

# Fingerroot, *Boesenbergia rotunda* and its Aphrodisiac Activity

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## ABSTRACT

*Boesenbergia rotunda* (Family: *Zingiberaceae*) as known as fingerroot is a daily food ingredient and traditional medicinal plant in Southeast Asia and Indo-China. It has been shown to possess anti-allergic, antibacterial, anticancer, anti-inflammatory, antioxidant, and antiulcer activities and also shown wound healing. Its common phytochemical components include alkaloids, essential oils, flavonoids, and phenolics. This plant is rich in boesenbergin, krachazin, panduratin, and pinostrobin, all of which has been reported to contribute to its remedial properties including aphrodisiac property. Based on established literature on the aphrodisiac property of *B. rotunda* and possible mode of action, this review article has attempted to compile that *B. rotunda* could be further explored for the development of potential aphrodisiac treatment.

**Key words:** Aphrodisiac, *Boesenbergia rotunda*, plant, sex behavior, traditional medicine

## APHRODISIAC PLANTS

Erectile dysfunction is a neurovascular disorder that affects the sexual life of men worldwide and also contributes to infertility.<sup>[1]</sup> It occurs commonly in middle-aged and older men.<sup>[2]</sup> Some complication diseases such as cardiovascular disorders, depression, diabetes mellitus, hyperlipidemia, or hypertension can course effect to erectile dysfunction.<sup>[3]</sup> Aphrodisiac is described as any substance that can enhance sexual pleasure such as drugs, minerals, and medicinal plants.<sup>[4,5]</sup> Some of the medicinal plants have been provided as aphrodisiac plants by their mode of actions. (i) Those are increasing the quantity and quality of semen for example black cumin, *Nigella sativa* in Iran,<sup>[6]</sup> and dragon blood tree, *Dracaena draco* in Nigeria.<sup>[7]</sup> (ii) Those are delaying the time of ejaculation, for example, drumstick tree, *Moringa oleifera* in India,<sup>[8]</sup> and bindii, *Tribulus terrestris* in Singapore.<sup>[9]</sup> (iii) Those are increasing penile erection, for example, creeping butea, *Butea superba* in Thailand,<sup>[10]</sup> and *Aspidosperma ulei* in Brazil.<sup>[11]</sup> (iv) Those are arousing sexual desire, for example, cattle stick, *Carpolobia lutea* in Nigeria.<sup>[12]</sup> The present review explores scientific evidence to provide updated information about the properties of *Boesenbergia rotunda*, one of the aphrodisiac plants that is being investigated for its mechanism.

## TAXONOMICAL CLASSIFICATION

The taxonomy of *B. rotunda* is in the Kingdom: *Plantae*; Subkingdom: *Viridiplantae*; Infrakingdom: *Streptophyta*; Superdivision: *Embryophyta*;

Division: *Tracheophyta*; Subdivision: *Spermatophytina*; Class: *Magnoliopsida*; Superorder: *Liliane*; Order: *Zingiberales*; Family: *Zingiberaceae*; Genus: *Boesenbergia*; Species: *B. rotunda*.<sup>[13]</sup> The plant genus *Boesenbergia* is a ginger species belonging to the family of *Zingiberaceae*, which is comprised almost fifty genera and over 1000 species distributed throughout tropical and subtropical regions. It was previously categorized under the *Kaempferia* genus. This plant has different botanical names which are *Boesenbergia cochinchinensis*, *Boesenbergia pandurata*, *Curcuma rotunda*, *Gastrochilus panduratus*, *Gastrochilus rotundus*, *Kaempferia cochinchinensis*, *Kaempferia ovate*, and *Kaempferia pandurata*; nonetheless, it is currently known as *B. rotunda*.<sup>[14]</sup>

## NOMENCLATURE

*B. rotunda* is a native of the tropics areas, particularly in South and Southeast Asia and China. The rhizome is finger look-like appearance, so its common English name is fingerroot. The vernacular names of *B. rotunda* include ao chun jiang (Chinese); temoe koentji (Dutch); petits doigts (French); fingerwurz (German); temu kunci (Indonesian); gajutu (Japanese); khchiey (Khmer); neng kieng (Lao); temu kunci (Malay); krachai (Thai); and cu ngai (Vietnamese).<sup>[15]</sup>

## PLANT DESCRIPTION OF BOESEBERGIA ROTUNDA

*B. rotunda* is a perennial with a short stem that is replaced by pseudostems, formed by leaf sheaths growing up to 50 cm tall. There are 3–4 leaves which are 7–11 cm in width and 25–50 m in length, which are not divided, oval or elongate shape. The surface of rhizomes is light brown and yellow inside, ovoid-globose, and strongly aromatic. Its rhizomes look-like fingers which growing from a central part [Figure 1].<sup>[16]</sup>

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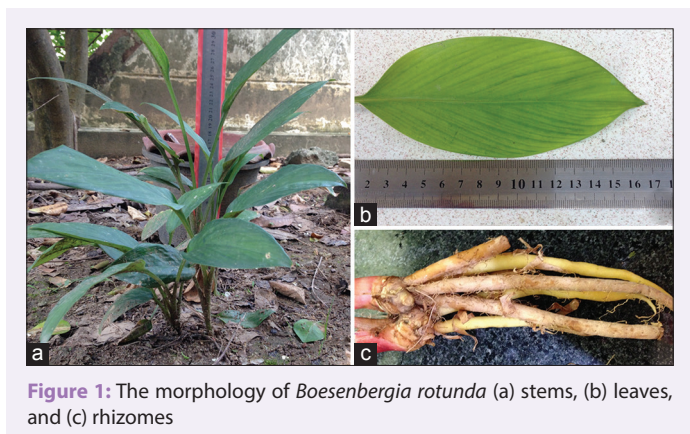
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**Figure 1:** The morphology of *Boesenbergia rotunda* (a) stems, (b) leaves, and (c) rhizomes

## PHYTOCHEMICAL SUBSTANCES

The active phytochemical substances of *B. rotunda* are as follows: (1) flavonoids including alpinetin, boesenbergin, cardamonin, geraniol, krachaizin, panduratin, pinostrobin, pinoembrin, rotundaflavone, and silybin;<sup>[17-19]</sup> (2) essential oils including nerol, camphor, cineole, fenchene, hemanthidine, and limonene;<sup>[20]</sup> (3) polyphenols including caffeic acid, coumaric acid, chlorogenic acid, hesperidin, kaempferol, naringin, and quercetin.<sup>[21]</sup>

## TRADITIONAL USES

The rhizomes of *B. rotunda* have been used as spices, flavoring agents, dyes and as traditional medicine. The uses or phytochemical properties of *B. rotunda* from several literature reviews are anti-allergic,<sup>[22]</sup> antibacterial,<sup>[23,24]</sup> anti-*Helicobacter pylori*,<sup>[25]</sup> anti-leptospirosis,<sup>[26]</sup> anticancer,<sup>[27,28]</sup> anti-inflammatory,<sup>[29]</sup> antioxidant,<sup>[30]</sup> antiulcer,<sup>[31]</sup> and anti-dengue viral,<sup>[32,33]</sup> and anti-herpes viral activities<sup>[34]</sup> and wound healing.<sup>[35]</sup> It also uses to treatment hepatic disease.<sup>[36]</sup> Moreover, it can act as larvicidal and pupicidal activities.<sup>[37]</sup>

## APHRODISIAC ACTIVITY

The extracts of various plant parts of *B. rotunda*, including the leaf, stem, and rhizomes, have been investigated and found to be pharmacologically active inducing aphrodisiac activity. Sudwan *et al.*<sup>[38]</sup> from Thailand studied the effect of oral feeding of *B. rotunda* rhizome in male rats for 60 days. They reported that the doses of 0.06, 0.12, and 0.24 g/kg of ethanolic extract increased the diameter of seminiferous tubules and increased the weights of the testicular and seminal vesicle. There was no effect in the sperm density, serum testosterone, and androstenedione levels. Temkitthawon *et al.*<sup>[39]</sup> evaluated the phosphodiesterase inhibitory activity among plants that were collected from Northern part of Thailand using a radioassay, compared with isobutylmethylxanthine, the standard inhibitor. Yotarlai *et al.*<sup>[40]</sup> from Thailand studied the effect of oral feeding at the doses of 0.06, 0.12, and 0.60 g/kg of fresh juice of *B. rotunda* rhizome on sperm qualities on both premature and mature male rats for 30 days. This plant increased the motility and number of normal sperm but decreased the abnormal morphology sperm tails only in mature rats. They suggested that this plant juice could increase the fertility by improving sperm's quality and its effect is age dependence. The researchers from Indonesia studied the effect of traditional herbs such as egg, bee honey, fingerroot, cardamom, and vitamin as a dietary supplementation for enhance quality of bull semen. The researcher analyzed these parameters such as libido, volume of semen, motility and number of sperm, percentage of life, and abnormality of sperm. The results indicated bull fed with herbal supplement made the quality of

semen at ejaculation better than those of control group.<sup>[41,42]</sup> In several review articles, *B. rotunda* is one of the aphrodisiac plants.<sup>[4,5,43-45]</sup> In additional, the plants in the same *Zingiberaceae* family also show the aphrodisiac activities. Chaturapanich *et al.*<sup>[46]</sup> from Thailand studied the effect of oral feeding at the doses of 70 mg/kg/day of ethanolic, hexane, and aqueous extracts of krachaidum, *Kaempferia parviflora*, in male rats for 5 weeks. They reported that ethanolic extract had an aphrodisiac activity by increased blood flow to the testis and decreased mount and ejaculatory latencies. Morakinyo *et al.*<sup>[47]</sup> from Nigeria studied the effect of oral feeding at the doses of 500 and 1000 mg/kg/day of aqueous extract of ginger, *Zingiber officinale* in male rats for 14 and 28 days. There were dose and time dependent increased in sperm count and motility, increased testis and epididymis weights, and increased serum testosterone level. Mazaheri *et al.*<sup>[48]</sup> from Iran studied the effect of oral feeding at the doses of 100 and 300 mg/kg/day of methanolic extract of greater galangal, *Alpinia galanga* in male rats for 56 days. The extract increased serum testosterone level and percentage of sperm viability and motility.

## PHYTOCHEMICAL SUBSTANCES IN APHRODISIAC ACTIVITY

Up to now, the scientific studies have proven that the phytochemical substances or plant secondary metabolites have the aphrodisiac activities and can be classified into three main groups due to the similarity of their structures. (i) Flavonoids and other phenolic compounds including chalcones, flavonols, flavones, dihydroflavonoids, anthocyanidins, isoflavones, bioflavonoids, and neoflavonoids are normally extracted by less polar or nonpolar solvents.<sup>[49]</sup> These flavonoids have estrogenic<sup>[50]</sup> or androgenic activities.<sup>[51]</sup> The functions of these flavonoids and other phenolic compounds show as phosphodiesterase inhibitors, particularly like as Viagra.<sup>[52]</sup> (ii) Alkaloids, xanthins and other amines, are natural nitrogenous secondary metabolites found in flowering plants.<sup>[53]</sup> Their structures are similar with the cyclic adenosine monophosphate, therefore bind competitively to the phosphodiesterase regions, and act as nonselective phosphodiesterase inhibitor.<sup>[54]</sup> They also improve central pro-erectile mechanisms by reacting with the receptors in the paraventricular nucleus of the hypothalamus.<sup>[55]</sup> (iii) Saponins are the nonnitrogenous secondary metabolites that are the components of the higher plants. Some of saponins can be phosphodiesterase inhibitor and some are adaptogens or anti-stress agents.<sup>[56,57]</sup>

## CONCLUSION

Many of the traditional medicinal plants have been evaluated for their aphrodisiac activities; several plants still need to be confirmed the efficiency and safety. Several researchers reported *B. rotunda* may present the aphrodisiac property through increasing the quantity and quality of sperm. The antioxidant activity of this plant might be the advantage property to protection testicular tissue damage and enhancing the sperm quality. This review article has attempted to compile the new medicinal plant *B. rotunda* to be one of the choices of aphrodisiac plants.

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## Conflicts of interest

There are no conflicts of interest.

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