

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.^[1] It occurs commonly in middle-aged and older men.^[2] Some complication diseases such as cardiovascular disorders, depression, diabetes mellitus, hyperlipidemia, or hypertension can course effect to erectile dysfunction.^[3] Aphrodisiac is described as any substance that can enhance sexual pleasure such as drugs, minerals, and medicinal plants.^[4,5] 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,^[6] and dragon blood tree, *Dracaena draco* in Nigeria.^[7] (ii) Those are delaying the time of ejaculation, for example, drumstick tree, *Moringa oleifera* in India,^[8] and bindii, *Tribulus terrestris* in Singapore.^[9] (iii) Those are increasing penile erection, for example, creeping butea, *Butea superba* in Thailand,^[10] and *Aspidosperma ulei* in Brazil.^[11] (iv) Those are arousing sexual desire, for example, cattle stick, *Carpolobia lutea* in Nigeria.^[12] 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*.^[13] 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*.^[14]

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).^[15]

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].^[16]

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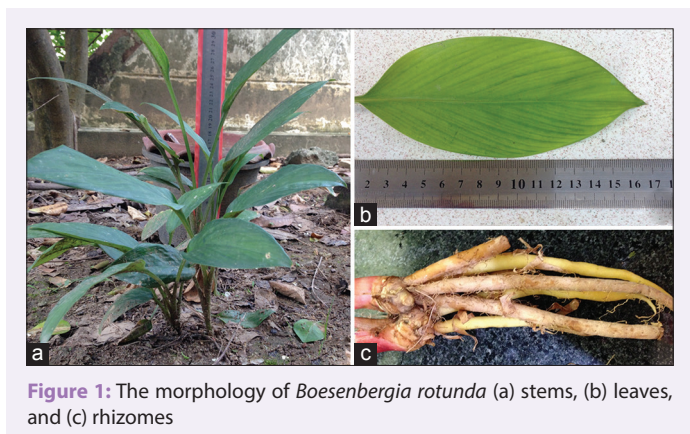


Figure 1: The morphology of *Boesenbergia rotunda* (a) stems, (b) leaves, and (c) rhizomes

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;^[17-19] (2) essential oils including nerol, camphor, cineole, fenchene, hemanthidine, and limonene;^[20] (3) polyphenols including caffeic acid, coumaric acid, chlorogenic acid, hesperidin, kaempferol, naringin, and quercetin.^[21]

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,^[22] antibacterial,^[23,24] anti-*Helicobacter pylori*,^[25] anti-leptospirosis,^[26] anticancer,^[27,28] anti-inflammatory,^[29] antioxidant,^[30] antiulcer,^[31] and anti-dengue viral,^[32,33] and anti-herpes viral activities^[34] and wound healing.^[35] It also uses to treatment hepatic disease.^[36] Moreover, it can act as larvicidal and pupicidal activities.^[37]

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.*^[38] 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.*^[39] 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.*^[40] 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.^[41,42] In several review articles, *B. rotunda* is one of the aphrodisiac plants.^[4,5,43-45] In additional, the plants in the same *Zingiberaceae* family also show the aphrodisiac activities. Chaturapanich *et al.*^[46] 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.*^[47] 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.*^[48] 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.^[49] These flavonoids have estrogenic^[50] or androgenic activities.^[51] The functions of these flavonoids and other phenolic compounds show as phosphodiesterase inhibitors, particularly like as Viagra.^[52] (ii) Alkaloids, xanthins and other amines, are natural nitrogenous secondary metabolites found in flowering plants.^[53] Their structures are similar with the cyclic adenosine monophosphate, therefore bind competitively to the phosphodiesterase regions, and act as nonselective phosphodiesterase inhibitor.^[54] They also improve central pro-erectile mechanisms by reacting with the receptors in the paraventricular nucleus of the hypothalamus.^[55] (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.^[56,57]

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.

REFERENCES

- Lue TF. Erectile dysfunction. *N Engl J Med* 2000;342:1802-13.
- Johannes CB, Araujo AB, Feldman HA, Derby CA, Kleinman KP, McKinlay JB. Incidence of erectile dysfunction in men 40 to 69 years old: Longitudinal results from the Massachusetts male aging study. *J Urol* 2000;163:460-3.
- Seftel AD, Sun P, Swindle R. The prevalence of hypertension, hyperlipidemia, diabetes mellitus and depression in men with erectile dysfunction. *J Urol* 2004;171(6 Pt 1):2341-5.
- Sumalatha K, Saravana KA, Lakshmi S. Review on natural aphrodisiac potentials to treat sexual dysfunction. *Int J Pharm Ther* 2010;1:6-14.
- Singh R, Ali A, Gupta G, Semwal A, Jeyabalan G. Some medicinal plants with aphrodisiac potential: A current status. *J Acute Dis* 2013;2:179-88.
- Phukerd U, Soonwera M. Larvicidal and pupicidal activities of essential oils from *Zingiberaceae* plants against *Aedes aegypti* (Linn.) and *Culex quinquefasciatus* say mosquitoes. *Southeast Asian J Trop Med Public Health* 2013;44:761-71.
- Ekere S, Okoye C, Udumoh A. Fertility enhancing effects of methanolic leaf extract of *Dracaena arborea* in albino rats (*Rattus norvegicus*). *Czech J Anim Sci* 2013;58:520-4.
- Zade V, Dabhadkar D, Thakare V, Pare S. Evaluation of potential aphrodisiac activity of *Moringa oleifera* seed in male albino rats. *Int J Pharm Pharm Sci* 2013;5:683-9.
- Gauthaman K, Ganesan A, Prasad R. Sexual effects of puncturevine (*Tribulus terrestris*) extract (protodioscin): An evaluation using a rat model. *J Altern Complement Med* 2004;9:257-65.
- Cherdshewasart W, Nimsakul N. Clinical trial of *Buten superba*, an alternative herbal treatment for erectile dysfunction. *Asian J Androl* 2013;15:243-6.
- Campos AR, Lima RC Jr., Uchoa DE, Silveira ER, Santos FA, Rao VS. Pro-erectile effects of an alkaloidal rich fraction from *Aspidosperma ulei* root bark in mice. *J Ethnopharmacol* 2006;104:240-4.
- Yakubu M, Jimoh R. *Carpolobia lutea* roots restore sexual arousal and performance in paroxetine-induced sexually impaired male rats. *Rev Int Androl* 2014;12:90-9.
- Integrated Taxonomic Information System (ITIS). *Boesenbergia rotunda* (L.) Mansf. Taxonomic Serial No.:506504. Geological Survey, VA, USA; 2016.
- Eng-Chong T, Yean-Kee L, Chin-Fei C, Choon-Han H, Sher-Ming W, Li-Ping CT, et al. *Boesenbergia rotunda*: From ethnomedicine to drug discovery. *Evid Based Complement Alternat Med* 2012;2012:473637.
- Veldkamp J. Nomenclatural notes on *Boesenbergia kuntze* (*Zingiberaceae*). *Philipp J Sci* 2013;142:215-21.
- Delin W, Larsen K. *Zingiberaceae*. *Flora China* 2000;24:322-77.
- Ching A, Wah T, Sukari M, Lian G, Rahmani M, Khalid K. Characterization of flavonoid derivatives from *Boesenbergia rotunda* (L.). *Malays J Anal Sci* 2007;11:154-9.
- Morikawa T, Funakoshi K, Ninomiya K, Yasuda D, Miyagawa K, Matsuda H, et al. Medicinal foodstuffs. XXXIV. Structures of new prenylchalcones and prenylflavanones with TNF- α and aminopeptidase n inhibitory activities from *Boesenbergia rotunda*. *Chem Pharm Bull* 2008;56:956-62.
- Yusuf N, Annuar M, Khalid N. Existence of bioactive flavonoids in rhizomes and plant cell cultures of *Boesenbergia rotunda* (L.) Mansf. *Kulturpfl. Aust J Crop Sci* 2013;7:730-4.
- Baharudin M, Hamid S, Susanti D. Chemical composition and antibacterial activity of essential oils from three aromatic plants of the *Zingiberaceae* family in Malaysia. *J Phys Sci* 2015;26:71-81.
- Jing L, Mohamed M, Rahmat A, Abu BM. Phytochemicals, antioxidant properties and anticancer investigations of the different parts of several gingers species (*Boesenbergia rotunda*, *Boesenbergia pulchella* var *attenuata* and *Boesenbergia armeniaca*). *J Med Plants Res* 2010;4:27-32.
- Madaka F, Tewtrakul S. Anti-allergic activity of some selected plants in the genus *Boesenbergia* and *Kaempferia*. *Songklanakarin J Sci Technol* 2011;33:301-4.
- Zainin N, Lau K, Zakaria M, Son R, Abdull RA, Rukayadi Y. Antibacterial activity of *Boesenbergia rotunda* (L.) Mansf. A. extract against *Escherichia coli*. *Int Food Res J* 2013;20:3319-23.
- Udomthanadech K, Vajrodaya S, Paisooksantivatana Y. Antibacterial properties of the extracts from some *Zingiberaceae* species in Thailand against bacteria causing diarrhea and food poisoning in human. *Int Trans J Eng Manage Appl Sci Technol* 2015;6:203-13.
- Bhamarapravati S, Juthaprueth S, Mahachai W, Mahady G. Antibacterial activity of *Boesenbergia rotunda* (L.) Mansf. and *Myristica fragrans* Houtt. against *Helicobacter pylori*. *Songklanakarin J Sci Technol* 2006;28:157-63.
- Chander M, Vinod KK, Lall C, Vimal RR, Vijayachari P. GC/MS profiling, *in vitro* anti-leptospiral and haemolytic activities of *Boesenbergia rotunda* (L.) Mansf. used as a medicinal plant by Nicobarese of Andaman and Nicobar Islands. *Nat Prod Res* 2016;30:1190-2.
- Cheah SC, Appleton DR, Lee ST, Lam ML, Hadi AH, Mustafa MR. Panduratin A inhibits the growth of A549 cells through induction of apoptosis and inhibition of NF-kappaB translocation. *Molecules* 2011;16:2583-98.
- Isa N, Abdul A, Abdelwahab S, Abdullah R, Sukari M, Kamalidehghan B, et al. Inhibitory activity of cyclohexenyl chalcone derivatives and flavonoids of fingerroot, *Boesenbergia rotunda* (L.), towards dengue-2 virus NS3 protease. *J Funct Foods* 2013;5:87-97.
- Isa N, Abdelwahab S, Mohan S, Abdul A, Sukari M, Taha M, et al. *In vitro* anti-inflammatory, cytotoxic and antioxidant activities of boesenbergin A, a chalcone isolated from *Boesenbergia rotunda* (L.) (fingerroot). *Braz J Med Biol Res* 2012;45:524-30.
- Chiang M, Kurmoo Y, Khoo TJ. Chemical and cell-based antioxidant capacity of methanolic extracts of three commonly edible plants from *Zingiberaceae* family. *Free Radic Antioxid* 2017;7:57-62.
- Abdelwahab S, Mohan S, Abdulla M, Sukari M, Abdul A, Taha M, et al. The methanolic extract of *Boesenbergia rotunda* and its major compound pinostrobin induces anti ulcerogenic property *in vivo*: Possible involvement of indirect antioxidant action. *J Ethnopharmacol* 2011;137:963-71.
- Kiat TS, Phippen R, Yusof R, Ibrahim H, Khalid N, Rahman NA. Inhibitory activity of cyclohexenyl chalcone derivatives and flavonoids of fingerroot, *Boesenbergia rotunda* (L.), towards dengue-2 virus NS3 protease. *Bioorg Med Chem Lett* 2006;16:3337-40.
- Chee C, Abdullah I, Buckle M, Rahman N. An efficient synthesis of (\pm)-panduratin A and (\pm)-isopanduratin A, inhibitors of dengue-2 viral activity. *Tetrahedron Lett* 2010;51:495-8.
- Wu N, Kong Y, Zu Y, Fu Y, Liu Z, Meng R, et al. Activity investigation of pinostrobin towards herpes simplex virus-1 as determined by atomic force microscopy. *Phytomedicine* 2011;18:110-8.
- Mahmood A, Mariod A, Abdelwahab S, Ismail S, Al-Bayaty F. Potential activity of ethanolic extract of *Boesenbergia rotunda* (L.) rhizomes extract in accelerating wound healing in rats. *J Med Plants Res* 2010;4:1570-6.
- Salama SM, Abdulla MA, Alrashdi AS, Hadi AH. Mechanism of hepatoprotective effect of *Boesenbergia rotunda* in thioacetamide-induced liver damage in rats. *Evid Based Complement Alternat Med* 2013;2013:157456.
- Phukerd U, Soonwera M. Repellency of essential oils extracted from Thai native plants against *Aedes aegypti* (Linn.) and *Culex quinquefasciatus* (Say). *Parasitol Res* 2014;113:3333-40.
- Sudwan P, Saenphet K, Aritajat S, Sitasuwan N. Effects of *Boesenbergia rotunda* (L.) Mansf. on sexual behaviour of male rats. *Asian J Androl* 2007;9:849-55.
- Temkithawon P, Viyoch J, Limpeanchob N, Pongamornkul W, Sirikul C, Kumpila A, et al. Screening for phosphodiesterase inhibitory activity of Thai medicinal plants. *J Ethnopharmacol* 2008;119:214-7.
- Yotarlai S, Chaisuksunt V, Saenphet K, Sudwan P. Effects of *Boesenbergia rotunda* juice on sperm qualities in male rats. *J Med Plants Res* 2011;5:3861-7.
- Ratnawati D, Affandhy L, Pratiwi W, Prihandini P. The effect of traditional supplement in semen quality of Bali bull. *Seminar National Technology Livestock and Veterinary* 2008;29:116-21.
- Sariubang M, Kallo R. Traditional herbal to increase semen quality of Bali cattle. *Proceeding Seminar National in World Food* 2014;34:203-10.
- Singh B, Gupta V, Bansal P, Singh R, Kumar D. Pharmacological potential of plant used as aphrodisiacs. *Int J Pharm Sci Rev Res* 2010;5:104-13.
- Wani B, Ganai B, Ganaie A, Bodha R, Mohiddin F. Plants as repository of aphrodisiacs. *J Pharm Res* 2011;4:3882-7.
- Chauhan NS, Sharma V, Dixit VK, Thakur M. A review on plants used for improvement of sexual performance and virility. *Biomed Res Int* 2014;2014:868062.
- Chaturapanich G, Chaiyakul S, Verawatnapakul V, Pholpramool C. Effects of *Kaempferia parviflora* extracts on reproductive parameters and spermatic blood flow in male rats. *Reproduction* 2008;136:515-22.
- Morakinyo A, Adeniyi O, Arikawe A. Effects of *Zingiber officinale* on reproductive functions in the male rat. *Afr J Biomed Res* 2008;11:329-34.
- Mazaheri M, Shahdadi V, Nazari Boron A. Molecular and biochemical effect of alcoholic extract of *Alpinia galanga* on rat spermatogenesis process. *Iran J Reprod Med* 2014;12:765-70.
- Yang RY, Lin S, Kuo G. Content and distribution of flavonoids among 91 edible plant species. *Asia Pac J Clin Nutr* 2008;17 Suppl 1:275-9.

50. Resende FA, de Oliveira AP, de Camargo MS, Vilegas W, Varanda EA. Evaluation of estrogenic potential of flavonoids using a recombinant yeast strain and MCF7/BUS cell proliferation assay. *PLoS One* 2013;8:e74881.
51. Nishizaki Y, Ishimoto Y, Hotta Y, Hosoda A, Yoshikawa H, Akamatsu M, *et al.* Effect of flavonoids on androgen and glucocorticoid receptors based on *in vitro* reporter gene assay. *Bioorg Med Chem Lett* 2009;19:4706-10.
52. Ko WC, Shih CM, Lai YH, Chen JH, Huang HL. Inhibitory effects of flavonoids on phosphodiesterase isozymes from guinea pig and their structure-activity relationships. *Biochem Pharmacol* 2004;68:2087-94.
53. Ghosh B. Polyamines and plant alkaloids. *Indian J Exp Biol* 2000;38:1086-91.
54. Rahimi R, Ghiasi S, Azimi H, Fakhari S, Abdollahi M. A review of the herbal phosphodiesterase inhibitors; future perspective of new drugs. *Cytokine* 2010;49:123-9.
55. Hage J, Faccini PJ. Benzylisoquinoline alkaloid metabolism: A century of discovery and a brave new world. *Plant Cell Physiol* 2013;54:647-72.
56. Güçlü-Ustündağ O, Mazza G. Saponins: Properties, applications and processing. *Crit Rev Food Sci Nutr* 2007;47:231-58.
57. Wang X, Wang S, Hu L. Neuroprotective effect of panax notoginseng saponins and its main components. *World J Neurosci* 2014;4:12-7.