the diversity of natural products rich in nutrients. The main objective of this work was to identify the main edible mushrooms harvested from the spontaneous flora of Romania, mushrooms that are of major interest for the Romanian market, as well as for the European market, followed by the average purchase value, the areas of provenance, packaging, and the delivery market. The data present in this study are data taken between 2019 and 2022. The value of non-wood forest products such as mushrooms is a dynamic of interest for the most harvested and marketed edible mushrooms by private entrepreneurs, as well as average purchase prices, identified areas with high harvest potential and packaging and delivery preferences.

Keywords: spontaneous flora, non-wood forest products, edible mushrooms, truffles, boletus
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INTRODUCTION

Due to the high nutritional value of edible mushrooms, their use in human food nutrition is of increased interest both for cultivated mushrooms and especially for mushrooms that come from spontaneous flora. The food consumption of edible mushrooms is quite widespread in Romania (Łuczaj Ł et al, 2015., Nicola S et al, 2021), the mycological background in the flora of our country is rich and varied, of about 1600 spontaneous species, of which only 400 are edible (Şesan T. E., Tănase C., 2004). Among those mentioned above in Romania was issued in 2019, Order no. 768/2019 on the amendment of the annex to the Order of the Minister of Agriculture, Forests and Rural Development no. 246/2006 for the establishment of the List of edible mushrooms from spontaneous flora whose harvesting or acquisition and marketing are premises (Romania 2019).

The final list officially lists 43 edible mushrooms which can be harvested from spontaneous flora and marketed to the final consumer. According to the Products and Services Catalog of the National Forest Administration, edible mushrooms are among the most appreciated natural products from the spontaneous flora of the Romanian forest fund.

Mushrooms from spontaneous flora are among the most important non-wood forest products, over 3000 species being consumed worldwide and over 100 being of great importance in medicine and the fight against several diseases (VASILE D., DINCĂ L., ENESCU C.M., 2017)

The main objective of this work was to identify which are the most appreciated, consumed, and marketed mushrooms in the current context of the market of edible mushrooms from the spontaneous flora of Romania, as well as their commercial value, starting with the average purchase prices in the last four years, respectively the main areas in Romania from which mushrooms are collected.

At European level, Romania is known for its organic products such as mushrooms and berries. Romania must develop policies that benefit these products, the EU being a free trade area, stimulating economic growth and promoting trade (Dehousse, 2005 quoted by Timofte, 2016).

MATERIAL AND METHOD

For the current study, data have been taken in the form of a questionnaire, for the period 2019-2022, to the main entrepreneurs who purchase the edible mushrooms and sell them to the final consumer in Romania and the European Union.

The questionnaire was attended by 18 companies, which purchase, sort, process and deliver in different forms, edible mushrooms harvested from the spontaneous flora of Romania.

The questionnaire included:

- the official list of the 43 edible mushrooms whose harvesting or acquisition and marketing are prerequisites, according to Order no. 768/2019 on the amendment of the annex to the Order of the Minister of Agriculture, Forests and Rural Development no. 246/2006.
- a grid of the average purchase price in the period 2019-2022.
- a grid of the final form in which the edible mushrooms are delivered to the consumer.
- a grid of edible mushroom harvesting areas
- a grid of the main delivery areas
- a grid about the packaging and storage of edible mushrooms

RESULTS AND DISCUSSIONS

Following the interpretation of the results in Figure 1, the main edible mushrooms harvested from spontaneous flora, mushrooms that are of interest for the Romanian local market and especially for the European one, are presented. This graph is based on the information provided by the purchasers and is correlated with the requirements of the consumer market.

At the top of the list of edible mushrooms are mushrooms known locally and under names such as buckwheat, hribi or porcini, (*Boletus sp.*).

This is also affirmed by Kovalčík M., 2014, who stated that the harvest rate at the mushroom picking is mainly related to *Boletus sp.*

The mushrooms of the *Boletus sp.* category are the most appreciated and marketed mushrooms being thus on the first place, we can also say that these mushrooms have a tradition, highly appreciated among gourmets, due to their taste, nutritional values and especially the form of presentation.

Also, in the first category of edible mushrooms of high interest we mention the mushrooms *Amanita cesarela* and *Craterellus cibarius* but compared to that of mushrooms of the *Boletus sp.* category, the interest for these mushrooms is at least 30% below its value.

The authors of Cioacă L., Enescu C.M., 2018 state that in the period 2012-2017 the three fungi *Craterellus cibarius*, *Amanita cesarela* and *Boletus edulis* had the highest quantities recorded in terms of volume harvested from the spontaneous flora of edible mushrooms.

Truffles (*Tuber sp.*) are also of medium to high interest to the market, being considered luxury culinary mushrooms. The specific legislation in Romania provides clear notions of harvesting and valorization, but requires high knowledge about this fungus, requiring trained dogs for their identification, as well as special tools for harvesting them. Now we could only identify medium interest for this type of fungus, but without statistical data indicating the quantity harvested and officially marketed, however, the most significant signals are from the eastern part of Romania where it seems that the willing companies assign on a contractual basis the areas where these mushrooms can be harvested with the help of specialized dogs and based on the authorizations and legislation in force.

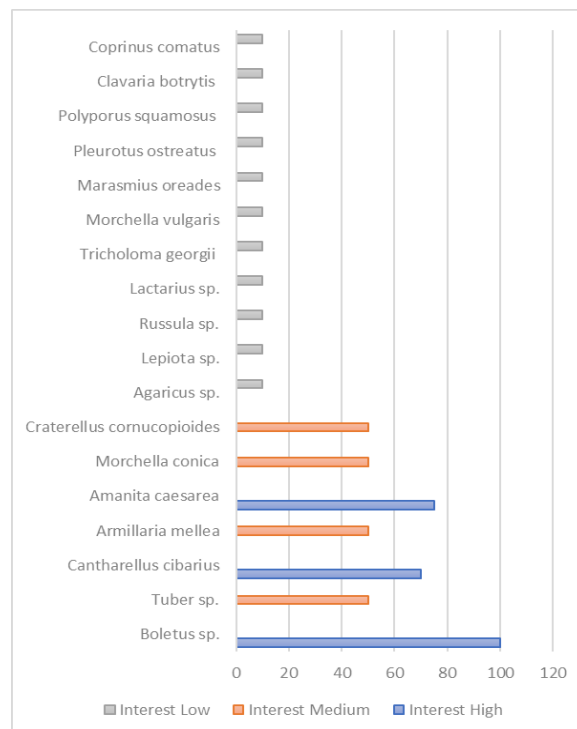


Figure 1. The main edible mushrooms that are of interest to the Romanian market and the EU.

The average purchase price, it is directly influenced by the season in which we can have the harvest of edible mushrooms from spontaneous flora. This season does not have a precise date, but it is included in the spring-autumn period of a calendar year between May

and November, being directly influenced by atmospheric precipitation, heat, woody plant species, relief, etc.

Unequivocally the highest price we have identified in the fungi of the *Tuber sp. category*. The low production of edible mushrooms, as happened in the 2021 season, has put a huge pressure on the purchase price of the main edible mushrooms coming from the spontaneous flora *Boletus sp.* as evidenced by Figure No. 2. which can be easily explained, the poorer the season is in the mushroom harvest, the purchase price increases in relation to the market requirement.

The average purchase price for *Boletus sp.* was 18 €/kg in the 2021 season, a price that remains a record for this category. In the year 2022, the average minimum price is a price is influenced by the abundant harvest in the season between August and September, so it had the average value of € 3 / kg, being the lowest price compared to all other seasons taken in the current study.

The harvesting of the *Boletus sp.* takes place in late spring until late autumn (Beldeanu E.C., 2004) in dry weather. The pedo-climatic conditions that are quite favorable, but also the diversity of forest species known to be the symbiosis between fungi and trees, allow to achieve impressive amounts of buckwheat annually, when the temperature and humidity conditions are met.

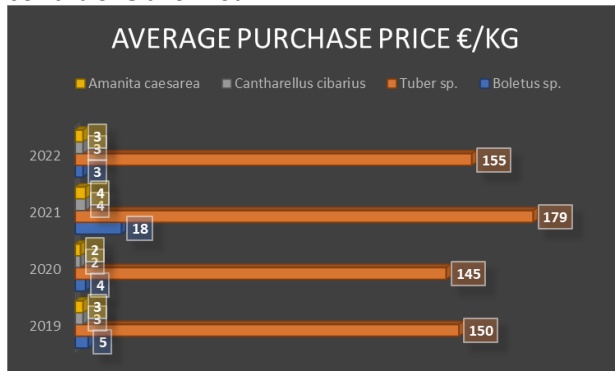


Figure 2. Average purchase price for the most appreciated mushrooms (2019-2022)

The category of mushrooms of medium interest as shown in Figure 3 reconfirms the 2021 season when the production of mushrooms was very low, which is why the price in some cases such as that of *Armillaria mellea* and *Morchella conica* mushroom, the purchase price has doubled thus reaching an average price between 4.5 and 5 €/kg, compared to the 2019, 2020 seasons, and the overproduction in 2022 practically significantly

reduces this price, thus reaching average prices between 1.4 and 2 €/kg.

The average purchase price for traditionally sun-dried mushrooms in the category *Boletus sp. mushrooms* in the case of purchase from peasant households in Romania, at the level of 2022 it is around 45 – 55 €/kg.

Mauro R.F., et al.,2022 in the study on the labelling and content of products of the *Boletus sp. category* states that the buying-in price for dried mushrooms in Spain was between €30/kg and €295/kg.

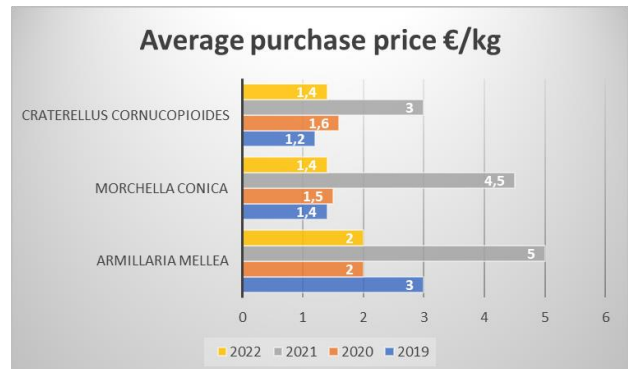


Figure 3. Average purchase price for mushrooms of medium interest (2019-2022)

For mushrooms in the category of low market interest, the average purchase price does not exceed the value of € 2 / kg, but it has not fallen below the value of € 1 / kg, which allows us to state that in the case of these edible mushrooms the price keeps a constant, a slight increase being influenced in this category in the 2021 season, as shown in Figure No 4.

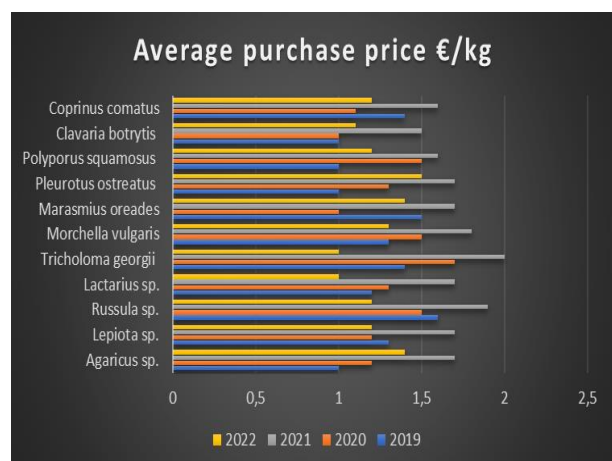


Figure 4. Average purchase price for mushrooms of low interest (2019-2022)

About the areas where edible mushrooms grow, Enescu C.M., 2022 states that superior mushrooms grow in deciduous, resinous, or mixed forests, through meadows, pastures, and orchards, being found from the lowlands to the

mountain hollows, at different altitudes and latitudes, where they find favorable conditions of humidity and heat.

In the case of truffles, the author of Romanian origin, Duck N., 2015 states that the main forest species where he found truffles were: hazelnut, Tartar maple, hornbeam, edible chestnut, sky, wild cherry, horn, beech, common ash, sessile oak, jugaster, birch, hawthorn, black pine, white poplar, trembling poplar, pedunculated oak, linden with large leaf, generally truffles being found much easier in mixed forests.

Following the centralized data on the areas of origin of the edible mushrooms, it emerged that the main areas from which the edible mushrooms are harvested are in the counties of Arad, Argeş, Bihor, Cluj, Bistrița Năsăud, Sălaj, Braşov, Hunedoara, Satu Mare, Harghita, Covasna, Dolj, Gorj, Vâlcea, Suceava, Botoşani, Piatra Neamţ and Bacău.

In the case of truffles (*Tuber sp.*) the region with a high impact is represented by the eastern part of Romania, especially in the counties of Piatra Neamţ, Suceava, Iaşi, Bacau, press sources report annually that this valuable fungus is illicitly marketed, but also in Bihor as concluded by Timiş-Gânsac Voichița et al, 2018.



Figure 5. Mushrooms marketed fresh on the shelf (a. - *Craterellus cibarius*; b- *Armillaria mellea.*) and cleaned according to customer requests (c- *Craterellus cibarius.*)

After the purchase of fresh mushrooms, they are marketed to consumers in several forms:

- chilled (kept immediately after harvesting at a temperature of 2-4C and delivered under these temperature conditions), it is worth mentioning that the mushrooms must be stored as short a period as possible after harvesting in a cold space, and the storage space must also have useful ventilation for the storage period.

- in some cases such as that of the marigolds (*Craterellus cibarius*) for delivery in their fresh form (Figure No 5), the mushrooms are cleaned and washed, thus reaching the recipient in the cleanest possible form;

- in the case of gherkins (*Boletus sp.*) they are in most cases supplied as they are harvested or according to customer preferences are easily cleaned from the humus part (Figure no.6) or are cleaned and cut in cubic form (Figure no.7).



Figure 6. *Boletus sp.* in wooden crates prepared for the expedition



Figure 7. Delivery method of *Boletus sp.* wash and cut into cubic forms

- another way the mushrooms are delivered is to cut into slices and dry them. The drying process can be carried out in special furnaces for this process but also naturally, in the sun (figure no.8), the local communities in most of the areas where buckwheat is harvested, put into practice this process, being known the ratio of 10 kg of fresh mushrooms from *Boletus sp.* quality II and III ultimately equate to 1 kg of dry product.



Figure 8. Drying in the sun of the mushrooms from the *Boletus sp.* group in the Codru Moma Mountains region of Arad County

- the freezing of edible mushrooms (Figure 9) shows another process by which they are stored and transported in different periods of time in different forms (whole, cubes, slices). In the first phase, freezing is carried out at a temperature of -30°C , and for the storage period the temperature of -20°C is used.



Figure 9. Mushrooms (*Boletus sp.*) cleaned and frozen in full form

As far as mushroom packaging is concerned, wooden crates are the most widely used form of packaging for fresh mushrooms refrigerated in a proportion of 75%, and for frozen ones, plastic crates and bags are used (Figure 10).



Figure 10. Sorting and packaging center for edible mushrooms, Beiuș Bihor County.

Local communities (Figure 11) are the first beneficiaries of edible mushrooms, firstly because they are an alternative to food inside a household, and secondly because, from an economic point of view, the harvesting of edible mushrooms is a source of income.

This income resource is welcome for communities in areas where edible mushrooms can be harvested, because in the current context, jobs in rural areas are very few, the migration of young people to large urban areas also has a major impact in terms of potential mushroom pickers, while the population is increasingly ageing.

It is also worth mentioning the average amount that a picker can harvest in a day, in a good season, the quantity harvested can reach 80-100 kg / day, mushrooms from the *Boletus sp.* category, this value is influenced by several factors, such as: knowledge of the areas, the distance from the point of harvest to the reception and season.



Figure 11. Mushroom pickers happy with the harvest.

Non-wood forest products are essential for many industrial branches, as well as for the creation of culinary products and handicraft products (Dincă L., Timiș G.V., 2020), the same authors describing some traditional recipes in which edible mushrooms can be used as a main culinary element.

Regarding the risks regarding the serious intoxications that can occur due to the consumption of fungi, Gawlikowski T, et al., 2015 are of the opinion that the only way to avoid poisoning is to avoid the consumption of toxic species, for this reason the initiation in the recognition of edible mushroom species is good to be carried out both on the basis of specialized guidelines but especially in the presence of people who know this field very well.



Figure 12. Thematic courses on the recognition of edible mushrooms. ([Http:// incredibleromania.com](http://incredibleromania.com)*)

Certainly lately, initiation courses in harvesting and valorization of edible mushrooms are on an upward trend (Figure 12.) as well as the organization of groups of tourists who can stay in rural areas specifically to participate in the identification and harvesting of edible mushrooms from spontaneous flora.

CONCLUSIONS

The dynamics of the edible mushroom market in Romania is influenced by each season depending on the harvest that can be obtained in a certain period.

The most appreciated and marketed edible mushrooms from the forest fund are *Boletus sp.* but without differences between the eight species of *Boletus* being followed by *Craterellus cibarius*, *Armillaria mellea* and obviously those of the truffle group (*Tuber sp.*) mushrooms which fall under the category of luxury products and for which both legislation and harvesting arrangements are more restrictive and knowledge also plays a decisive role in obtaining significant harvests.

Edible mushrooms of medium commercial interest *Armillaria mellea*, *Morchella conica* and *Craterellus cibarius* can also make a significant contribution to the economic circuit, followed by mushrooms in the low interest category that we have identified, but which have a correlation between supply and demand.

The lack of knowledge regarding the identification of these mushrooms is one of the reasons why they are classified in this category, and the purchase price influences in a negative sense most of the time the harvesting of these mushrooms.

Regarding the most favorable areas where edible mushrooms from the spontaneous flora of Romania are harvested and capitalized, these areas are also situated in the counties: Arad, Arges, Bihor, Cluj, Bistrița Năsăud, Sălaj, Brașov, Hunedoara, Satu Mare, Harghita, Covasna, Dolj,

Gorj, Vâlcea, Suceava, Botoșani, Piatra Neamț and Bacău.

In addition to the domestic consumption of edible mushrooms from spontaneous flora, an estimated consumption of 17%, the largest quantity being exported to Italy 37%, Germany 13%, Spain 18%, Austria 8%, and a percentage of 7% to other countries, sometimes even Japan or Canada.

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