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Review

Tongkat Ali (*Eurycoma longifolia* Jack): A review on its ethnobotany and pharmacological importance

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ABSTRACT

Eurycoma longifolia Jack is an herbal medicinal plant of South-East Asian origin, popularly recognized as 'Tongkat Ali.' The plant parts have been traditionally used for its antimalarial, aphrodisiac, anti-diabetic, antimicrobial and anti-pyretic activities, which have also been proved scientifically. The plant parts are rich in various bioactive compounds (like eurycomaoside, eurycolactone, eurycomalactone, eurycomanone, and pasakbumin-B) among which the alkaloids and quassinoids form a major portion. Even though toxicity and safety evaluation studies have been pursued, still a major gap exists in providing scientific base for commercial utilization and clearance of the Tongkat Ali products with regard to consumer's safety. The present review aims at reviewing the research works undertaken till date, on this plant in order to provide sufficient baseline information for future works and for commercial exploitation.

Contents

1. Introduction

Traditionally employed, indigenous plant based herbal medicines have been popular from time immemorial, and recently have commanded major attention worldwide due to their potential nutraceutical values [1–4].

Eurycoma longifolia Jack (Tongkat Ali, Genus: *Eurycoma*; Family, Simaroubaceae) is one of the most popular tropical herbal plants, indigenous to South-East Asian countries like Malaysia, Indonesia, and Vietnam. Some of the plant species are also found in certain patches in regions of Cambodia, Myanmar and in Thailand. This plant is locally known as

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'Tongkat Ali' wherein 'Ali' means "walking stick" — assigned due to the presence of long twisted roots. The plant extract, especially roots, are exclusively used (traditionally) for enhancing testosterone levels in men. The plant extract (particularly roots) have been used in indigenous traditional medicines for its unique antimalarial, anti-pyretic, antiulcer, cytotoxic and aphrodisiac properties [5–8]. Root extracts have also been used traditionally to reduce blood pressure, fevers (mainly due to the presence of quassinoids) and fatigue. As regular intake of root extracts is believed to enhance the testosterone levels, increased interest has also been created among the individuals involved in body building to enhance the muscle mass and strength. However, most of the times, the plant extracts forms an essential component in herbal remedies for a wide range of illnesses and as health supplements. Though the exact statistic demand in the international market is obscure, the dried Tongkat Ali roots are known to fetch somewhere between 20 and 25 US dollars/kg. However, the water extracts has been reported to have a better market value of 26 US dollars per bottle of 60 capsules [9].

Of late, there has been a tremendous increase in demand for this plant and nearly 200 Tongkat Ali products, mainly highlighting the aphrodisiac properties, are available in the health-food market [8]. Tongkat Ali products are available either in the form of raw crude powder (of root), as capsule mixed with other aphrodisiac herbs, as an additive mixed with coffee (and ginseng) or in certain health products as a replacement for ginseng.

To our knowledge, till date, no meticulous review is available on Tongkat Ali plant or on its products. Hence, the present review is intended to highlight some of the significant published scientific reports along with providing details of the traditional knowledge of this wonder-plant (mainly *E. longifolia* Jack). It is envisaged that the baseline information provided in this review will be useful and applicable for future research works aiming towards exploiting the plants nutraceutical potentials.

2. Taxonomy, cultivation and ethnobotanical uses

Scientific names: there are four different species of Tongkat Ali plant reported till now, which includes: *E. longifolia, Entomophthora apiculata*, *Polyathia bullata* and *Goniothalamus* sp. [10–12]. However, *E. longifolia* is used more routinely for traditional medicine purposes.

Popular names: some of the common and popular names of this plant includes: Long Jack, Malaysian Ginseng, Local Ginseng, Natural Viagra, Pasak Bumi, Payung Ali, Penawar Pahit, Setunjang Bumi, Bedara Pahit, Tongkat Baginda, Pokok Syurga, Tongkat Ali Hitam, Pokok Jelas, Cay ba binh, Ian-don, and Jelaih.

E. longifolia (Tongkat Ali) is an evergreen slow growing herbal plant (Fig. 1), attaining a maximum height of 15–18 m and bearing fruits after nearly 2–3 years of cultivation. However, it is generally believed that for complete maturation of the plant, it might take up to 25 years. But, for commercial uses, most of the times, roots are harvested after 4 years of cultivation. The fruits are green in color, 2–3 cm long and turn to dark red after ripening. The leaves are pinnate, spirally arranged, long (10–15 inches) with 10–30 leaflets. The flowers are produced in large panicles and the plant is dioecious with male and female flowers borne on different trees.

Generally, harvesting of the root is carried out manually and requires lot of serenity and time, as for uprooting a single plant (of around 70–100 mm diameter size) possibly requires between 8 and 10 h. The plant grows profusely in sandy, well drained soil in the presence of partial shade and with adequate quantity of water. Tongkat Ali plant has been declared as a protected plant in most of the cultivated areas (including Malaysia) and harvesting is highly restricted. This plant grows naturally in the wild jungle slopes and is widely sought 'singly' or as an 'essential component' in herbal remedies for a variety of illnesses and as health supplements.

Almost all the parts of the Tongkat Ali plant have been used traditionally for therapeutic purposes. The plant extracts have been traditionally employed for its antimalarial, aphrodisiac and anti-pyretic activities [13]. The roots are the most valuable component and are used for the treatment of aches, persistent fever, malaria, sexual insufficiency, dysentery, glandular swelling, and as health supplements [14–16]. Root extract of the plant have been administered for restoring energy and vitality, enhancing blood flow and functioning as a herbal ingredient for women after child birth [7]. The process of consuming the root also follows the traditional way, wherein the roots are cut into smaller portions and boiled to blood-warm temperature and is consumed as a tea. However, due to extensive bitterness in the root, intense boiling (in fresh water for several times) is also suggested to remove bitterness in the decoction. Some traditional healers also advise mixing of extract (chipped roots) with honey, sugar syrup or dates for reducing the bitterness. In certain cases the root powder is mixed with alcohol and consumed after maintaining for specified time of incubation (extending up to 6–8 weeks). However, it is also opined by a few experienced traditional healers that 'the more the bitterness' – the 'better is the efficacy.'

The leaves of the plant have also been used by traditional healers to cure malaria, ulcers, prevent gum diseases and for the treatment of sexually transmitted diseases like syphilis and gonorrhea.

3. Chemical composition

A wide range of chemical compounds have been isolated and characterized from *E. longifolia*, particularly from the roots. Some of them include: canthin-6-one alkaloids,-β-carboline alkaloids, quassinoids, quassinoid diterpenoids, Eurycomaoside, tirucallane-type triterpenes, squalene derivatives, biphenylneolignans, eurycolactone, laurycolactone, and eurycomalactone [17–22]. Fig. 2 depicts the structure of some of the quassinoids isolated form *E. longifolia* with potential anti-tumor promoting and anti-parasitic activities.

Kuo et al. [23] have reported the isolation of nearly sixty-five compounds from the roots of *E. longifolia,* and characterized them by 1D and 2D NMR and by mass spectral data. Among these isolates, for the first time they identified four quassinoids diterpenoids obtained from natural sources, viz., eurycomalide A, eurycomalide B, 13β, 21-dihydroxyeurycomanol, and 5α, 14β, 15β-trihydroxyklaineanone. Chan et al. [24] isolated a new quassinoid glycoside from *E. longifolia*, eurycomanol-2-*O*-β-D-glycopyranoside along with eurycomanol which was found