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A Perspective Study of *Pogostemon cablin* Benth as an Aphrodisiac

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Abstract

Pogostemon cablin Benth also known as a patchouli plant, is a member of Lamiaceae family, and the source of patchouli essential oil. This plant is an important herb which possesses many therapeutic properties. In traditional medicinal practices, patchouli oil is used to relieve depression, stress, calm nerves, control appetite and to improve sexual interest. Up to the present moment, almost 200 volatile and non-volatile compounds have been isolated and identified from *Pogostemon cablin* including flavonoid, phytosterols, glycosides, terpenes, sesquiterpenes, organic acids, and others. Modern studies revealed that the patchouli plant have been used for various applications such as an antioxidant, anti-inflammatory, analgesic, antidepressant, antithrombotic, antiplatelet, fibrinolytic, antiemetic, antimutagenic, and aphrodisiac. In aromatherapy, this plant is believed to be able to improve blood circulation and sexual interest. The flavonoid compounds, such as acacetin and apigenin are believed to play an important role as an aphrodisiac. The mechanisms of action of this plant as an aphrodisiac is believed by increasing androgens and estrogen levels in dehydroepiandrosterone (DHEA), which further increases arousal sexual desire. However, some uses need to be verified and may require standardizing and authenticating the bioactivity of purified compounds through scientific methods. This perspective study discusses the aphrodisiac potential of *Pogostemon cablin* Benth, including their chemical constituents, health benefit, mechanism action, and the role of main bioactive compound as an aphrodisiac.

1. Introduction

Sexual dysfunction is a sexual problem that manifests as an impediment to the usual sexual response cycle [1]. Sexual disorders frequently cause problems in relationships and can harm one's quality of life [2]. Heidelbaugh defines erectile dysfunction as a man's inability to achieve or maintain adequate repeated erections during sexual activity. Depending on the severity of the condition, erectile dysfunction can be treated with oral therapy, injections, topical medications, or medical treatment. The first line of therapy for patients with erectile dysfunction is an oral drug called phosphodiesterase-5 inhibitor (PDE5-I), which triggers vasodilation activity in the penis by inhibiting the phosphodiesterase-5, causing the blood vessels to relax

and blood flow to increase [3]. Despite the fact that its use is thought to be effective, PDE5-I drug users are burdened by high drug market price [4]. According to Aytaç, 152 million men experienced erectile dysfunction in 1995. The number of men affected is expected to reach 322 million by 2025 [5]. This tremendous increase is seen in developing countries around the world in Africa, Asia, and South America. According to the Asian Urology Congress IV in Singapore stated that 14% of Asian men over 18 have erectile dysfunction [6]. Researchers state that medicinal plants are still being studied, not only for traditions used but also for their medicinal value [7, 8], Patchouli (*Pogostemon cablin Benth* or *P. cablin*) is one of the medicinal plants that has been used for generations. Traditionally, patchouli is used as an antiseptic, antidepressant, and as aromatherapy. Patchouli has biological properties as an antioxidant, analgesic, antiplatelet, antithrombotic, aphrodisiac, and antiemetic [9]. *P. cablin Benth*, is also known to contain several sesquiterpenes and hydrocarbons compounds, such as patchouli alcohol (patchoulol) as main compound, patchoulene, bulnesene, guaiene, caryophyllene, elemene, and copaene [10]. *P. cablin* Benth also contains several non-volatile compounds such as flavonoids and glycosides [11].

Conventional medicines have many adverse effects on the body, so natural products have become a popular alternative as natural treatments due to them having few adverse effects [12–14]. *P. cablin* Benth has great potential to be developed as an alternative to synthetic drugs because they are less likely to cause side effects and lower medical costs. Aphrodisiacs are substances or drugs that stimulate sexual instincts, arousal, behaviour, sexual performance, or pleasure [15, 16]. In this article, we present our perspective study of *P. cablin* Benth as an alternative natural aphrodisiac.

2. *Pogostemon cablin* Benth

Pogostemon cablin Benth is a member of the Lamiaceae family and is used in traditional medicine to treat nausea, vomiting, diarrhea and stomachache [17]. *P. cablin* is a fragrant shrub with smooth leaves and a rectangular trunk and is one of Indonesia's most popular essential oil producers. The dried leaves of this plant can be distilled to obtain an essential oil i.e., patchouli oil, which is usually used in the industrial sector. The main component of this oil is patchouli alcohol ($C_{15}H_{26}O$) which acts as a fixative. Patchouli oil from Aceh is top-rated in international markets, particularly in America and Europe, and it is often used as a raw material in the industry [11, 18]. Patchouli is also used as an ingredient in soap, toothpaste, shampoo, lotion, and deodorant in the cosmetics industry. Patchouli is used as a flavor enhancer in the food industry. Patchouli is also used in the pharmaceutical industry as anti-inflammatory, antifungal, anti-insect, aphrodisiac, anti-inflammatory, antidepressant, antiphlogistic, and decongestant medications [19].

P. cablin is a tropical shrub with many branches that grows upright and is stratified. Patchouli plants grow to a height of 0.5-1.0 m, and the stem of patchouli is branched, dense, and angular. The patchouli plant's leaves are ovate to oval in shape, 5-11 cm long, thin, green, and not stiff, with the administration on the upper surface. Patchouli has a leaf position which faces each other, and has rough leaf surface with jagged edges, a blunt leaf tip, and protruding leaf veins. Patchouli plants hardly ever bloom. Patchouli flowers grow in clusters at the end of the stalk and have a reddish-purple color. The flower stalk measures 2 - 8 cm in length and 1 - 1.5 cm in diameter. The flower crown is 8 mm in diameter [20].

The essential oil of *P. cablin* is considered a cell rejuvenator and antiseptic, and is also used to treat acne, eczema, inflamed, mature skin and dandruff. Its antifungal properties are used in the treatment of athlete's foot [21]. In Malaysia, they use it to relieve headaches, cold and fever, and it is also considered an antidote for snake and insect bites. Infusion of the leaves, dried tops or roots is used for treating dysuria [17, 22].

3. Chemical Constituents of *Pogostemon cablin* Benth

3.1. The volatile compounds in Pogostemon cablin

Phytochemical screenings have revealed that *P. cablin* contains various secondary metabolites, including many monoterpenoids, triterpenoids, sesquiterpenoids, phytosterols, flavonoids, organic acids, lignins, glycosides, alcohols, and aldehydes. The main components of patchouli or patchouli oil are patchoulol, α-patchoulene, β-patchoulene, α-bulnesene, α-guaiene, caryophyllene, norphatchoulenol, sechellene, and pogostol. The volatile compounds found in *P. cablin* Benth include a variety of compounds such as monoterpenes, sesquiterpenes, and alcohol (Table 1) [23].

3.2. The non-volatile compounds in P. cablin

The non-volatile compounds contained in *P. cablin Benth*, generally are compounds from the flavones group, such as retusine and pachypodol. The types of non-volatile compounds from *P. cablin* are presented in Table 1. The table also shows that the non-volatile compounds in *P. cablin* were divided into 7 groups of non-volatile compounds, i.e., flavonoids (consist of 15 compounds); phytosterols (consist of 5 compounds); glycosides

Table 1. The volatile and non-volatile compounds contained in *Pogostemon cablin* Benth extracts [23].

I.	**Volatile compounds**	
No.	**Compounds**	**Formula**
1.	Aciphyllene	$C_{15}H_{24}$
2.	Alloaromadendrene	$C_{15}H_{24}$
3.	Aromadendrene	$C_{15}H_{24}$
4.	β-Bourbonene	$C_{15}H_{24}$
5.	α- and β-Bulnesene	$C_{15}H_{24}$
6.	(+)-Camphene	$C_{10}H_{16}$
7.	(-)-Camphor	$C_{10}H_{16}O$
8.	δ-Cardinene	$C_{15}H_{24}$
9.	α-Caryophyllene (α-Humulene)	$C_{15}H_{24}$
10.	β-Caryophyllene	$C_{15}H_{24}$
11.	*trans*-Caryophyllene	$C_{15}H_{24}$
12.	Caryophyllene oxide	$C_{15}H_{24}O$
13.	Copaene	$C_{15}H_{24}$
14.	β-Cubebene	$C_{15}H_{24}$
15.	β-Copaen-4-α-ol	$C_{15}H_{24}O$
16.	Cycloseychellene	$C_{15}H_{24}$
17.	Diidro-aromadendrane	$C_{15}H_{26}$
18.	α-, β- and δ-Elemene	$C_{15}H_{24}$
19.	Elemol	$C_{15}H_{26}O$
20.	Epiglobulol	$C_{15}H_{26}O$
21.	Eucalyptol	$C_{10}H_{18}O$
22.	α-Elemenone	$C_{15}H_{22}O$
23.	Epifriedelinol	$C_{30}H_{52}O$
24.	7-Epi-α-selinene	$C_{15}H_{24}$
25.	*cis*-Farnesol	$C_{15}H_{24}O$
26.	Friedelin	$C_{30}H_{50}O$
27.	Germacrene- A, B, D	$C_{15}H_{24}$
28.	Globulol	$C_{15}H_{26}O$
29.	α-, β- and δ-Guaiene	$C_{15}H_{24}$
30.	α-, γ-Gurjunene	$C_{15}H_{24}$
31.	Heptanal	$C_7H_{14}O$
32.	Limonene	$C_{10}H_{16}$
33.	Longipinanol	$C_{15}H_{26}O$
34.	Myrtenol	$C_{10}H_{16}O$
35.	Nonanal	$C_9H_{18}O$
36.	Norpatchoulenol	$C_{14}H_{22}O$
37.	1-Octen-3-ol	$C_8H_{16}O$
38.	3-Octanol	$C_8H_{18}O$
39.	Oleanolic acid	$C_{30}H_{48}O_3$
40.	Patchouli alcohol	$C_{15}H_{26}O$
41.	α-,β-,γ- and δ-Patchoulene	$C_{15}H_{24}$
42.	β-Phellandrene	$C_{10}H_{16}$
43.	α- and β-Pinene	$C_{10}H_{16}$
44.	Pogostol	$C_{15}H_{26}O$
45.	Pogostone	$C_{12}H_{16}O_4$
46.	α- and β-Selinene	$C_{15}H_{24}$
47.	Seychellene	$C_{15}H_{24}$
48.	Spathulenol	$C_{15}H_{24}O$
49.	(-)-α-Terpineol	$C_{10}H_{18}O$
50.	Valencene	$C_{15}H_{24}$
51.	Viridiflorene	$C_{15}H_{26}O$
II.	**Non-Volatile compounds/ Groups**	
No.	**Compound**	**Formula**
A.	**Flavonoid**	
1.	Acacetin	$C_{16}H_{12}O_5$
2.	Apigenin	$C_{15}H_{10}O_5$
3.	Diosmetin-7-O-β-D-gluco- pyranoside	$C_{22}H_{22}O_{11}$
4.	4',5-Dihydroxy-3,3',7trimethoxyflavone	$C_{18}H_{16}O_7$
5.	4',5-Dihydroxy-3',7-dimethoxyflavanone	$C_{17}H_{16}O_6$
6.	5,4'-Dihydroxy-3,3',7-trimethoxyflavanone	$C_{18}H_{18}O_7$
7.	3,5-Dihydroxy-7,4'-dimethoxyflavanone	$C_{29}H_{36}O_{15}$
8.	5,7-Dihydroxy-3',4'-dimethoxyflavanone	$C_{29}H_{36}O_{15}$
9.	5-Hydroxy-3,3',4',7-tetramethoxyflavone	$C_{19}H_{18}O_7$
10.	5-Hydroxy-7,3',4'-trimethoxyflavanone	$C_{19}H_{20}O_7$
11.	5-Hydroxy-3,7,3',4'-tetrmethoxyflavanone	$C_{19}H_{18}O_6$
12.	Licochalcone A	$C_{21}H_{22}O_4$
13.	Ombuin	$C_{17}H_{14}O_7$
14.	Rhamnetin	$C_{16}H_{12}O_7$
15.	Retusine	$C_{19}H_{18}O_7$
B.	**Phytosterols**	
1.	5α-Stigmast-3,6-dione	$C_{29}H_{48}O_2$
2.	Daucosterol	$C_{35}H_{60}O_6$
3.	β-Sitosterol	$C_{29}H_{50}O$
4.	Stigmasterol	$C_{29}H_{48}O$
5.	Stigmast-4-ene-3-one	$C_{29}H_{48}O$
C.	**Glycosides**	
1.	Acteoside	$C_{29}H_{36}O_{15}$
2.	Agastachoside	$C_{24}H_{24}O_{11}$
3.	Apigenin-7-*O*-(3",6"-di-(*E*)-*p*coumaroyl)-β-D-galactopyranoside	$C_{30}H_{26}O_{12}$
4.	3α-Hydroxypatchoulol 3-*O*-β-Dglucopyranoside	$C_{21}H_{36}O_7$
5.	15-Hydroxypatchoulol 15-*O*-β-D-glucopyranoside	$C_{21}H_36O_7$
6.	Isocrenatoside	$C_{29}H_{34}O_{15}$
7.	3"-*O*-Methylcrenatoside	$C_{29}H_{36}O_{15}$
8.	Soya-cerebroside I and II	$C_{40}H_{75}NO_9$
9.	Tilianin	$C_{22}H_{22}O_{10}$
10.	Rubusoside	$C_{32}H_{50}O_{13}$
D.	**Triterpenes**	
1.	Epifriedelinol	$C_{30}H_{52}O$
2.	Methyl oleanolate	$C_{31}H_{50}O_3$
E.	**Sesquiterpenes**	
1.	8α,9α-Dihydroxypatchoulol	$C_{15}H_{26}O_3$
2.	3α,8α-Dihydroxypatchoulol	$C_{15}H_{26}O_3$
3.	2β,12-Dihydroxypathoulol	$C_{15}H_{26}O_3$
4.	10 α-Hydroperoxyguaia-1,11-diene	$C_{15}H_{25}O_2$
5.	1 α-Hydroperoxyguaia-10(15),11-diene	$C_{15}H_{26}O_2$
6.	15 α-Hydroperoxyguaia-1(10),11-diene	$C_{15}H_{24}O_2$
7.	2-Keto-4β-hydroxyguai-1, 11-diene	$C_{15}H_{22}O_2$
8.	4-Hydroxy-10-epi-rotundone	$C_{15}H_{22}O_2$
9.	10 α-Hydroperoxyguaia-1,11-diene	$C_{15}H_{25}O_2$
10.	1 α-Hydroperoxyguaia-10(15),11-diene	$C_{15}H_{25}O_2$
11.	15 α-Hydroperoxyguaia-1(10),11-diene	$C_{15}H_{24}O_2$
12.	6-Hydroxypatchoulol	$C_{15}H_{26}O_2$
13.	Patchouli alcohol	$C_{15}H_{26}O$
F.	**Organic Acids**	
1.	Dibutyl phthalate	$C_{16}H_{22}O_4$
2.	Succinic acid	$C_4H_6O_4$
G.	**Others**	
1.	Tschimganical A	$C_{11}H_{16}O_3$
2.	Uracil	$C_4H_4N_2O_2$

(consist of 10 compounds); triterpenes (consist of 2 compounds); sesquiterpenes (consist of 13 compounds); organic acids (consist of 2 compounds); and others (consist of 2 compounds) [9].

Table 2. Health benefits of some varieties of *P. cablin* [24, 25].

Patchouli variety	Country of origin	Benefits
P.cablin (Dark)	Indonesia	It increases mood and relaxation, controls emotions, reduces inflammation, improves cognitive function, and is able to stimulate libido
P.cablin (Light)	Indonesia	It increases immunity, works as a natural deodorant, prevents fungal growth, strengthens hair, is able to regulate hormones and strengthens the nervous system.
P. cablin	India	It prevents infection in wounds, acts as an anti-dandruff, eliminates skin irritation, and reduces wrinkles on the skin.

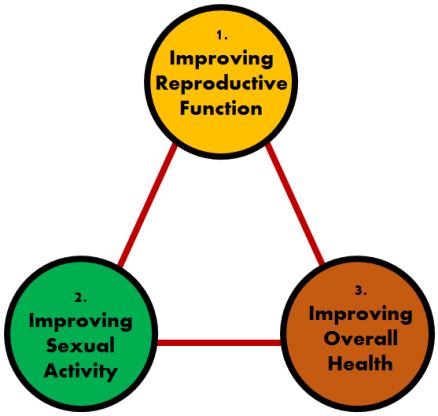

Figure 1. Three concepts of Vajikarna therapeutic treatment [26].

4. Health Benefits of *Pogostemon cablin* Benth

P. cablin is commonly used as a therapeutic agent because of its pleasant (soothing) and calming (peace-inducing) aroma. Patchouli is thus ideal for cosmetics, aromatherapy, fragrance, and room purification. Patchouli is also widely used in treatment (healing), such as an anti-inflammatory, antidepressant, antilogistic, antiseptic, astringent, cicatricial, cytoplactic, deodorant, diuretic, fungicide, sedative, tonic quality, and aphrodisiac agent [24].

P. cablin can also be used as a topical agent for skincare products, and can also be used to prevent body odor (deodorize body odors), inflammation (soothe inflammation), maintain water retention, stop cellulite, relieve constipation, lose weight, to close wounds by stimulating the growth of new skin, as a moisturizer, to eliminate cracks in the skin, and reduce blemishes or wrinkles on the skin. *P. cablin* is also suitable for the treatment of fever by lowering body temperature and it is also good for the treatment of digestive diseases. *P. cablin* may also be used as a youth medicine in treatment by enhancing the oxygen circulation in the organs and cells. *P. cablin* tonic oil can also be used to increase metabolic function by stimulating the stomach, intestines and regulating proper excretion. *P. cablin* can also be used to strengthen the immune system because of its ability to combat external infections [10]. The advantages of *P. cablin* also largely depend on the variety of Patchouli (Table 2).

5. Aphrodisiac

Aphrodisiacs are substances or medications that stimulate sexual arousal or libido [13]. The name is derived from Aphrodite, the name of the goddess of love in Greek mythology. Some herbal plants have traditionally been used as drugs to increase sexual arousal in some countries. Traditional Ayurvedic therapies, for example, have been used by many indigenous people. Ayurveda was known about more than 5000 years ago and gradually spread to include China, Tibet, Greece, Rome, Egypt, Afghanistan, and Persia. The concept of "aphrodisiac" in modern therapy is considered close to Vajikarna therapy [26].

There are three concepts of Vajikarna therapeutic treatment (Fig. 1):

a. Improving reproductive function

   (Including: purify and improve the quality and quantity of semen; improve the function of reproductive organs; vitalizers reproductive tissue; increase sperm motility; threat infertility; increase hormone level; and generate sperm).

b. Improving sexual activity

   (Including: prevent exhaustion during sexual intercourse; enhance sexual performance; help sexuality and ejaculation; enjoy optimum sexual delight in woman; delaying the time ejaculation; arousing sexual desire; and increase libido).

c. Improving overall health

   (Including: strength body tissue like muscle, fats, and bone; promotes strength, virility, and nourishment; increase health and vitality of offspring; increase physical and physiological health; and increase immunity of the body).

6. Mechanisms Action of Herbal Plants as Aphrodisiac

According to Bruce [27], aphrodisiacs have three mechanisms of action: 1) Aphrodisiac as a source of nutrition; some aphrodisiacs are only a source of nutrients that improve the health of users, resulting in increased sexual performance and libido, 2) Aphrodisiacs

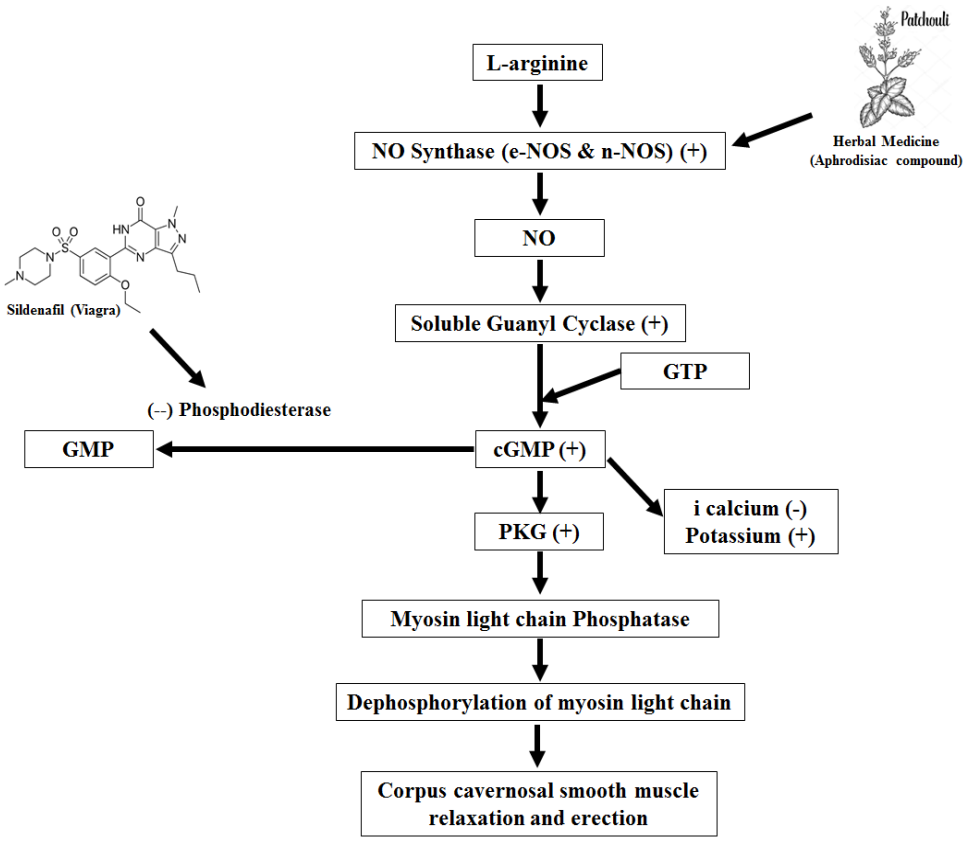

Figure 2. Suggested action of the aphrodisiac compound on the pathway principally responsible for sexually stimulated erection. NO, nitric oxide; e-NOS, endothelial nitric oxide synthase; n-NOS, neuronal nitric oxide synthase; cGMP, cyclic GMP; i calcium, intracellular calcium. (+) The increase in activity or quantity and (--) the decrease [28].

that affect physiology; some aphrodisiacs are claimed to have a more specific physiological effect but are not psychologically active. They can affect blood flow, increase the duration of sexual activity. 3) Aphrodisiacs that affect psychopharmacology; this type of aphrodisiac can cross the blood-brain barrier and stimulate multiple areas of sexual arousal. This category includes neurotransmitters, hormones, pheromones, and drugs that disrupt the normal function of these molecules. Meanwhile, the aphrodisiac mechanisms of action ofplants are divided into two parts mechanisms: nitrous oxide (NO)-based mechanism of action and androgen-based mechanism of action [27].

6.1. Nitrous Oxide (NO) Mechanisms

Nitrous oxide (NO) relaxes penile blood vessels and trabecular smooth muscle, which is essential for penile erection. The relaxation of the corpus cavernous trabecular smooth muscle reduces vascular resistance and increases blood flow to the penis. Decreased blood flow is ensured by compression of the subtunis venules. Both increase blood flow and cause penile swelling to allow for an erection-NO-mediated vasosolidation of the vascular endothelium of the sinusoids and nonadrenergic, noncholinergic and cavernous nerves [25]. Natural aphrodisiac compounds (such as alkaloid, flavonoids, and sponins) stimulate the n-NOS and e-NOS enzymes in the corpus cavernosum (CC). As a result, NO production increases, which further activates guanylate cyclase (SGC), catalysing GTP conversion to cGMP. The role of cGMP is to regulate CC smooth muscle tone and penile erection (relaxation) (Figure 2). This relaxation is caused by a decrease in the level of *i*-calcium. Herbal medicine aphrodisiac compounds are thought to play a role in increasing cGMP levels of GTP [28].

6.2. Androgen Mechanisms

Secondary sexual characteristic such as the epididymis, vas deferens, seminal vesicles, prostate, and penis are influenced by androgens such as testosterone. The hypothalamic conversion of testosterone to estradiol improves sexual function. The cyclic adenosine monophosphate (cAMP) pathway, which is mediated by corporal smooth muscle and the associated enzymes and proteins such as prostaglandins and protein G-kinase, is also responsible for penile erection. Therefore, there will be smooth muscle relaxation and an increase in Ca^{2+} concentration which induces a loss of contractile tone of the smooth muscles of the penis and increases blood flow in the body resulting in an erection [29].

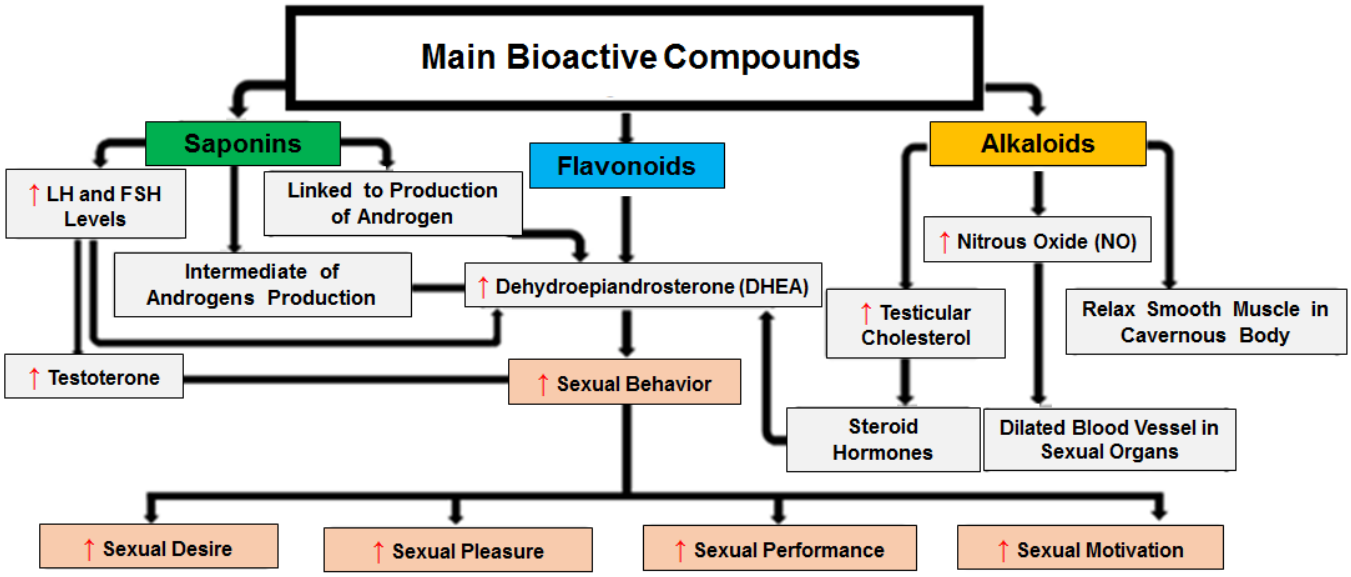

Figure 3. The potential of the main bioactive compound in herbal medicine as an aphrodisiac. Adopted from [28].

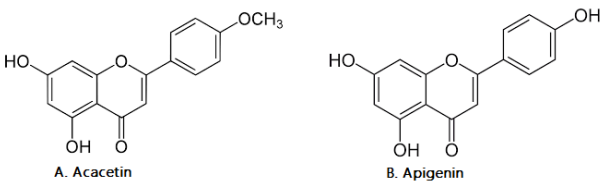

Figure 4. The chemical structure of acacetin and apigenin are flavonoid compounds play an important role as an aphrodisiac agent.

7. The Potentials of *Pogostemon cablin* Benth as Aphrodisiac

Herbal plants are known to impact the hypothalamic-hypophysial-testicular axis and increase the libido. It occurs in increasing the amounts of several hormones and serum testosterone levels that stimulate the receptors of dopamine, vasodilation, formation of the nitrous oxide (NO), androgens and gonadotropins. Several herbal plants, including *Pogostemon cablin* Benth can influence penile erection by various mechanisms (Figure 3). Alkaloid compounds, for example, have ergogenic properties that cause vasodilation in blood vessels, resulting in an erection. Meanwhile, saponin group compounds play a role in the formation of nitrous oxide (NO) and also play a role in the formation of smooth muscle relaxation through *L*-arginine/nitrous oxide. In addition, flavonoid compounds from herbal plants play a role in changing androgen levels [30].

P. cablin is well-known as aromatherapy to eliminate unpleasant odors and to maintain emotional balance. *P. cablin* may also be used as a sedation agent as it can stimulate the hormonal release of serotonin and dopamine and increase mood and relaxation. *P. cablin* can act as an aphrodisiac by stimulating sensory energy and increasing libido. When used at night as a diffuser, *P. cablin* also improves sleep quality (restful sleep), improving mood, cognitive function, and metabolism. Flavonoids, such as Acacetin, apigenin, diosmetin-7-O-β-D-gluco- pyranoside, licochalcone A, ombuin, rhamnetin, retusine, dihydroxy and hydroxy flavones (Table 2) are found to play a role in stimulating sensual energy and increasing libido by increasing androgen levels so that that dehydroepiandrosterone (DHEA) will increase; consequently, sexual behavior will also increase. Monoterpenoides, triterpenoids, sesquiterpenoids, phytosterols, flavonoids, organic acids, lignins (glycosides), alcoholics or aldehydes are the chemical components of patchouli considered to act as an aphrodisiac by stimulating sensory energy and increasing libido [23]. Alkaloids and flavonoids are thought to be effective aphrodisiacs [9]. Yetman mentions that secondary metabolites such as alkaloids and isoflavonoid derivatives play a role in inhibiting PDE-5 (phosphodiesterase-5 inhibitors) [31]. Phosphodiesterase-5 inhibitors are a type of drug that is often used to induce an erection of the penis, so it is often used to treat erectile dysfunction [32].

7.1. Acacetin and Apigenin Play an Important Role as an Aphrodisiac

7.1.1. Structure of Acacetin and Apigenin

Acacetin is a 4'-O-methylated flavone and also known as 5,7-dihydroxy-4'-methoxyflavone. Acacetin commonly found in *Robinia pseudoacacia* and *Turnera diffusa*. Apigenin is 4',5,7-trihydroxyflavone compound,

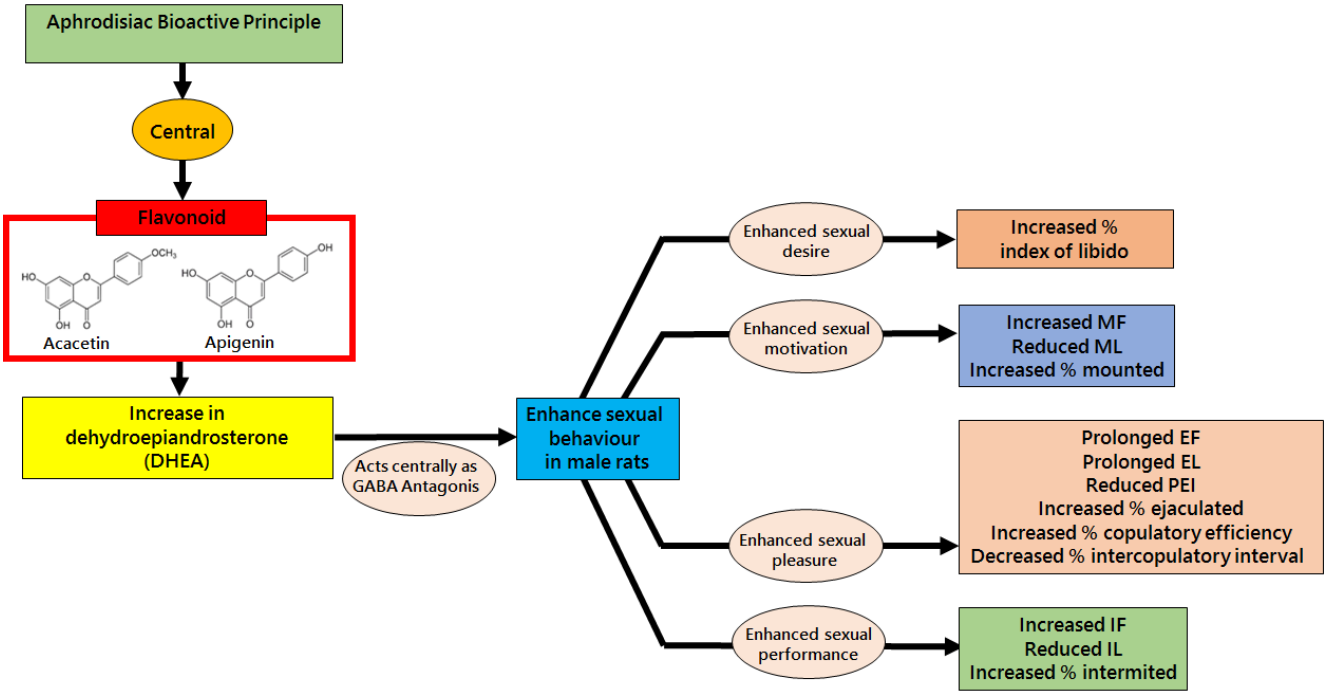

Figure 5. The feasible of bioactive flavonoid compounds (acecatin and apigenin) of natural aphrodisiac. Adopted from [33]. Note: GABA (Gamma-aminobutyric acid); MF (mount frequency); ML (mount latency); EF (erection frequency); EL (erection latency); PEI (postejaculatory interval); IF (Intromission frequency); and IL (Intromission latency).

belonging to the flavone class. These compounds also have found in *Pogostemon cablin* Benth but in small quantities (Fig. 4) [34].

7.1.2. Acacetin and Apigenin as Aphrodisiac Agent

The previous study reported that *Gmelina arborea* roxb have several medicinal properties such as antioxidant, anti-inflammatory, antiepileptic, analgesic, antipyretic, and aphrodisiac. Shankar et al have been isolated the flavonoidal compound that is acacetin (5,7-dihydroxy-4 methoxy flavone) from *Gmelina arborea*, and the result exhibited that this compound responsible for several pharmacological activities [35]. Chaurasiya et al mentioned that acacetin have a potent selective inhibitor of recombinant human monoamine oxidases (MAO-B) with the IC_{50} of 198 nM. Chaurasiya also mentioned that acacetin and its derivative from *Agatache rugose* have a selective potent as inhibitor of MAO-B. *Turnera diffusa* ex Schult (known as damiana) is traditionally used for aphrodisiac to improve sexual interest and sexual impotence [36]. The extract of *Turnera diffusa* contain various flavonoids compound such as luteolin, arbutine, damianine, gonzalitozin, acacetin, and apigenin. Study on experimental animals exhibited that the aqueous extract of *Turnera diffusa* was able to Improve sexual stimulant or sexual performance of male rats.

The sexual performance of the *Turnera diffusa* extract probably influenced by the flavonoid compounds such as acacetin and apigenin through their effects on central nervous system (CNS), but the mechanism of action is not yet known with certainly (Fig. 5). However, several studies show that the mechanisms of action of flavonoid compounds as aphrodisiacs is through increasing androgens and estrogen levels in dehydroepiandrosterone (DHEA) or via increasing the production of nitric oxide (NO), which plays an essential role in the triggering and maintenance of the erection [9, 33, 37].

Several researchers reported that the other plants such as *Panax ginseng* C. A. Meyer (Araliaceae), *Mucuna pruriens* Linn. (Leguminosae), *Zingiber officinale* Roscoe (Zingiberaceae), *Myristica fragrans* Houtt. (Myristaceae), and *Pogostemon cablin* Benth (Lamiaceae) have been established in the management of sexual dysfunction [29].

Pogostemon cablin Benth is believed to work as an aphrodisiac by stimulating sensual energy and boosting the libido by increasing the production of the sex hormones estrogen and testosterone, thereby helping to eliminate sexual anxiety and sluggish libido. In aromatherapy, the essential oil *Pogostemon cablin* (patchouli oil) has been used to reduce tension, insomnia and anxiety, helps sharpen intelligence, improve concentration, provide insight, and stimulate adrenal hormone secretion [33].

8. Conclusions

Pogostemon cablin Benth is being explored broadly to achieve key lead compounds for explored new drug compounds with great therapeutic potential as aphrodisiac. This perspective study summarizes the recent research study of *P. cablin* as an aphrodisiac. This perspective study helps provides up-to-date information on the potential of natural aphrodisiac of *P. cablin*. The flavonoid compounds containing in *P. cablin* such as acacetin and apigenin is believed play an important role as an aphrodisiac agent. The action mechanisms of *P. cablin* as an aphrodisiac is expected through increasing androgens and estrogen levels in dehydroepiandrosterone (DHEA) or via increasing the production of nitric oxide (NO), which plays an essential role in the triggering and maintenance of the erection. This result should be explored in detail especially in pharmacology, pharmacokinetics, toxicity and safety aspects of *P. cablin* related to aphrodisiac effect of the flavonoids compounds such as acacetin and apigenin under in vitro and in vivo conditions.

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