Tonic, fortifier and aphrodisiac: adaptogens in the Brazilian folk medicine

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Abstract: In Brazil, many plants are used as tonic, fortifier, aphrodisiac, anti-stress, among other uses that are similar to the indications of an adaptogen. In general, such plants are used unspecifically, in situations of stress and fatigue, in the recovery after a previous pathological or debilitating state, or simply aiming at the maintenance of a healthy state. This article discusses the popular terms employed in the Brazilian folk medicine for the plants with this profile, their particularities and limitations. The article also discusses the possible mechanisms of action of an adaptogen and compares the main Brazilian plants used for that purpose: guarana (Paullinia cupana Kunth, family Sapindaceae), muirapuama (Ptychopetalum olacoides Benth., Olacaceae), catuaba (Anemopaegma arvense (Vell.) Stellfeld & J.F. Souza, Bignoniaceae, and Trichilia catigua A. Juss., Meliaceae), nó-de-cachorro (Heteropterys aphrodisiaca O. Mach, Malpighiaceae), damiana (Turnera diffusa Willd. ex Schult., Turneraceae) and pfaffia or Brazilian ginseng (Pfaffia sp, Amaranthaceae).

Introduction

The term adaptogen, or resistogen, as it is usually called, was created by Nikolai Lazarev in the former Soviet Union to classify a group of substances that can improve the body’s nonspecific resistance after being exposed to various stressing factors, promoting a state of adaptation to the exceptional situation (Brekhman & Dardymov, 1969). Israel Brekhman, his successor, established that a plant should meet three requirements in order to be considered an adaptogen (Brekhman & Dardymov, 1969): i) to be innocuous and not to disturb the body functions more than necessary. This means that an adaptogen should not produce effect on a healthy individual not submitted to stress; ii) to show a nonspecific activity, that is, to increase the body resistance in relation to harmful agents such as physical (heat, cold, variations of pressure, etc.), chemical (poisons and toxic substances) and biological (infections by viruses and bacteria); iii) to have a normalizing influence on a pathological state, independently of the nature of that state and the change in the previous pathological state (for instance, increase resistance to both heat and cold, aiming at balancing the body in adverse situations).

Even though these criteria are still mentioned, they are now being questioned, since the advances regarding this issue demonstrate, among other things, that adaptogens might indeed promote biochemical alterations in healthy individuals. Moreover, the way they are formulated, such concepts are considered vague and imprecise, therefore making it difficult to define whether the plants considered adaptogens today actually meet the three criteria.

In the 90’s, a group of scientists interested in the theme, comprised by Hildebert Wagner (Germany), George Wikman (Sweden) and Alexander Panossian (Armenia), proposed as a definition that “adaptogens are natural bioregulators that increase the body’s ability to adapt to environmental factors and avoid damage caused by those factors” (Panossian et al., 1999). In fact, the great merit of adaptogens is to minimize the body response to stress, reducing the negative reactions in the alarm phase and eliminating, or at least decreasing, the onset of the exhaustion phase that is part of the so-called syndrome of general adaptation (Wagner et al., 1994; Wagner, 1995; Rege et al., 1999).

However, adaptogens are indicated not only to counteract stress and its resulting damage. They are often used chronically to elicit a healthy state, or to improve or reduce some disorders and illnesses that result from aging, such as memory and attention deficits, tiredness...
and general weakness, sexual impotence, among others (Wahlström, 1987; Russo, 2001). According to this line of thought, one can classify a plant as being potentially adaptogenic when it is used popularly for prophylactic rather than healing purposes; as a tonic, a fortifier, etc. This kind of use is common in countries of Eastern Asia such as China, India, Korea and Japan as part of their traditional medicine, in which many plants are used to help individuals keep a physical and psychic well-being (Fulder, 1980; Wahlström, 1987; Davydov & Krikorian, 2000; Chan, 2005; ven Murthy et al., 2010). Even though it is a millenary practice, the principles of traditional Asian medicine are still unknown to most part of the Western population, including the medical and scientific communities (Dahanukar & Thatte, 1997; Chan, 2005).

Adaptogens are essentially prescribed for prophylactic purposes. However, they can also be used by healthy individuals to improve their cognitive and physical performance, in which case their efficacy is questionable.

Chart 1 brings a relation of the main adaptogen plants all over the world, indicating the family and the part used. In this list we can observe a higher incidence of plants of the Araliaceae family, being the root the medicinal part commonly employed. The Korean ginseng (*Panax ginseng* C.A. Meyer, Araliaceae), whose roots are used for various purposes, is the best known example of adaptogen plant.

The Brazilian flora has countless plants that are used as adaptogens, that is, instead of being used for a specific ailment, they are employed for the same purposes of adaptogen plants, generally referred to as tonics, fortifiers, revigorating, among so many other popular terms (Carlini, 1991; Mendes & Carlini, 2007). This article will discuss the meaning of those popular terms and some of the plants best characterized as Brazilian adaptogens: guarana (*Paullinia cupana* Kunth, Sapindaceae), muirapuama (*Ptychopetalum olacoides* Bent., Olacaceae), fáfia or Brazilian ginseng (*Pfaffia glomerata* Spreng., among other species, Amaranthaceae), damiana (*Turnera diffusa* Willd. ex Schult.,Turneraceae), nó-de-cachorro (*Anemopaeagma arvensa* (Vell.) Stellfeld ex de Souza (Bignoniaceae) and *Trichilia catigua* A. Juss. (Meliaceae) species).

**Data search**

The folk terms related to the adaptogenic effect that are discussed in this review were obtained from a survey in dozens of books about medicinal plants and folk medicine published in Brazil. The complete list of these books is available in Mendes (2005) and Mendes & Carlini (2007). It was used the databanks Scopus and PubMed to access the main studies carried out with possible Brazilian adaptogen plants.

**The “adaptogen” in the Brazilian popular culture**

The diversity of popular terms to explain the uses and effects of medicinal plants, along with the way different populations see illnesses and their manifestations, often make it hard to understand the exact meaning of their indications. The variety of designations used in the Brazilian popular medicine is compatible with the dimensions of the country and its cultural diversity. Therefore, it is important to highlight the fact that the same popular term might have different meanings depending on the region and community investigated.

Although there are several plants used in the country for the same purposes of adaptogens, this term is not often used in the Brazilian popular culture. Chart 2 is an attempt to classify the plants regarding popular uses related to adaptogenic effect (PURAE), as well as their possible terms in English.

Out of the terms used generically (listed in Chart 2), the most commonly used and also one of the least precise is probably the word “tonic”. Elisabetsky & Siqueira (1998) report that tonics are found in several

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**Chart 1. Some of the best-known adaptogen plants over the world.**

<table>
<thead>
<tr>
<th>Scientific name</th>
<th>Folk name</th>
<th>Family</th>
<th>Part used</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Bryonia alba</em> L.</td>
<td>loshtak</td>
<td>Curcurbitaceae</td>
<td>root</td>
</tr>
<tr>
<td><em>Eleutherococcus senticosus</em> (Rupr. &amp; Maxim.) Maxim.</td>
<td>Siberian ginseng, taiga</td>
<td>Araliaceae</td>
<td>root</td>
</tr>
<tr>
<td><em>Ocimum sanctum</em> L.</td>
<td>tuli</td>
<td>Lamiaceae</td>
<td>whole plant</td>
</tr>
<tr>
<td><em>Panax ginseng</em> C.A. Meyer</td>
<td>Korean ginseng</td>
<td>Araliaceae</td>
<td>root</td>
</tr>
<tr>
<td><em>Panax quinquefolius</em> L.</td>
<td>American ginseng</td>
<td>Araliaceae</td>
<td>root</td>
</tr>
<tr>
<td><em>Rhodiola rosea</em> L.</td>
<td>Artic root, golden root</td>
<td>Crassulaceae</td>
<td>root</td>
</tr>
<tr>
<td><em>Schisandra chinensis</em> (Turcz.) Baill.</td>
<td>Chinese magnolia vine</td>
<td>Schisandraceae</td>
<td>fruits</td>
</tr>
<tr>
<td><em>Withania somnifera</em> Dunal</td>
<td>Indian ginseng, ashwagandha, winter cherry</td>
<td>Solanaceae</td>
<td>root</td>
</tr>
</tbody>
</table>
traditional medical systems, regarding substances used by elderly individuals; those who are convalescing; to face periods of physical or mental stress, or simply to keep a good health. In another context, the word tonic may refer to isolated organs or parts of the body, as in cardiac tonic, capillary tonic, etc, and therefore are not within the range of action of a typical adaptogen, whose action extends to the body as a whole. Other terms used in the Brazilian popular medicine, and with the same purpose, are energetic, fortifier, regenerator, and restorative, among others. Plants that present those properties are also referred to as stimulants. However, the term stimulant was not included in Chart 2, since it represents an acute effect, characteristic of psychoactive drugs. Even though an adaptogen may also present a stimulant effect, it is different from that induced by stimulants of the central nervous system (Panossian & Wagner, 2005), being more closely associated with the idea of an energy drink, and its adaptive actions are the result of chronic use and slow adaptation mechanisms of the body, as this article will discuss later.

“Depravative”, another common term not included in Chart 2, does not mean much alone, since it is often observed along with the tonic and fortifying properties. According to popular medical dictionaries, depravative is a substance that has the property to purify the blood, being also used to mean substances that “thin the blood”. It is widely recognized that blood viscosity interferes in the blood flow, and therefore in the distribution of oxygen and glucose to the whole body. The aging process leads to a reduction in the blood flow, especially because of the reduction in the plasticity of the capillaries and of the red blood cell walls, which impairs the irrigation of the brain tissue. In this sense, *Ginkgo biloba* L. (*Ginkgoaceae*) can be mentioned as an example of a plant recognized by its capacity to reduce blood viscosity, increasing the brain blood flow, which may, in turn, contribute to its beneficial effect on memory (Santos et al., 2003). Nootropic drugs, such as piracetam, increase the blood flow in the capillaries and improve the brain irrigation by acting as vasodilators with activity in the brain. Substances with this property are known as revulsive, that is, they increase blood flow.

It is important to consider the understanding of “illness” in popular medicine. We frequently observe the concept that illness manifests as a response to blood impurities, therefore demanding an intervention in the sense of cleansing or purifying the blood. Depravative drugs, along with laxatives, emetic, diuretic and diaphoretic drugs could help in the process of cleansing the body as a whole.

An important indication of adaptogens is as a geriatric agent, preventing or minimizing the physical and cognitive deficits that result from aging. In fact, the elderly population is the main therapeutic target of several phytotherapeutic medications available in the market.

With aging, there is a gradual decline in the body functioning as a whole, leading to constant tiredness; physical indisposition; reduction of motivation; learning and memory difficulties; impotence and disinterest in sex, among other deficits (Albert & Knoefel, 1994). Plants prescribed as aphrodisiacs, sexual stimulants, energetic, rejuvenating, or those indicated to fight feebleness, weakness and impaired memory would hence be useful to counterbalance the harm that arises from aging.

Other terms, such as restoring, normalizing and revigorating, regard the property of this class of substance

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**Chart 2. Portuguese terms and expressions related to the adaptogenic action and possible corresponding in English.**

<table>
<thead>
<tr>
<th>Properties</th>
<th>Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afrodísíaco • aphrodisiac</td>
<td>Ativamento • discouragement</td>
</tr>
<tr>
<td>Analéptico • analeptic</td>
<td>Adinamia • adynamia</td>
</tr>
<tr>
<td>Anti-estresse • anti-stress</td>
<td>Astenia (geral ou psíquica) •</td>
</tr>
<tr>
<td>Ativador da memória • memory booster</td>
<td>Aestenia, weakness (general or psychological)</td>
</tr>
<tr>
<td>Aumenta a líbido • increases libido</td>
<td>Atonia muscular • atonia</td>
</tr>
<tr>
<td>Dinamogênico • dynagenic</td>
<td>Cansaço • tiredness (physical or intellectual)</td>
</tr>
<tr>
<td>Energético • energetic</td>
<td>Cauxia • cachexia</td>
</tr>
<tr>
<td>Estimulante sexual • sexual stimulant</td>
<td>Convalecência • convalescence</td>
</tr>
<tr>
<td>Excitante das funções cerebrais • excitatory of brain functions</td>
<td>Debilidade (física, orgânica, sexual) •</td>
</tr>
<tr>
<td>Excitante dos órgãos genitais • excitatory of genital organs</td>
<td>Debility (physical, organic, sexual) •</td>
</tr>
<tr>
<td>Fortificante • fortifier</td>
<td>Depauperamento do organismo • depletion of the body’s reserves</td>
</tr>
<tr>
<td>Fortificante dos nervos e sistema nervoso • fortifier of the nerves and nervous system</td>
<td>Desânimo • despondency</td>
</tr>
<tr>
<td>Reconstituinte • restoring</td>
<td>Doenças causadas por esgotamento nervoso • illnesses caused by nervous breakdown</td>
</tr>
<tr>
<td>Reduz cansaço • reduce tiredness</td>
<td>Enfraquecimento da memória • memory weakness</td>
</tr>
<tr>
<td>Regenerador • regenerator</td>
<td>Envelhecimento • aging</td>
</tr>
<tr>
<td>Rejuvenescedor • rejuvenator</td>
<td>Esgotamento • exhaustion (physical, nervous, mental)</td>
</tr>
<tr>
<td>Restaurador das forças • restorer of strength</td>
<td>Estafa, fadiga • fatigue</td>
</tr>
<tr>
<td>Revulsivo • revulsive</td>
<td>Esterilidade / infecundidade • sterility / infertility</td>
</tr>
<tr>
<td>Reconstituinte • restoring</td>
<td>Estresse • stress</td>
</tr>
<tr>
<td>Restaurativo • restorative</td>
<td>Exaustão (física, mental e intelectual) • exhaustion (physical, mental and intellectual)</td>
</tr>
<tr>
<td>Rejuvenescedor • rejuvenator</td>
<td>Falta de atenção ou memória • lack of attention or memory</td>
</tr>
<tr>
<td>Reconstituinte • restoring</td>
<td>Fraqueza geral / orgânica- general / organic weakness</td>
</tr>
<tr>
<td>Reconstituinte • restoring</td>
<td>Fraqueza infantil • child weakness</td>
</tr>
<tr>
<td>Rejuvenescedor • rejuvenator</td>
<td>Impotência sexual • sexual impotence</td>
</tr>
<tr>
<td>Restaurador das forças • restorer of strength</td>
<td>Indisposição • indisposition</td>
</tr>
<tr>
<td>Revulsivo • revulsive</td>
<td>Lassitude • lassitude</td>
</tr>
<tr>
<td>Tônico, tonificante • tonic (general, muscular, of the nervous system)</td>
<td>Letargia • lethargy</td>
</tr>
<tr>
<td>Vitalizante • revitalizing</td>
<td>Mal de altitude • altitude sickness</td>
</tr>
<tr>
<td>Vitalizante • revitalizing</td>
<td>Marasmo • boredom</td>
</tr>
<tr>
<td>Vitalizante • revitalizing</td>
<td>Memória franca • weak memory</td>
</tr>
<tr>
<td>Vitalizante • revitalizing</td>
<td>Neurastenia • neurasthenia</td>
</tr>
<tr>
<td>Vitalizante • revitalizing</td>
<td>Neurastenia genital ou sexual • genital or sexual neurasthenia</td>
</tr>
<tr>
<td>Vitalizante • revitalizing</td>
<td>Preguiça • laziness</td>
</tr>
<tr>
<td>Vitalizante • revitalizing</td>
<td>Raioeclinio dificultado • impaired reasoning</td>
</tr>
<tr>
<td>Vitalizante • revitalizing</td>
<td>Sensibilidade • senility</td>
</tr>
<tr>
<td>Vitalizante • revitalizing</td>
<td>Velhice • aging age</td>
</tr>
</tbody>
</table>
to help in the recovery from pathological processes and previous debilitation, whether it is in the elderly or the young. Consequently, they are indicated for convalescence; asthenia (general debility); cachexia (state of severe undernourishment); depletion of the body’s reserves; fatigue; mental or physical exhaustion, among others.

Sometimes the description of the medical virtues of an adaptogen plant in the popular literature uses expressions as “heightens mental faculties”, “beats weakness”, “gives the nervous system a boost”, or “awakens dormant vital forces”. Similar popular terms are used in the traditional medicine of many countries, sometimes within well established “systems”, as the *rasayana* (Ayurvedic medicine) and the *jamu* (traditional medical system of Malaysia and India) (Davydov & Krikorian, 2000). Other times, an adaptogen plant receives the reputation of panacea, as in the case of *Panax ginseng* (pan=all; axos=cure). In Brazil, the *Pfaffia paniculata* (Mart.) Kuntze (Amaranthaceae) and other species of *Pfaffia* are sometimes called “para-tudo” (for-everything, a reference to its broad use), as well as the species *Gomphrena arborescens* L. f. (Amaranthaceae), *Drimys winteri* J.R. Forst. & G. Forst. (Winteraceae) and *Tabebuia aurea* (Silva Manso) Benth. & Hook. f. ex S. Moore (Bignoniaceae) (Lorenzi & Matos, 2002; Mendes & Carlini, 2007).

It is interesting to observe that the commercial names of some ginseng-based phytotherapeutic medications registered in the Brazilian Ministry of Health mention its alleged usefulness, conveying the idea of a tonic, geriatric or aphrodisiac product. In the middle of the last century there was in Brazil a product commercialized by a laboratory that was in the market at the time, Silva Araújo, called Energil®. Its formula was a combination of phosphate salts and strychnine, testicular extracts and vegetable extracts of miriapanua and catuaba. In the advertisements of the product it was announced as dynamogenic and neurotonic in convalescence; to treat asthenia, emotional exhaustion, insufficiency of genital functions and senility, and it showed the picture of an elderly man in a happy disposition. Another traditional product, Viriliflora® (Figure 1), was commercialized by the laboratory Flora Medicinal. It was composed by the tinctures of *Ptychopetalum olacoides*, *Tynanthus fasciculatus* Miers (Bignoniaceae) and *Anemopaegma mirandum* (Cham.) Mart. ex DC. (Bignoniaceae) (current botanical names), all of them Brazilian plants popularly used as aphrodisiacs.

**Chemical constituents of adaptogen plants**

It was initially believed that for a plant to be considered an adaptogen it should be rich in saponins and should not contain alkaloids (Brekhman & Dadymov, 1969; Carlini, 1991). However, it is clear that adaptogen plants are distinctly different as regards their chemical composition; hence their effect cannot be attributed to one single class of substances (Wagner, 1995; Davydov & Krikorian, 2000).

Generally speaking, a set of active principles of one or more classes have a synergic interaction to produce the beneficial effect of adaptogen plants. Therefore, we should highlight the ginsenosides (triterpene glycosides) present in *P. ginseng*, the eleutherosides (phenylpropanoid or coumarin derivatives) in *Eleutherococcus senticosos* (Rupr. & Maxim.) Maxim., Araliaceae, the ginkgolides and bilobalide (terpenoids) of *Ginkgo biloba*, among others (Wagner, 1995; Pang et al., 1996). On basis of their secondary metabolites, Panossian et al. (2007) classified some adaptogen plants as stress-protectors [*P. ginseng*, *Bryonia alba* L., *Cucurbitaceae*, and *Withania somnifera* (L.) Dunal, Solanaceae, and typical adaptogens [*Rhodiola rosea* L., Crassulaceae, and *Schisandra chinensis* (Turcz.) Baill., Schisandraceae].

Davydov & Krikorian (2000) suggest that many of the regulatory effects are due to the capacity of the constituents present in those plants to mimic hormones and endogenous molecules structurally similar. Some saponins and other triterpene constituents have a chemical structure quite similar to that of steroid hormones, such as ginsenoside Rb₁ (1) and ginsenoside Rg₂ (2), hence their acting mechanisms are partially attributed to this similarity – see cortisol for comparison (3). On the other hand, some phenolic constituents, as lignans and phenylpropanoids, such as eleutheroside B (also called syringin) (4), are structurally similar to catecholamines, like noradrenaline (5), important mediators of the activation of the sympathetic nervous system (Panossian & Wikman, 2005).

**Mechanisms of action of adaptogen plants**

While most of the drug classes have specific sites or well established mechanisms of action, adaptogens seem to act through different systems, with the combination...
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of those actions being responsible for their beneficial and protective effects (Wagner et al., 1994; Panossian & Wikman, 2009). It is a known fact that adaptogens might act enhancing the capacity of the body to respond to stressing stimuli by activating/deactivating mediators of response to stress, as corticosteroids, catecholamines and nitric oxide (Panossian et al., 1999; 2007; Rege et al., 1999; Panossian & Wikman, 2005; 2009). Adaptogens may also act in an unspecific way, through its antioxidant and immunomodulating activities, and others (Rege et al., 1999; Davydov & Krikorian, 2000; Chen et al., 2008).

Among the several activities mentioned, the modulation of the hypothalamic-pituitary-adrenal axis (HPA) is probably the most studied, and seems to be one of the main mechanisms of action of adaptogens. Apparently, they do not only modulate the functioning of the axis under stressful conditions, but act on their own as well, acutely stimulating the production of adrenocorticotropic hormone and corticosteroid, slightly changing the basal levels of these hormones that stabilize some time after administration (Wagner, 1995; Panossian et al., 1997; 1999, Panossian & Wikman, 2009). In this case, the adaptogen is described as a mild stressor (stress mimetic) that would have a beneficial effect, increasing the mobilization of energy sources and preventing the need for a more abrupt reaction to stress (Wagner et al., 1994; Panossian et al., 1999, Kimura & Sumiyoshi, 2004). Under situations of chronic stress, adaptogens would act by reestablishing the functioning of the axis, stopping the liberation of stress hormone by the negative feedback mechanism (Figure 2). The role of adaptogens in the HPA would take place mainly by promoting a positive regulation of certain stress modulators, especially the heat shock protein HSP70, which plays a key role in the apoptosis and cell lifespan (Chowdhuri et al., 2002; Panossian et al., 2009; Panossian & Wikman, 2009).

A second system that seems to play an important role in the set of positive actions of adaptogens is the immune system. A number of plants considered adaptogens are immunostimulants: Eleutherococcus senticosus, Withania somnifera, Bryonia alba, Ocimum sanctum L. Lamiaceae, and the Panax ginseng, as well (Wagner, 1995; Panossian et al., 1997; Davydov & Krikorian, 2000; Davis & Kuttan, 2000; Mediratta et al., 2002; Kimura & Sumiyoshi, 2004). Evidence shows that the immune, sympathoadrenal systems and the HPA axis (stress system) share several mediators, with effects on target organs in common (Brown et al., 1990; Kvetnansky et al., 1995; Carrasco & van de Kar, 2003).

Another effect that certainly contributes to the set of actions of adaptogens is its antioxidant activity, even though this activity is not clearly observed in all plants considered adaptogens. The role of antioxidants in the prevention of neurodegenerative diseases and those related to aging is well known (Harman, 1994; Moosmann & Behl, 2002; Di Matteo & Esposito, 2003), which reinforces the importance of this activity by the plants commonly used to decrease the deficits resulting from aging. Some examples are Ginkgo biloba (Bridi et al., 2001), Schisandra chinensis (Hancke et al., 1999), Rhodiola rosea (Chen et al., 2008) and Eleutherococcus senticosus (Lin & Huang, 2000; Chen et al., 2008), plants with a considerable antioxidant action.

Since they act by improving cognitive performance, it is believed that adaptogens can also modulate the cholinergic system and other neurotransmission systems. Some studies corroborate this hypothesis, suggesting that P. ginseng and G. biloba interfere in the cholinergic and monoaminergic neurotransmission (Petkov et al., 2003; Liu et al., 2004). Elisabetsky & Siqueira (1998) also state that the modulation of the dopaminergic, monoaminergic and serotonergic systems are important targets for plants and preparations used in conditions of nervous weakness, depression and sexual impotence.

Other mechanisms that seem to contribute to the action of adaptogens include the modulation of genic transcription and protein synthesis, and the modulation of the several glycolysis phases. For more details on the molecular mechanisms of adaptogens, please see Panossian & Wikman (2009).

Brazilian plants with an adaptogen profile

In Brazil, many plants used to improve memory, sexual and physical performance, or to preserve a healthy state (Chart 3), are generically called tonics or fortifiers. Several parts of those plants can be used, and sometimes the plant is used as food or drink, as in the case of buriti (Mauritia flexuosa L. f., Arecaceae), cocoa (Theobroma cacao L., Sterculiaceae), mate (Ilex paraguariensis A. St.-Hil., Aquifoliaceae) and guarana (Paullinia cupana). Table 1 compares the popular uses of the main Brazilian plants presented in Chart 3 with the classic adaptogens well established in the literature. One can observe that the Brazilian plants are used mainly as aphrodisiacs, while...
classic adaptogens are indicated mainly for their anti-stress property. Among the Brazilian plants, guarana is the best known internationally, being indicated as tonic, stimulant, to improve memory, among other uses (Mendes & Carlini, 2007).

Native of the Amazon region, guarana was already used by the native Indians as tonic and stimulant before Brazil was discovered. The in vitro evaluation of the antioxidant effect of guarana seeds showed a powerful action, possibly as a result of the large concentration of tannins (Mattei et al., 1998). The administration of guarana extract to mice, both acutely and chronically, partially reversed the scopolamine-induced amnesia, and the addition of the extract to their drinking water prolonged the swimming time of the animals, in some evaluation intervals (Espinola et al., 1997).

In a study carried out with young volunteers, Kennedy et al. (2004) observed an increase in their cognitive performance in parameters of attention, working memory and accuracy after treatment with guarana, ginseng or a combination of the two plants. A later study showed that a multivitamin supplement containing guarana reduced the mental fatigue of volunteers after tests of mental effort (Kennedy et al., 2008).

The effects of *Pfaffia glomerata*, one of the species known as Brazilian ginseng, were also evaluated as to its adaptogenic effects. Aging mice showed improvement in learning and memory after chronic treatment with *P. glomerata* extract (Marques et al., 2004). Another study detected a protective effect against ulcerogenesis, such action being attributed to the effect of the plant in increasing the secretion of nitric oxide (Freitas et al., 2004). Elderly volunteers submitted to ergospyrometric and cognitive tests after the use of *P. glomerata* showed improvement in some cognitive tests and no toxic effects (Marques, 1998; Marques et al., 2002). However, no improvement was detected in the parameters analyzed in the test of effort. Even though scientific studies have focused mainly on the *P. glomerata*, other species of *Pfaffia* are commonly used by the population and sold generically as Brazilian ginsengs (also known outside Brazil as "suma"), being the *Pfaffia paniculata* and the *Pfaffia resinosoides* (Kunth) Spreng (Amaranthaceae) the most common (Marques, 1998; Davydov & Krikorian, 2000).

Another Brazilian plant that has been extensively studied, with results that corroborate its use as an adaptogen, is muirapuama (*Psychotropical olacoides*). Muirapuama is used in the North of Brazil as a nerve tonic and to increase physical and sexual performance. Studies with standardized extracts of its roots showed antioxidant, neuroprotective, anti-stress properties, and reversal in states of induced amnesia (da Silva et al., 2004; Siqueira et al., 2004; 2007; Piazzo et al., 2010).

With fewer studies on their properties but the same popularity of muirapuama, several species designated as catuaba in different regions of Brazil stand out. There is great confusion as to the identification of which species are actually used by the population for medical purposes and those available in the market (Ducke, 1966; Lorenzi & Matos, 2002). In the state of Minas Gerais and in the Middle-West of Brazil, garrafadas (bottled brew) are made with the bark and the roots of the species *Anemopaegma arvense* (synonym: *A. mirandum*), while in other regions the bark of the species *Trichilia catigua* is used. Other species also described as catuaba are *Erythroxylum vaccinifolium* Mart., *Erythroxylaceae*, and *Tetragastris catuaba* Soares da Cunha, Burseraceae, to mention a few (Lorenzi & Matos, 2002). Some studies suggest a possible analgesic and antidepressant effect for the *Trichilia catigua* mediated by dopaminergic mechanisms (Campos et al., 2005; Viana et al., 2009), while rare are the studies on *Anemopaegma arvense* reported in the literature.

As in the case of catuaba, the roots of nó-de-cachorro (*Heteropterys aphrodisiaca*) are often prepared as *garrafadas*, and employed against physical debility and as a sexual stimulant. The chronic treatment of aging rats with hydroalcoholic extract of nó-de-cachorro reversed the memory impairment observed in the passive avoidance and in the T maze (Galvão et al., 2002). Later studies showed that the treatment time and the dose could be reduced, and suggest the involvement of the dopaminergic system among the mechanisms of action of *H. aphrodisiaca* (Galvão, 2003; Galvão et al., 2004/2005).

Damiana (*Turnera diffusa*, synonym *Turnera

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**Figure 2.** Response to stress by the hypothalamic-pituitary-adrenal axis. In situations of chronic stress, the mechanism of negative feedback is lost. Adaptogens restore the functioning of the axis. Thick lines: stimulation; dotted lines: inhibition.
Tonic, fortifier and aphrodisiac: adaptogens in the Brazilian folk medicine
Fábio R. Mendes

Adaptogen plants are characterized by their diffuse and adaptable properties, and they are considered beneficial to health in a variety of ways. They are often used to support the body's natural processes and can help in the prevention and treatment of various health conditions. These plants are known for their ability to enhance the body's resilience and adaptability, which can lead to improved overall health and well-being. The use of adaptogens in traditional medicine and modern phytotherapy is based on the principle that they can help the body to cope with stress and promote a state of optimal health.

**Chart 3. Main Brazilian plants used for purposes similar to those of an adaptogen.**

<table>
<thead>
<tr>
<th>Plant</th>
<th>Region where it is found</th>
<th>Popular uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buriti - <em>Mauritia flexuosa</em> L., Arecaceae</td>
<td>Cerrado, marshy regions and riparian forests</td>
<td>The oil and the pulp are used as energetic and fortifier</td>
</tr>
<tr>
<td>Cacau - <em>Theobroma cacao</em> L., Sterculiaceae</td>
<td>Native of the tropical forests of Central America and South America; also grown in Bahia</td>
<td>Raw material of chocolate, the seeds (and sometimes the pulp) are used as a powerful energetic and to supply more resistance against low temperatures</td>
</tr>
<tr>
<td>Catuaba - <em>Anemopaegma arvense</em> (Vell.) Stellfeld ex de Souza, Bignoniaceae</td>
<td>Cerrado, in central Brazil</td>
<td>The root is considered a powerful tonic, aphrodisiac, used to treat neurasthenia and difficulty to concentrate</td>
</tr>
<tr>
<td>Catuaba - <em>Trichilia catigua</em> A. Juss., Meliaceae</td>
<td>Brazilian Cerrado, mainly in Bahia</td>
<td>The part used of this species of catuaba is the bark, and it is indicated for the same medicinal uses mentioned above</td>
</tr>
<tr>
<td>Cipó-caboco - <em>Davilla rugosa</em> Poiret., Dilleniaceae</td>
<td>Present mainly in the Atlantic Forest, but scattered all over tropical Brazil</td>
<td>The whole plant is used as stimulant and aphrodisiac, but each part has its own use</td>
</tr>
<tr>
<td>Cipó-cravo - <em>Tynanthus elegans</em> Miers, Bignoniaceae</td>
<td>Broad geographic distribution, including the Southeast of Brazil and Bolivia</td>
<td>The whole plant is used as infusion or decoction (roots) against weakness, exhaustion and impotence</td>
</tr>
<tr>
<td>Damiana - <em>Turnera diffusa</em> Willd. ex Schult., Turneraceae</td>
<td>From the Southern of California to Argentina. In Brazil it is found mainly in the agreste and the Northeastern sertão (backcountry)</td>
<td>Leaves and aerial parts are used as tonic and aphrodisiac</td>
</tr>
<tr>
<td>Fáfia/Brazilian ginseng - <em>Pfiaffia glomerata</em> (Spreng.) Pedersen, Amaranthaceae, and other species</td>
<td>Regions of tropical climate, can be found all over Brazil and abundantly in Paraná</td>
<td>The roots of several species of fáfia are used as tonic and aphrodisiac, as a substitute of the Korean ginseng, sometimes being part of adulterations of products sold as <em>P. ginseng</em></td>
</tr>
<tr>
<td>Guarana - <em>Paullinia cupana</em> Kunth, Sapindaceae</td>
<td>Amazon region; grown in many other areas</td>
<td>The seed powder is used as general tonic, stimulant, and to fight physical and mental exhaustion</td>
</tr>
<tr>
<td>Mate - <em>Ilex paraguariensis</em> A. St.-Hil., Aquifoliaceae</td>
<td>Pampas (South American lowlands), in the South of Brazil and South America, mainly in high areas</td>
<td>The leaves are used to provide improvement of general disposition. Usually used as chimarrão (a kind of infusion) or tereré (as a cold tea)</td>
</tr>
<tr>
<td>Muirapuama - <em>Psychotropical olacoides</em> Benth., Olacaceae</td>
<td>Amazon forest</td>
<td>Roots and bark are considered powerful neuromuscular tonic and are also used as aphrodisiac</td>
</tr>
<tr>
<td>Nó-de-cachorro - <em>Heteropteryx aphrodisiaca</em> O. Mach, Malpighiaceae</td>
<td>Pantanal (wetland) and Cerrado</td>
<td>Roots are prepared in garrafadas as sexual tonic and to fight weakness</td>
</tr>
</tbody>
</table>


**Final considerations**

As this article discussed, adaptogens comprise a particular class of pharmacological agents with multiple actions and some peculiarities. However, the diversity of indications and alleged miracles for this type of drugs led them to be disdained by the medical community.

The biomedical model has always postulated that each drug would be useful for one single illness, acting on receptors or other targets specific to that pathology (Capra, 1993). Nowadays we can observe a change in this paradigm, with the treatment of the body as a whole being valued, and a special emphasis placed on the drugs known as multitarget, that is, drugs that act through different mechanisms. Many phytotherapeutic drugs largely accepted seem to act in that way, possibly by the synergic action of their active principles (Spinella, 2002; Ulrich-Merzenich et al., 2007). Adaptogen plants are characterized by their diffuse and
unspecific action on the body (Wahlström, 1987; Davydov & Krikorian, 2000).

Another reason why the scientific community does not accept adaptogens is the difficulty to obtain results that could verify their alleged effects using classical pharmacological methods (Ramachandran et al., 1990; Carlini, 1991; Rege et al., 1999). Another problem is that the beneficial actions of adaptogens can be better observed after chronic treatment. One should not forget that, within this type of use, an adaptogen is ingested mainly for the individual to remain healthy, that is, preventively. Therefore, the models most often employed in the evaluation of an adaptogen are those in which animals are submitted to stress, hence the capacity of the plant to protect against that type of damage can be evaluated, in other words, its prophylactic use (Wagner et al., 1994; Rege et al., 1999; Panossian & Wikman, 2005). Animal models of memory and learning are also commonly used, since the property of adaptogens to improve cognitive processes is another key point among their multiplicity of actions. Nevertheless, these different aspects (physical resistance, cognition and anti-stress effect) can not be easily evaluated in humans, a reason why many adaptogens come up against scientific corroboration.

The evaluation of biochemical markers of response to stress, such as the hormones of the HPA axis, nitric oxide, arachidonic acid, heat shock proteins, eicosanoids, among others, have proved quite useful to support the physiological and behavioral data routinely evaluated, and may be a good way to help identify adaptogen plants.

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