

PLANTS USED FOR THE PRODUCTION OF STIMULANTS

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Summary

Plants having stimulant effects and taken into the digestive system are used in many different forms, varying from region to region around the world. The consumption of stimulants dates back to prehistoric times, and production of their extracts, solutions and preparations are very common and practised, even today, world-wide. The active agents responsible for stimulant action are alkaloids of purin and tropane bases, being present in the majority of species belonging to this plant group. Tea (*Camellia sinensis*) is widely used as a beverage, due to its refreshing and stimulation activity. Extracts made of leaves can be used as a flavor in beverages, frozen desserts, candy, baked goods, gelatines and puddings. The plant is a potential source of food colors (black, green, orange, yellow, etc.). Coffee (*Coffea spp.*) is used as a drink for stimulation. Because of its chemical composition coffee is applied as a flavoring, as in ice cream, pastries, candies and liqueurs. In recent decades the consumption of decaffeinated coffee and specialities (espresso-based beverages, iced/cold coffee, instant coffee) has markedly increased. Kola (*Cola spp.*) is used as a flavor ingredient in cola beverages, for making baked goods, candy, frozen dairy desserts, gelatines and puddings, and the seed used as a condiment. Dye is produced from the red juice. Cacao (*Theobroma cacao*) seeds are the source of the commercial cocoa, chocolate and cocoa butter.

The main compounds responsible for stimulation action are caffeine and theobromine. There are other stimulant species having mainly local or regional significance. This

group includes Maté (*Ilex paraguariensis*), Guarana (*Paullinia cupana*) and Yoko (*Paullinia yoko*). Coca is the only source of cocaine, which was used as an ingredient of Coca-Cola, until 1904, when the U.S. courts ruled against its use.

1. Introduction

Humankind has used stimulants of plant origin for a great many centuries. The plants have been consumed in different forms to stimulate the central nervous system. Some of them, based on their activity, giving a sense of boundless energy and freedom from fatigue, and were regarded as a divinity. In some cases the stimulating effect, depending on the dosage, are combined with narcotic, euphoriant and hallucinogenic actions. The plants having stimulant activities and taken into the digestive system are used in many different forms, changing from region to region (see Figure 1.). For instance the consumption of tea dates back to the ancient China; the production of extracts, solutions and preparations is very common and practised, even today, worldwide. Other species have much less tradition, their consumption is restricted to the local region and the utilization form is sometimes rather extraordinary one, e.g. leaves of stimulating plants are gathered and chewed in original green form (e.g. coca).

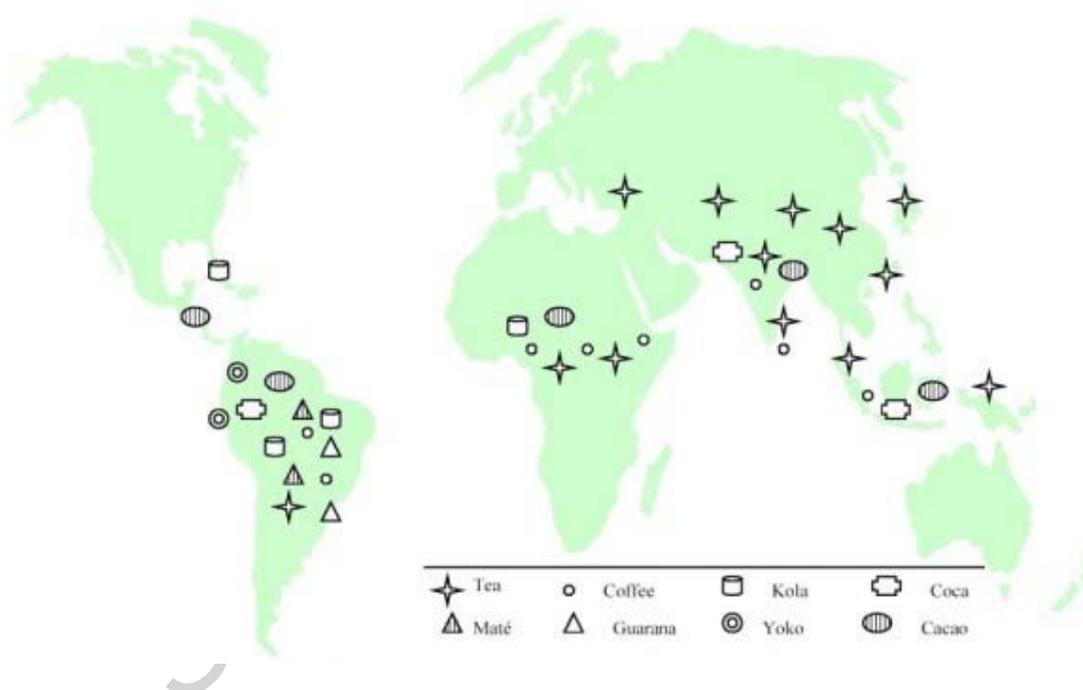


Figure 1. Geographical distribution of regions of main importance specialized for production of plant stimulants

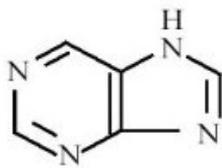
The active agents, which are responsible for stimulant action are alkaloids of purine and tropane bases being present in the majority of species belonging to this plant group. The purines are derivatives of a heterocyclic nucleus consisting of a 6-membered pyrimidine ring fused to a 5-membered imidazole ring. The pharmaceutically important bases of this group are all methylated derivatives of 2,6-dioxypurine (xanthine). Caffeine is 1,3,7-trimethylxanthine, theophyllin is 1,3-dimethylxanthine and theobromine is 3,7-

dimethylxanthine. Cocaine is also an alkaloid, belonging to the tropane alkaloid group. The structure of the purine base alkaloids, as well as cocaine, is given in Figure 2.

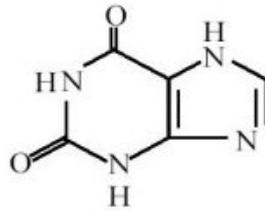
2. Species used for stimulation

The number of species, which are used on a large scale for stimulation is rather limited, being less than ten. Their botanical and common names, as well as their active agents, are grouped in Table 1.

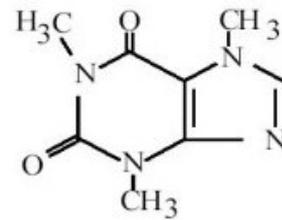
ALKALOIDS OF PURINE BASES



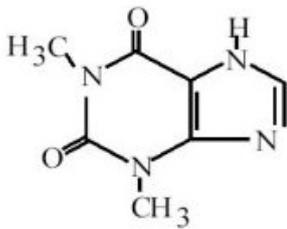
Purine



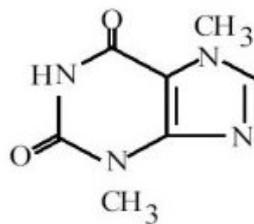
Xanthine



Caffeine

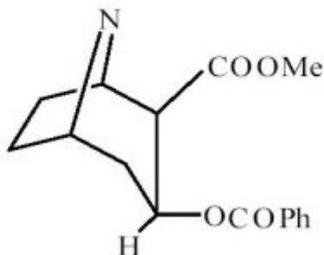


Theophylline



Theobromine

ALKALOID DERIVED FROM TROPINE



Cocaine

Figure 2. Alkaloids of purine and tropane bases present in the majority of plant species and responsible for stimulation

Common names	Scientific name	Active agents
Tea, Thea Bohea, Thea Stricta Jassamica, Thea Veridis	Camellia sinensis	caffeine, theobromine, theophylline, xanthine
Arabian Coffee, Arabica Coffee, Abyssinian Coffee, Coffea	Coffea arabica Coffea canephora	caffeine, paraxanthine, theobromine, theophylline
Cola, Cola Bissy Nuts, Guru, Guru Nuts, Kola Nuts, Kola Seeds	Cola acuminata Cola nitida	caffeine, theobromine
Coca, Cocaine, Cuca,	Erythroxyllum coca	cocaine
Brazil Tea, Gón Gouha, Houx Maté, Ilex Maté, Jesuit's Tea, Paraguay Herb, Paraguay Tea, Maté, Yerba Mate, South American Holly	Ilex paraguariensis	caffeine, theobromine, theophylline
Brazilian Cocoa, Guarana, Guarana Bread, Pasta Guarana, Paullinia, Sorbilis Paullinia, Uabano, Uaranzeiro	Paullinia cupana	caffeine, theobromine, theophylline, xantine
Yoko	Paullinia yoko	caffeine
Cacao, Chocolate, Chocolate Tree, Cocoa, Cocoa Beans	Theobroma cacao	caffeine, theobromine

Table 1. Plant species used as stimulants

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Biographical Sketch

Prof. Dr. Jenő Bernáth was born in Rimaszombat in 1944. He obtained an academic qualification from the University of Agriculture, Gödöllő in 1966. Between 1967 and 1992 he was employed by the Research Institute for Medicinal Plants (Budakalász, Hungary), at first as a research worker but he was later promoted to the post of scientific director. In 1989 he was invited to be an honorary professor of the University of Szeged and, in 1992, full professor of the Faculty of Horticulture, Department of Medicinal and Aromatic Plants (BKA University Budapest). On the basis of his scientific activity he was awarded a Doctor Degree of Hungarian Academy of Sciences in 1985 (Budapest).

His scientific activity is demonstrated by publication of 32 books or book-chapters, 239 scientific articles and about 150 scientific lectures. Between 1974 and 2004 he acted as editor of the international journal *Herba Hungarica* and *Acta Horticulturae* (ISHS - International Society of Horticultural Sciences) and editor of *Newsletter of Medicinal and Aromatic Plants* (supported by FAO). He was invited to be a member of the editorial board of *Journal of Spices, Herbs and Medicinal Plants* (USA). He has contributed to the creation of 11 new medicinal plant cultivars, two of them registered in Germany.

Between 1974 and 2004 he held positions as president or chairman of medicinal plant working groups of International Pharmaceutical Federation (FIP), International Society of Horticultural Sciences (ISHS), European Co-operative Programme of Crop Genetic Resources Networks (ECP/GR) and the International Council of Medicinal and Aromatic Plants (ICMAP).