

An Ethnobiological Glance on Globalization Impact on the Traditional Use of Algae and Fungi as Food in Bulgaria

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Abstract

Bulgaria, situated in one of the hotspots of European biodiversity-the Balkan Peninsula, and inhabited since pre-historian time, is a good example for ethnobiological studies. The present paper, based on the studies of ethnobotanical and ethnomycological sources currently available combined with author's field trips and inquiries, follows the traditional use of fungi in the national cuisine, and the recent appearance of new, *exotic* mushrooms and algae and their products in the menu of Bulgarians. It is recorded that their consumption during the last two decades changed food habits of local people. This trend is accelerated by globalization and the increased rate of urbanization in the country.

Keywords: Wakame; Chinese fungi; Ethnobotany; Ethnomycology; Green microalgae; Honey; Mushrooms; Nori; *Saccharina*; *Spirulina*

Introduction

Ethnobiology can be briefly defined as the study of the biocultural domains that develop in the interaction between human beings and their surrounding landscape [1]. Therefore it covers many facets of our life on earth and is interested in all aspects of people's life, especially on man's relations or activity contexts with the biota in every form [2]. Among the both traditional and contemporary subjects of this science are food and feeding habits, which have been recognized as link between nature and culture [3]. However, "deeply embedded in local culture but made portable by technology, food is ... tied to economic developments and ecology, political policy and religion, taste and tradition. And, in the modern era, it has been subject to rapid change" [4]. Indeed food systems are being transformed at an unprecedented rate as a result of global economic and social changes related with the mass food production, development of biotechnologies, etc., (e.g. [4-6] among the many others). Globalization expresses the widening scope, deepening impact and speeding up of interregional flows and networks of interaction within all realms of social activity [7]. It is a force that can neither be halted nor ignored [8] and therefore the relationship between globalization and nutritional changes is one that is receiving increasing attention [9]. However, for some regions the recent impact of global exchange of people and goods on the traditional plant and fungal food is less documented. This is especially valid for Balkan countries, from which the knowledge on wild plant and mushroom consumption is yet more scarcely described in comparison with other European regions [10]. Nowadays even without special scientific tools is easily to recognize that there is a strong *invasion* on the actual food market of species and their products, traditionally used as food mostly in Asian region, but almost neglected in Europe and on the Balkans especially. Such species can be brought together in two main groups: *allochthonous* (*exotic, alien, non-native incl. introduced*) species, only very recently imported in the region (e.g. mainly seaweeds) and *autochthonous* species, overlooked in the traditional kitchen, most probably due to presence of many other edible ones (e.g. mainly xylotrophic fungi). In this paper we claim that this situation recently is typical for Bulgaria and its cultural development. This is especially true for the inhabitants of the capital and big towns since Bulgaria's population of 7.4 million people is predominantly urbanized and mainly concentrated in the administrative centres [11]. Therefore the paper, based on the studies

of ethnographical, ethnobotanical and ethnomycological sources currently available, follows the recent appearance of *exotic* mushrooms and algae and their products in the menu of Bulgarians, known by their strong cooking traditions, kept alive for many years by passing recipes from grandparents to parents, children, grandchildren, etc.

Materials and Methods

This study compiles and evaluates the ethnobiological (ethnobotanical and ethnomycological) data currently available [12-46]. Fungal names are given according to Index Fungorum [47] and algal names follow World Listing of Algae: Algaebase [48].

Field studies on the use of algae and fungi were conducted by the authors in the years 1986-2015 during their scientific field trips and student summer practices in the country. Our students were also inquired and were asked to mention all algal and fungal species and products, which were used by them or their parents and relatives. Ethical guidelines drafted by the International Society of Ethnobiology [49] and American Anthropological Association [50] were followed.

The study area covers practically the whole territory of Bulgaria-111,000 km². The country occupies a portion of the eastern Balkan Peninsula (Figure 1) bordering five countries: Greece and Turkey to the south, Macedonia and Serbia to the west, and Romania to the north. The Danube defines the border with Romania, while the eastern parts of the country reach the Black Sea coast. Plains occupy about one-third of the territory, while plateaus and hills occupy 41%. Bulgaria is home to the highest point of the Balkan Peninsula, Musala, at 2,925 m and its lowest point is sea level. Bulgaria has a temperate continental climate, which results from its being positioned at the meeting point of Mediterranean and continental air masses and the barrier effect of its mountains. Temperature amplitudes vary

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significantly in different areas: from the lowest recorded -38.3°C to the highest of 45.2°C . Precipitation averages about 630 mm per year, and varies from 500 mm in plains to more than 2,500 mm in the mountains. Continental air masses bring significant amounts of snowfall during winter. Due to the interaction of climatic, hydrological, geological and topographical conditions, Bulgaria is one of the countries with highest biodiversity in Europe. Most of the plant and animal life is central European, although representatives of Arctic and alpine species are present at high altitudes. The population of Bulgaria is 7,245,677 people according to the 2011 national census. The majority of the population, or 72.5%, reside in urban areas; approximately one-third part of the total population is situated in the seven biggest towns (>100,000 inhabitants-Sofia, Plovdiv, Varna, Burgas, Russe, Stara Zagora, Pleven) of the country and only in the capital Sofia is concentrated one-sixth of the total population. Bulgarians are the main ethnic group and comprise 84.8% of the population [11].

Results

Historical notes on Bulgarian cuisine

The term *Bulgarian cuisine* includes the main complex of dishes and compounds represented in the customs of Bulgarian people. In spite that human activity in the lands of modern Bulgaria can be traced back to the Paleolithic, this cuisine practically dates back to the establishment of the First Bulgarian Empire in 681 AD [11,34]. Then the food habits and traditional cuisines of Thracians, Slavs and proto-Bulgarians merged. In this amalgam is to be seen also the historical presence of food habits, meals and traditions of the Persians, Greeks and Romans. According to Vakarelski [30] the written data on Bulgarian food are quite scarce. Archaeological data show that the main cuisine compounds in Bulgaria were the traditional for the region vegetables (cabbage, carrots, beetroot, onion, garlic, etc.), different meat (sheep, goat, pork, beef, poultry, game), cereals (millet, oats, barley, rye, wheat), as well as some legumes (broad beans, lentils, peas, vetch). The culinary exchange with the East started as early as 7th century AD, when traders started bringing herbs and spices to the First Bulgarian Empire from

India and Persia. Therefore Bulgarian cuisine shares a number of dishes with the Middle Eastern Cuisine, and a limited number with the Indian cuisine as well. In 16-17th centuries the main products and foods discovered in America appeared in the country and since then started to play important role in meals preparation (e.g. (kidney) beans, paprika, tomatoes, potatoes, maize, sunflowers, etc.). After the Liberation from Ottoman rule in 1878, European culture had a strong influence on the cultural development of the country, including the food habits and local cuisine. The strongest impact on it played French, English and Italian dishes [34]. The Russian influence was to be felt even before the Liberation, but it became much stronger after the Second World War due to the leading role of Soviet Union. The appearance of many traditional Russian dishes and spices on Bulgaria table in this period is clearly seen from the recipes provided in Book for the Housekeeper from 1956 [20]. More recently, after the democratic political changes in 1989, the food habits of Bulgarians entered in a new phase through intensive exchange of nutritional products available from all over the world. With few exceptions [e.g. 12,13], most ethnographical and ethnobiological sources, which contain information related to the present study, were created after the Liberation in 1878.

Mushrooms in traditional Bulgarian cuisine

This very brief analytic report on traditional products, spices and food habits, mentioned in literature on Bulgarian cuisine (since its first descriptions by Rakovski [12] till nowadays [45]), clearly shows the small importance of mushrooms in our dishes. Some general advices how to choose fungi from natural habitats for cooking (according to their colour and smell) were provided in the first officially published Bulgarian Cookbook [13]. These advices, written in a flowery language, recently sound very naive. They shall not be discussed here in detail since this book did not reflect the real Bulgarian kitchen, but complies information on meals “as they are prepared in Istanbul” and also on some European meals.

It has to be noted that in spite of their low number, there exist some local traditional meals with mushrooms. For example, 37 principle recipes with them are provided by Sechanov [21] in his specialized handbook on mushrooms, 27 are in the comprehensive book “Bulgarian National Cuisine” by Petrov et al. [34], 25-in the Home encyclopedia “Daily Book for Each House” [29], 21-in the cookbook “What cooks woman today?” [39], 19-in the “Handbook for a Housekeeper” [20], 8-in the specialized “Cookbook for men” [35] and only one is included in the book “Bulgarian Table”, oriented towards both traditional and festivity kitchen [46]. Only one recipe with mushrooms is included in one of the very popular cookbooks for modern Bulgarian women in the end of 30’s, which contains descriptions of both national and foreign meals [15]. The types of dishes in which fungi are used, are quite different-salads, pixels, soups, gruels (messes), fish, meat and vegetarian dishes (incl. *moussaka*, *gyuvetch*), pastries, sauces and garnishes. With the appearance in 90’s in our lifestyle of microwaves and freezers, 10 special recipes for cooking of mushrooms with these “new apparatuses” were given [40]. An interesting fact is that almost all the above mentioned recipes did not contain the exact vernacular or Latin fungal name, but only the generalized word “mushrooms”, and in most cases from recipe details becomes clear that generally representatives of *Agaricus* are considered as ingredients. Few exceptions concern recipes where exactly the fungal names *Agaricus* and *Marasmius oreades* are mentioned in the meals name.

The knowledge on mushroom consumption together with the increasing interest to such type of food provoked the appearance of first Bulgarian handbooks for fungal collection in nature and their

cultivation [14,16-18,21] in addition to the scientific mycological studies in the country started by F. Bubák [51], St. Gueorgieff [52] & B. Barsakoff [53].

Edible mushrooms in Bulgaria

In the second edition of the most comprehensive Bulgarian handbook on fungi and their collection [21], its author noticed that village people by practice are able to distinguish some edible and poisonous species. According to him, these species are ca. 250 from the total amount of more than 2000 macromycetes, recorded in the country. Almost the same numbers are provided in the mycological literature more than half-a-century later [54]: 2072 macromycetes in total and 200 of them edible. Below are enlisted in alphabetical order the 10 most popular mushrooms collected by Bulgarian people for fresh-eating or for drying, freezing or other preservation, combined according to [12,19,21,29,32,54] and according to our own field experience and inquires: *Agaricus campestris* L., *Agaricus sylvaticus* Schaeffer, *Amanita caesarea* (Scop.) Pers., *Boletus edulis* Bull., *Boletus pinophilus* Pilát & Dermek, *Cantharellus cibarius* Fr., *Macrolepiota procera* (Scop.) Singer, *Marasmius oreades* (Bolton) Fr., *Lactarius deliciosus* (L.) Gray and *Suillus luteus* (L.) Roussel.

Less consumed according to [21,32,44] and our data are the gasteromycetes like *Calvatia gigantea* (Batsch) Lloyd, *Lycoperdon perlatum* Pers., *Bovista* spp. and agaricales like *Amanita rubescens* Pers., *Calocybe gambosa* (Fr.) Singer, *Coprinus comatus* (O.F. Müll.) Pers., *Clitocybe nebularis* (Batsch) P. Kumm., *Tricholoma portentosum* (Fr.) Quél., *Tricholoma terreum* (Schaeff.) P. Kumm and some species of *Russula* (e.g. *Russula virescens* (Schaeff.) Fr., *Russula cyanoxantha* (Schaeff.) Fr.).

According to the specific advices for preparation of Bulgarian edible mushrooms given in [22] it is possible to add some more species to the list of traditionally used fungi. There as most suitable for drying were indicated the aromatic mushrooms with tubular hymenophore, because in drying process they form aromatic substances which give a valuable taste of cooked dishes: *Boletus edulis* Bull., *Gyroporus castaneus* (Bull.) Quél., *Melanogaster variegatus* (Vittad.) Tul. & C. Tul. and *Choiromyces meandriformis* Vittad. Mushrooms with gills, which have acid milk and also mushrooms with an unpleasant taste and smell like *Lactarius piperatus* (L.) Pers. were precepted for salting, while as suitable for being pickled were indicated *Boletus* spp., *Suillus luteus* (L.) Roussel., *Agaricus campestris* L., *Pleurotus ostreatus* (Jacq.) P. Kumm, *Armillaria mellea* (Vahl) P. Kumm., *Calocybe gambosa* (Fr.) Singer, *Albatrellus confluens* (Alb. & Schwein.) Kotl. & Pouzar.

In the period between 60's and 90's of the last century increased the number of national specialized books published on mushroom collection, identification and cultivation [25,27,28,31-33,36,37,41-44].

New phase in mushroom consumption in Bulgaria

After the political and economic changes in the country, in the beginning of 90s of the last century, an obvious change in the awareness of mushrooms by Bulgarians could be detected. The deep economic crisis ultimately provoked the interest of people in mushrooms as type of nourishing food and in this period some national booklets on edible fungi appeared on the market [41-44]. In parallel, recipes with them, provided in modern cook books, became more popular, as well. In some mountain regions (e.g. Rodopi Mts), the large representatives of Boletales (and mainly *Boletus edulis* Bull.) became of great importance in the means of livelihood of local people because of their export trade value. This interest of foreign companies also provoked the curiosity

of local people to the fungal nourishing value. With the appearance of Chinese restaurants in big cities of the country in the beginning of 90s, Bulgarians started to consume some fungal species, which are typical for Chinese cuisine - *Auricularia auricula-judae* (Bull.) Quél. (jew's ear), *Auricularia nigricans* (Fr.) Birkebak, Looney & Sánchez-García (Black fungus), *Tremella fuciformis* Berk. (silver ear or white jelly mushroom). Among the last is *Flammulina velutipes* (Curtis) Singer (winter mushroom, Velvet stem, Velvet foot), which is popular for its consumption in cold year periods in different countries of Central and Western Europe and is more and more broadly-used in Chinese meals. There it is used mostly in its cultivated forms, as cultivars under the names «Enoki mushroom» or «Enokitake» (Golden needle mushroom or Lily mushroom). It looks nothing like the wild mushroom, however; it is pale, long-stemmed, and tiny-capped.

Paradoxally, some of these species are common in Bulgaria (*Auricularia auricula-judae* (Bull.) Quél., *Flammulina velutipes* (Curtis) Singer and *Tremella* spp.) But they never received the attention of local people. According to our teaching experience, not only common people, but students-beginners in biology are always surprised to hear that these fungi are not exotic aliens and could be easily gathered from our nature. Indicative is also the naming of these mushrooms in Bulgarian shops and restaurants, and among people as well, as «Chinese fungi», or «Chinese mushrooms». This expression is used even in cases when the fungus has a vernacular name (e.g. *Auricularia auricula-judae* is known in Bulgaria as «Yudino ucho» (=Juda's ear), *Flammulina velutipes* as «Zimna pripunka» (=Winter stub mushroom).

Barsakoff [16] and Sechanov [21] provided explanations on the organization of fungal cultivation for truffles and more than 11 basidial species: *Boletus edulis* Bull., *Leccinum scabrum* (Bull.) Gray, *Suillus grevillei* (Klotzsch) Singer, *Imleria badia* (Fr.) Vizzini, *Cantharellus cibarius* Fr., *Pleurotus ostreatus* (Jacq.) P. Kumm, *Entoloma clypeatum* (L.) P. Kumm., *Lepiota clypeolaria* (Bull.) P. Kumm., *Paxillus involutus* (Batsch) Fr., *Tricholoma populinum* J.E. Lange, *Armillaria mellea* (Vahl) P. Kumm. Sechanov [21] strongly recommended for both industrial and home cultivation especially in Bulgaria to be used *Agaricus campestris* L. nevertheless of the popular vision that all *Agaricus* representatives are easily cultivated. Since the middle of the last century as industrially cultivated mushrooms in Bulgaria could be pointed only the Button mushroom (white and brown) and the Oyster mushroom (*Agaricus bisporus* (J.E. Lange) Imbach and *Pleurotus ostreatus* (Jacq.) P. Kumm, respectively). During the last years in some places in the country starts the cultivation of the Shiitake mushroom (*Lentinula edodes* (Berk.) Pegler).

Algae in Bulgarian cuisine

In spite that studies on Bulgarian algae dated more than one century (starting with Petkoff [55]) and comprise of more than 200 sources, we could not find in any of them even a mentioning of this organismic group as traditional food resources for Bulgarian population. However, most recently, algae and their compounds achieved much higher public awareness in the Bulgarian society. One of the first events which brought to this change in the food habits of Bulgarians (as was in the case of so-called «Chinese fungi» mentioned above), was the appearance of Chinese restaurants and Japanese sushi restaurants in the country in the early 90's. Now they are widespread, at least in the seven biggest towns, where lives one-third of the population of the country [11] and by years became very popular and commonly used, rising the interest of people to other Asian kitchens (Korean, Indian, etc.). Another vector for dispersal of exotic food products are:

1) the big chains of supermarkets, which started to promote different kitchens and new commodities and 2) the raising amount of small shops for peculiar Asian food products. In this way different red and brown seaweeds and their products appeared on our market and started to become more and more popular. Among them are different species of *Pyropia*, more popular with its older synonym *Porphyra* (mainly *Pyropia tenera* (Kjellman) N.Kikuchi, M.Miyata, M.S.Hwang & H.G.Choi and *Pyropia yezoensis* (Ueda) M.S.Hwang & H.G.Choi, both commonly named here with its broadly used Japanese and trade name Nori), *Saccharina latissima* (Linnaeus) C.E.Lane, C.Mayes, Druehl G.W.Saunders, et al. (Syn. *Laminaria saccharina* (Linnaeus) J.V.Lamouroux, popular with the Bulgarian name Morsko Zele (=Sea cabbage in English), *Undaria pinnatifida* (Harvey) Suringar, popular here with its broadly used Japanese and trade name Wakame). Different species of *Pyropia* (*Porphyra*) are consumed mainly as ingredients of sushi or in soups, generally named here “Soup with algae”, *Undaria* is taken mainly as appetizer and prepared salad (sold spiced in the supermarkets), while *Saccharina* is consumed predominately as salad (separately, or in combination with onion and cucumbers) and as soup in restaurants.

In spite of the earlier scientific attention paid in Bulgaria to the nutritional qualities of *Spirulina* [56] and outdoor cultivation of green microalgae like *Chlorella* and *Scenedesmus* [57-68], only in the last year started the consumption of blue-green algal “*Spirulina* shakes”, served in some modern restaurant chains, situated along the highroads. For a short period in the beginning of 80’s, in Bulgarian apothekes a honey named *Algomed* (*med* in Bulgarian language means honey), enriched by green microalgae produced in outdoor cultivation systems in Bulgarian village Rupite, was sold. In 2013, on the Fest of apiarists in Bulgarian town Dobrich a linden honey, combined with propolis and *Spirulina* extract was presented and achieved a special award [69].

In the last two decades strongly increased the usage of red algal product agar-agar (recently becoming popular with its Chinese name *kanten*) as better jellifying agent in home production of cakes, ice-cream and jellied dishes (jellied, meat, jellied chicken, etc.) instead of the more traditional gelatin.

Discussion

Discussing the events and reasons which lead to reported above changes in algal and fungal consumption of Bulgarian people in the frame of globalization effects with import of exotic products, undergone by the country, we have to mention also.

- The modern trend to use more nutritional food (incl. food of medicinal value) and different palette of food supplements.
- The increase of interest to vegetarian type of feeding. Both develop on the background of constant advertisements of natural way of life, translating and publishing of cook books of different countries.

Here have to be mentioned also the raised interest of Bulgarians to gastronomic literature and TV (or Internet) competitions and to the *molecular gastronomy* [70]. Important 3rd factor is the increased possibility for travelling of Bulgarian people due to the better economic situation in the country and enhanced travelling abroad due to the entrance of the state in the European Union.

It is really difficult to arrange indubitably the set of factors, which led to the increased interest and consumption of algal and fungal species and products in the country. In parallel to the knowledge on the health benefits from them, it has to be noted that they become more

and more fashionable on the modern table and some people try them for first time just for such reason. For example, the algal species, enlisted above, contain essential polyunsaturated fatty acids and are very high in vitamins, natural minerals and elements, in protein and essential aminoacids together with peculiar polysaccharides -phycocolloids (like alginates) [71-73 among the many others]. Therefore they are broadly advertised as a nutrient-rich food especially beneficial for health and well-being (*superfood*), but according to our inquiries some people start to consume them just because they came in fashion, appearing as *exotic* food in Asian restaurants, and only afterwards some of them start to check the nutritional values of these *miracle* algae. The comparison of available nutrient tables for mushrooms used in traditional Bulgarian kitchen and newly invented species [74-83] shows no significant difference in percentage representation of their main compounds and even lesser protein content in some of the newly consumed species Table 1. Therefore it could be stated that the reason for their consumption lies mainly in their *vogue* appearance. According to our own observations, the mentioned exotic algal and fungal species and their products not only appeared on Bulgarian market, but they remained on it and their diversity and amounts increase. This inevitably shows the increased interest in their buying and consumption, at least by town inhabitants, where the main supermarket chains and foreign restaurants are situated. It has to be boldly underlined that the changes in food consumption described in this paper concern only the appearance of new algal and fungal species on Bulgarian table as additional, interesting type of food but not as replacement of our traditional meals.

We believe that the facts briefly represented above outlined the

Fungus name	Nutritional Profile (Percentage on 100 g dry weight)
<i>Agaricus bisporus</i>	25-33% proteins, 9% fiber, and 10% ash
<i>Amanita rubescens</i>	18% proteins
<i>Amanita caesarea</i>	15% proteins, 14% fat, and 10% ash
<i>Auricularia auricula-judae</i>	10,6% proteins, 0,2% fat, 65% carbohydrates, 7% fiber, and 5,8% ash
<i>Auricularia nigricans</i>	8-10% proteins, 0,8-1,2% fat, 84-87% carbohydrates, 9-14% fiber, and 4-7% ash
<i>Boletus edulis</i>	23-38% proteins, 2-9% fat, 47% carbohydrates, and 1-7% ash
<i>Cantharellus cibarius</i>	15-21% proteins, , 5% fat, 62-64% carbohydrates and 2-13% ash
<i>Coprinus comatus</i>	25-29% proteins, 3% fat, 59% carbohydrates, 3-7% fiber, and 1,18% ash
<i>Flammulina velutipes</i>	17-31% proteins, 1,9-5,8% fat, 3,7% fiber, and 7,4% ash
<i>Lactarius deliciosus</i>	23-27% proteins, 7% fat, 28% carbohydrates, and 6% ash
<i>Lentinula edodes</i>	13-18% proteins, 2-5% fat, 6-15% fiber, and 3,5-6,5% ash
<i>Macrolepiota procera</i>	20% proteins, <4% fat, 69% carbohydrates, 7% glycoproteins, 7% fiber, and 12% ash
<i>Pleurotus ostreatus</i>	10-30% proteins, 2-4,2% fat, 54,4% carbohydrates, and 6,9% ash
<i>Russula cyanoxantha</i>	17% proteins, 8% fat, and 8% ash
<i>Suillus luteus</i>	20% proteins, 4% fat, 57% carbohydrates, and 6% ash
<i>Tremella fuciformis</i>	4,6% proteins, 0,2% fat, 1,4% fiber, and 0,4% ash
<i>Tricholoma portentosum</i>	45% fiber
<i>Tricholoma terreum</i>	15% proteins, 6,6% fat and 50% fiber

Table 1: Nutritional profiles of some mushrooms consumed in Bulgaria. The table is compiled according to recently available nutrient table data. For reference details see the text of the paper.

general trend for enrichment of the palette of food sources, used till recently by Bulgarians, due to globalization effects. Taking into account the stable trend for increasing urbanization of the country population (e.g. acc. to [11] there is a stable raise from ca. 10% town population in 1887 to 72.5% in recent years), we claim that these changes could take place only contemporary because of three strong reasons:

- The central situation of the country in the Balkan region, one of the hotspots of European biodiversity [84], with moderate climate conditions and rich natural resources, which provide great diversity of plants and animals as available food sources in former times, thus preventing Bulgarians from looking around for food among more neglected groups like algae and fungi;
- The situation of the country on the shore of the very untypical sea - the Black Sea with its lack of typical tides and mixo-mesohaline (brackish) waters where no real marine algal flora develops [70,85];
- The extremely strong conservatism of Bulgarian characters, which impedes the easy acceptance of any novelties [86], especially in food habits.

We believe that this first ethnobiological evaluation of the changes in algal and fungal consumption and food habits of Bulgarian people due to globalization effects may be of interest to scholars and could be especially useful for further statistical re-evaluating local food niche markets and avant-garde gastronomic trends.

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