

*Biotechnology*

## Georgian Green Specialty Tea. The Most Northern Tea Technology

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**In the 80s of the 20<sup>th</sup> century the area of tea plantations in Georgia amounted to 65,000 hectares with an annual harvest of 400-500 thousand tons of raw material. Tea industry was one of the key branches of agrarian sector of the country. Geographical factor and soil-climate terms impact over biochemical and technological indicators of the tea raw material. Georgia tea is known for its characteristic, specific taste and aromatic properties. These indicators depend on the varietal composition of the plant, agro-technical measures, technological parameters of the processing and ecological factors. The formation of perfect bouquet is associated with a sharp diurnal change in ambient temperature and relative humidity as a result of the influence of geographical factor. Tea made in the North of Georgia is characterized by a particularly delicate aroma and a relatively small number of secondary metabolism products. Aroma is of particular importance when evaluating the quality of these products. Tea is not only a tasty product, but also an important source of biologically active substances. The most important taste properties and biological activity of tea are determined by polyphenols, primarily catechins. © 2021 Bull. Georg. Natl. Acad. Sci.**

Georgian specialty green tea, organoleptic characteristics, biologically active substances

History of the tea plant (*Camelia sinensis* (L) O. Kuntze) in Georgia begins in the middle of the 19<sup>th</sup> century, when tea bushes were first brought from China. Tea bushes were planted in the humid subtropical zone of the Black Sea near Sokhumi and Batumi. First cultivation of tea plants and production of tea grew very slowly and were rather primitive. The intensive development of tea plantations and real tea industry began only in the early of the 30s. At the same time, in Anaseuli, on a hill surrounded by tea plantations, not far from the

city of Ozurgeti, special Institute of Tea, Subtropical Cultures and Tea Industry was organized. The scientific research of the Institute involved foundations of tea breeding technologies, its cultivation and processing, taking into account soil-climatic and local characteristics, creation of new machines and equipment to provide high yield and high-quality product in the northernmost subtropics of the World. The regions of tea growing in Georgia by their geographical location (42-43<sup>0</sup> north latitude) are one of the most northern amongst the

existing industrial tea growing areas. The seasonal change in temperature in the northern subtropics has a pronounced character. Winter is characterized by short-term frost and snow cover, which practically excludes the use of pesticides. Geographical factor influences the biochemical properties of the tea leaf.

The most important taste properties and biological activity of tea are determined by polyphenols, primarily catechins, which have antioxidant, anti-inflammatory, antimicrobial, antiviral, antitumor and anticoagulant activities [1-7]. It became possible, along with traditional products, to obtain dry and liquid concentrates, natural food colors and tonic drinks.

Since the mid-eighties, the area of tea plantations in Georgia amounted to 65,000 hectares with an annual harvest of 400-500 thousand tons of green tea leaves.

Over the past two to three decades tea plantations in Georgia deteriorated and decreased up to 7,000 hectares. Despite the decline in production, Georgia still remains a country with scientific and engineering potential, where research is constantly being carried out aimed at expanding tea production and new technologies. Specific soil

climatic conditions and raw material basis adapted to the conditions make it favorable to develop – the production of high-quality specialized and organic (“bio”) products with distinctive properties.

## Materials and Methods

The following experimental and commercial tea products are used as research objects: Specialized experimental Georgian green tea are: “Greenfield” (Chinese green tea), “Shemokmedi” (Georgian green tea); “Royal Richards” (Chinese green tea); “Gurieli” (Georgian green tea); “Akhmad”.

The content of the main chemical compounds of tea leaves (caffeine, soluble pectin substances, protopectin, cellulose, soluble carbohydrates, lignin, protein substances, and free amino acids) were determined by standard methods used in laboratory practice. The total amount of phenolic compounds and antioxidant activity was determined by appropriate methods. Catechins of High Performance Liquid Chromatography (HPLC) [8-11].

## Results and Discussion

Tea is not only a tasty product, but also an important source of biologically active substances. In the tea leaf of different ages of the Georgian

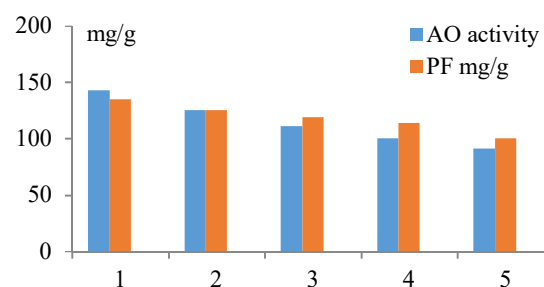
**Table. Organoleptic characteristics of experimental Georgian specialty green tea and green tea “Greenfield”**

№	Indicators	Organoleptic Characteristics	
		“Experimental, Georgian specialty green tea”	“Greenfield”
1	Aroma and taste	Subtle delicate aroma, pleasant taste with astringency	Delicate aroma, pleasant taste with astringency
2	Liquor	Transparent, light green, with yellowish tinge	Transparent, light green
3	Appearance of infused leaf	Transparent, light green, with yellowish tinge	Transparent, light green, with a yellowish tinge
4	Appearance of dry leaf	Attractive uniform in size and texture	Consisting of leaves of approximately equal size

**Note:** in the aroma of Georgian specialty green tea, along with the full bouquet, there is also a noticeable citrus tones.

plant variety, a large amount of the following substances are accumulated: polyphenols (20.9-22.6%), the main part of which is catechins (120.2-130.4 mg/g); alkaloid caffeine (2.30-2.92%), soluble pectin substances (4.21-4.72%), protopectin (4.19-5.0%), cellulose (11.81-13.4%), soluble carbohydrates (5.70-6.76%), lignin (5.17-7.46%), protein substances (24.94-29.06%) and free amino acids (1.16-1.58%). As tea shoots develop, the content of all major soluble quality-determining chemicals decreases with leaf age. With the advancement of the tea plant to more northern regions, decrease in the total amount of polyphenols and catechins, increase in the content of protein substances and soluble carbohydrates is observed. These data indicate that tea raw materials are heterogeneous in their composition, biochemical and technological properties. Each part of it requires purposeful complex use for the development of specific type of product using appropriate technology and regulations. As a result of the research, the integrated technology was proposed, which provides for the production of specialized tea from especially high-quality components of raw materials, and from the other part the production of traditional varieties,

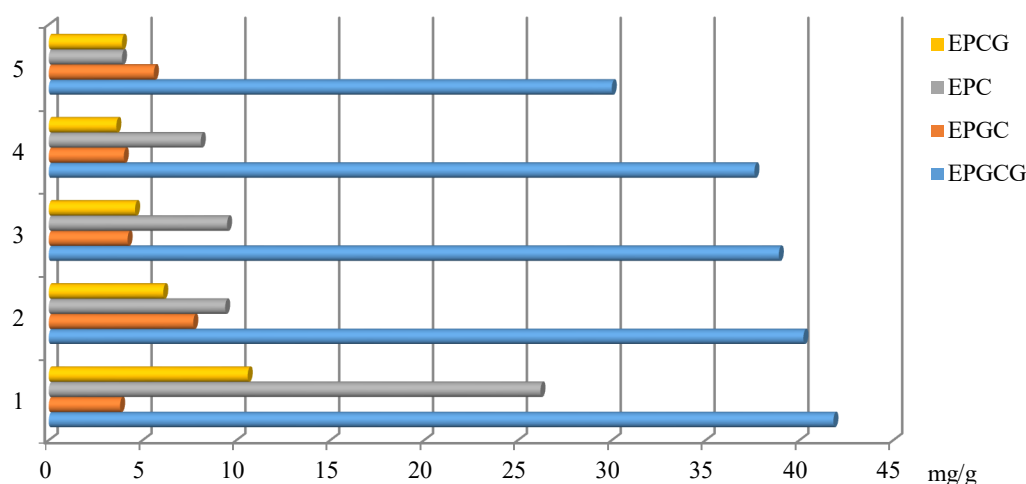
granulated and briquetted tea, biologically active extracts and additional food products [12-14].



**Fig. 1.** Total amount of polyphenols (PF), mg/g and antioxidant activity (AO)  $R=1/S \text{ sec.} \times 1000$  in tea: 1 – Experimental, Georgian specialty green tea; 2 – “Greenfield” (Chinese green tea); 3 – “Shemokmedi” (Georgian green tea); 4 – “Royal Richards” (Chinese green tea); 5 – “Gurieli” (Georgian green tea).

The results of the study of organoleptic parameters, catechins and antioxidant activity of extracts of specialized Georgian experimental and commercial tea varieties in comparison with foreign tea (6 samples) are presented. In the commercial green tea samples, the quantitative composition of four main catechins was studied.

The results of tasting two green tea varieties show that specialized experimental Georgian green tea differs from “Greenfield”, characteristic with



**Fig. 2.** Comparative amount of four catechins (mg/g) in commercial green tea extracts: (EPCG – epicatechingallate; EPC – epicatechin; EPGC – epigallocatechin; EPGCG – epigallocatechin gallates). 1 – “Greenfield”; 2 – “Shemokmedi”; 3 – “Royal Richards”; 4 – “Akhmad”; 5 – “Gurieli”.

specific taste and aroma properties (Table 1). These indicators depend on the varietal composition of the plant, agro-technical measures, technological parameters of processing and ecological factors. The formation of a perfect bouquet is associated with a sharp diurnal change in ambient temperature and relative humidity as a result of the influence of geographical factor. Tea made in the North is characterized by particularly delicate aroma and a relatively small number of secondary metabolism products. Aroma is of particular importance when evaluating the quality of these products.

The results of the study show that experimental Georgian specialty green tea is superior to all tea samples in terms of the amount of polyphenols and antioxidant activity. Along with the distinctive taste properties, high rates of experimental specialized Georgian green tea have been shown in terms of total phenolic compounds, antioxidant activity

resulting from deep inactivation of oxidizing enzymes in the technological process of making experimental tea. The main purpose of production of green tea is to preserve all matters containing in a green leaf.

The results of the quantitative determination of catechins in extracts of green tea “Greenfield” and “Shemokmedi” confirm high content of epigallocatechin gallate (Fig. 2). On the other hand, compared to imported green tea, Georgian teas “Shemokmedi” and “Gurieli” contain more epigallocatechin, which is also characterized by high biological activity [11].

The optimal balance of total polyphenols, catechins and other quality-determining compounds in the tea leaf creates the best background for maximum demonstration of the qualities of Georgian specialty green tea.

**ბიოტექნოლოგია****ქართული მწვანე საფირმო ჩაი. ყველაზე ჩრდილოეთი ჩაის ტექნოლოგია****თ. რევიშვილი\*, ი. ჩხიკვიშვილი\*\*, თ. მიქაძე\***

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(წარმოდგენილია აკადემიის წევრის გ. კვესიტაძის მიერ)

გასული საუკუნის 80-იან წლებში ჩაის პლანტაციების ფართობი საქართველოში 65 ათას ჰექტარს აჭარბებდა და წლიურად 400-500 ათასი ტონა ნედლეული მზადდებოდა. მეჩაიეობა ქვეყნის აგრარული სექტორის ერთ-ერთ უმთავრეს დარგს წარმოადგენდა. გეოგრაფიული ფაქტორი და ნიადაგობრივ-კლიმატური პირობები გავლენას ახდენენ ჩაის ნედლეულის ბიოქიმიურ და ტექნოლოგიურ მაჩვენებლებზე. ქართული ჩაი გამოირჩევა მისთვის დამახასიათებელი განსხვავებული საგემოვნო და არომატული თვისებებით. ეს მაჩვენებლები დამოკიდებულია მცენარის ჯიშურ შემადგენლობაზე, აგროტექნიკურ ღონისძიებებზე, გადამუშავების ტექნოლოგიურ პარამეტრებსა და ეკოლოგიურ ფაქტორებზე. სრულყოფილი თაიგულის წარმოქმნა უკავშირდება გეოგრაფიული ფაქტორის გავლენის შედეგად გარემოს ტემპერატურის და ფარდობითი ტენიანობის მკვეთრ სადღეღამისო ცვლილებას. ჩრდილოეთით მდებარეობის პირობებში დამზადებული ჩაი განსაკუთრებული ნაზი არომატით და მეორეული მეტაბოლიზმის პროდუქტების შედარებით ნაკლები რაოდენობით ხასიათდება. ამ პროდუქტების ხარისხის შეფასების დროს განსაკუთრებული მნიშვნელობის მაჩვენებელს არომატი წარმოადგენს.

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