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Current status of Indian medicinal plants with aphrodisiac potential

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ABSTRACT

In India, indigenous remedies have been used in treatment of sexual dysfunction since the time of Charaka and Sushruta. Plants have been always an exemplary source of drugs and many of the currently available drugs have been derived directly or indirectly from them. An aphrodisiac is defined as an agent that arouses sexual desire. Erectile dysfunction or sexual dysfunction (ED or SD) or male impotence is defined as the inability of a man to achieve and maintain an erection sufficient for mutually satisfactory intercourse with his partner. Sexual health and function are important determinants of quality of life. To overcome the problem of male sexual (or) erectile dysfunction, various Indian natural aphrodisiac plants potentials were preferred. The ethnobotanical information reports that about 200 plants possess aphrodisiac potential. Out of several Indian medicinal plants, 33 plants were reviewed. In this review, studies on Indian medicinal plants were reviewed and their possible therapeutic applications were discussed. This review discusses about aphrodisiac potential of Indian medicinal plants, its botanical name, common name, family, extract, models used, part used and references, which are helpful for researchers to develop new herbal aphrodisiac formulations. In the recent years, interest in drugs of plant origin has been progressively increased.

1. Introduction

Sexual activity has been universally recognized as a vital component of a normal and healthy lifestyle and general well-being. Sexual dysfunction especially erectile dysfunction is a serious public health problem as reflected in epidemiological data. Aphrodisiac is the word derived from Aphrodite, the Greek goddess of sexual, love and beauty. An aphrodisiac is defined as an agent (food or drug) that arouses sexual desire. From time immemorial, man's endeavour have been to increase his sexual powers. When man did not know metals and used only stones, he exhibited his sexual powers by ritual dances accompanied by hunting. This leads early man was motivated by his quest for food, sex and self-preservation. The possibility of bioactive aphrodisiacs which may be derived from plants, animals or minerals, has been attractive throughout recorded history. Aphrodisiac are mentioned there as Vajikaranas, the word vaji meaning horse and karanta meaning making, i.e., measure to excite lust by charms, etc. Many natural substances have been historically known as aphrodisiacs in Africa and Europe, such as Yohimbine and the Mandrake plant, as well as ground Rhinoceros horn in the Chinese culture and "Spanish fly" which is actually toxic. Sexual relationships are some of the most important social and biological relationship in human life. Male impotence also called erectile dysfunction (ED or SD) is a common medical condition that affects the sexual life of millions of men worldwide. Erectile dysfunction is defined as the persistent inability to obtain and maintain an erection sufficient for naturally satisfactory intercourse. Sexual dysfunction is a serious medical and social symptom that occurs in 10%-52% of men and 25%-63% of women. Erectile dysfunction is adversely affected by diabetes mellitus, antihypertensive, antipsychotic, and antidepressant therapeutic drugs. Organic causes of ED include hypogonadism, hyperprolactinaemia, and neurological disorders. Treatment of ED involves several natural aphrodisiac potentials. Aphrodisiac

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is described as any substance that enhances sexual pleasure. Sexual dysfunction caused by various factors such as psychological disorders like anxiety, depression, stress, fear of sex, neurological disorders, stroke, cerebral trauma, Alzheimer, Parkinson's disease and chronic disorders-diabetes, hypertension, vascular insufficiency, atherosclerosis, penile disease-phinosis, peyronies, life style-chronic alcohol abuse, cigarette smoking, aging, decrease in hormone level with age, and systemic diseases-cardiac, hepatic, renal, pulmonary, and cancer. Since introduction of sildenafil citrate to treat erectile dysfunction, there has been renewed and vigorous interest in medicinal herbs with folkloric reputation for sexual disorders. The Ayurvedic system of medicine addresses the problem of sexual inefficiencies/ deficiencies by treatment with specialized therapy known as Rasayana therapy. A class of Rasayana drugs known as 'Vrishya' or 'Vajikaran Rasayana' has been prescribed in debility, especially encountered with advancing age. Vajakarna therapy includes aphrodisiacs for erectile dysfunction, causes of infertility, spermatogenesis, semenogenesis, reproduction, methods of correcting defective semen and sexual satisfaction[1,2].

This review will discuss the current research done in India on the most popular natural aphrodisiacs and examine the weight of evidence to support or discourage the use of any of them to enhance sexual desire and/or function.

2. Parameters used in assessing aphrodisiac activity

For the study of aphrodisiac activity, many *in vitro* and *in vivo* models have been used. Methods that are used in aphrodisiac study can be categorized into physical methods including male sexual behavior (Mount frequency, mount latency, intromission frequency, intromission latency, ejaculation frequency, post-ejaculatory interval, index of libido, and computed male sexual behavior parameter), orientation behavior, determination of hesitation time & attraction towords female, test of potency, test for libido, penile microcirculation study, intracavernous pressure study and biochemical methods, hormonal determination, assay of nitric oxide synthase & androgen receptor protein.

(i) Intromission frequency (IF) is the introduction of one organ or parts in another. (ii) Mount frequency (MF) is the number of mounts in series, or number of mounts in a given period of time. (iii) Mount latency (ML) is the time interval between the introductions of the female to the first mount by the male. (iv) Intromission latency (IL) is the interval from the time of introduction of the female to the first intromission by the male. (v) Ejaculatory latency (EL) is the time interval between the first intromission and ejaculation. (vi) Post-ejaculatory interval (PEI): The time between the occurrence of ejaculation and the resumption of sexual activity, as indicated by next intromission[3,4].

3. Guidelines follow during experiment

The following guidelines followed during experiment. (i) Males were kept individually but females were kept in groups. (ii) Training of each male for 15 min at a time was performed until sexual behavior was elicited and when the behavior was noticed, males were exposed to receptive females (1 male with 5 females). (iii) Repeated training to overcome the lack of sexual response in the presence of observers. (iv) The study was conducted in a silent room under dim red light. (v) Any jerking movement of the mating area was avoided to enable the rats to chase each other. (vi) Cleaning of the mating area was performed after each trial, since the urine trails left by one rat might alter the sexual behavior of the next rat[5].

4. Mechanism involved in aphrodisiac potentials

Sexual desire is controlled and regulated by the central nervous system which integrates tactile, olfactory and mental stimuli[6].

Role of nitric oxide: On sexual stimulation (visual (or) otherwise the famines of the axons of parasympathetic nerves release nitric oxide (NO) gas. The gas diffuses into smooth muscle cells that line those arteries of the corpus carvenosum (spongy erectile tissue) and activates the enzyme guanylate cyclase (GC). The later converts the nucleotide guanosine triphosphate (GTP) into cyclic guanosine monophosphate (cGMP). The cGMP in turn causes the smooth muscle cells around the penis to relax, leading to dilation and increased flux of blood into the penile tissue. This blood is essentially trapped in the penis and results in an erection. The erection ceases after a while because cGMP is hydrolyzed by phosphodiesterase type-5 enzyme (PDE-5) into inactive GMP. (The PDE-5 enzyme resides in the penile tissues). Aphrodisiac potentials inhibit the hydrolyzing action of PDE-5 with the result that active cGMP can accumulate. 'Undisturbed' and prolong the erection through increased blood flow[2].

The scientific community explained the biologically significant aphrodisiac into three primary categories.

First: Some aphrodisiac simply provide a burst of nutritional value improving the immediate health or well being of the consumer and consequently improving sexual performance and libido.

Second: This group includes the purported aphrodisiac have more specific physiological affects but are not

psychologically active. They may affect blood flow; increase duration of sexual activity by numbing the genital area.

Third: The third group of aphrodisiac is made up compounds that are psychopharmacological, i.e. they actually cross the blood brain barriers and stimulates some area of sexual arousal. This category includes a wide range of neurotransmitters, hormones, pheromones and drugs that interfere with the normal function of these molecules. This category is most difficult to study because knowledge of both sexual arousal and the mechanisms of the psychoactive properties of drugs are limited. Only the most general information about sexual arousal and the brain is understood[7].

5. Pharmacologically active aphrodisiac Indian medicinal plants in experimental models

In India with the advent of the ayurvedists some of the medicinal plants have proven to possess a traditional as well as scientifically proven aphrodisiac that can enhance passion, increase libido, enhance sexual performance and help to increase the intensity of lovemaking. A brief report of plants has been tested for aphrodisiac potential are documented.

5.1. Abelmoschus manihot (L.)

Abelmoschus manihot (L.) commonly reffered to as "Junglee bhindi". Two doses i.e. 100 and 200 mg/kg b.w. of ethanolic extract administered to Swiss albino mice, showed pronounced anabolic and spermatogenic effect in animals of respective groups. There was a remarkable increase in sperm count and penile erection index and also improved sexual behavior of male mice by increased mount and intromission frequency. Further it was noticed that a 200 mg/kg b.w. dose of *Abelmoschus manihot*, the performance rate enhances without any side effect[8].

5.2. Anacyclus pyrethrum

Anacyclus pyrethrum DC belongs to family Compositae. Aqueous extract of the roots was studied for its effect on sexual behavior, spermatogenesis, and sperm count. Fructose levels in seminal vesicles of albino rats were also recorded. Two doses i.e. 50 and 100 mg/kg of aqueous extract on administration in albino rats showed pronounced anabolic and spermatogenic effect in animals of respective groups. The sperm count and fructose levels in seminal vesicle were markedly increased. Improvement in sexual behavior of male rats was characterized by increased mount and intromission frequency and reduced mount and intromission latency[9].

5.3. Argyreia nervosa Syn.

Argyreia nervosa belongs to family Conovolvulaceae. Etahnolic extract of *Argyreia nervosa* on male mice exhibited significant aphrodisiac behavior at 200 mg/kg p.o., single dose. Significantly increase mounting behavior[10].

5.4. Asparagus racemosus Willd (A. racemosus)

A. racemosus belongs to family Liliaceae. Hydro-alcoholic and aqueous extracts at higher concentration (400 mg/kg body weight) showed significant aphrodisiac activity on male wistar albino rats as evidenced by an increase in number of mounts and mating performance. On the other hand, hydro-alcoholic extract at lower dose (200 mg/kg. body weight) and aqueous extract (400 mg/kg body weight) showed moderate aphrodisiac property.

A. racemosus is commonly known as Shatavari. Milk and aqueous decoction of roots of *A. racemosus* were studied for aphrodisiac activity in male albino rats and compared with untreated control group animals. The rats were evaluated for effect of treatments on anabolic effect. Six measures of sexual behavior were evaluated. 200 mg/kg body weight of milk decoction showed a significant difference in the sexual behavior of animals as reflected by reduction of mount latency, ejaculation latency, post ejaculatory latency, intromission latency, and an increase of mount frequency. Penile erection (indicated by penile erection index) was also considerably enhanced. Reduced hesitation time (an indicator of attraction towards female in treated rats) also indicated an improvement in sexual behavior of extract treated animals. The observed effects appear to be attributable to the testosterone-like effects of the milk decoction of *A. racemosus*. Nitric oxide based intervention may also be involved as observable from the improved penile erection[11].

5.5. Asteracanta longifolia

Asteracanta longifolia belongs to family Acanthaceae. Ethanolic extract of seeds of *Asteracanta longifolia* at 100, 150 and 200 mg/kg, p.o in male rats for a period of 28 days. Significantly increase in the sexual behavior such as mating performance and MF. A significant increase in the sperm count as well as fructose levels of seminal vesicles was noted[12].

5.6. Blepharis edulis Linn.

Blepharis edulis Linn. belongs to family Acanthaceae. Effect of etanolic extract of seeds of *Blepharis edulis* Linn. at 100, 250 & 500 mg/kg p.o. for 7 days on mice significantly increase MF, IF, IL, erections as well as aggregate of penile reflexes and caused significant

reduction in ML & PEI. Hormonal parameter like testosterone was evaluated. The most appreciable effect of the extract was observed at the dose of 500 mg/kg[13].

5.7. Butea frondonsa Koen

Butea frondonsa Koen belongs to family Papillionaceae. Aphrodisiac study was performed on bark of *Butea frondonsa* Koen. The extract (400 mg/kg body wt./day) was administered orally by gavage for 28 days. The extract reduced significantly ML, IL, EL and PEI. The extract also increased significantly MF, IF and EF. These effects were observed in sexually active and inactive male rats[4].

5.8. Chenopodium album

Chenopodium album belongs to family Chenopadiaceae. Ethanolic extract of *Chenopodium album* at 100, 250 & 500 mg.kg, p.o. in male albino mice showed significant increase in the MF, IF, IL, erection as well as aggregate of penile reflexes and caused in significant reduction in the ML and post ejaculatory interval. More over 500 mg/kg, p.o. was found to be most active[14].

5.9. Chlorophytum borivilianum

Chlorophytum borivilianum belongs to family Liliaceae. Lyophilized aqueous extracts of *Chlorophytum borivilianum* at 200 mg/kg, p.o. showed significant enhancement of body weight and reproductive organs, penile erection, MF, whereas significant variation in reduction of ML, EL, IL, reduced hesitation time indicates an improvement in sexual behavior of extract treated animals[15].

5.10. Crossandra infundibuliformis Linn.

Crossandra infundibuliformis Linn. belongs to family Acanthaceae. Effect of petroleum ether extract of *Crossandra infundibuliformis* Linn. on male rat exhibited significant aphrodisiac behavior at 200 & 400 mg/kg p.o. significantly increase MF, IF & ejaculatory latency & reduced ML & IL and significantly increase in serum testosterone[16].

5.11. Curculigo orchioides Gaertn

Curculigo orchioides Gaertn. belongs to family Amaryllidaceae. Ethanoilc extract of rhizomes of *Curculigo orchioides* Gaertn. at 100 mg/kg, p.o. in rats was found to change significantly the sexual behavior such as penile erection, mating performance, MF, ML & increase of penile erection index and weight of reproductive organs[4,17].

5.12. Dactylorhiza hatagirea (D.Don)

Dactylorhiza hatagirea (D.Don) belongs to family Orchidaceae. Aqueous extract of *Dactylorhiza hatagirea* (D.Don) causes significant anabolic effect. Penile erection index (PEI) was also considerably enhanced and significantly reduce mount latency in extract treated group[18].

5.13. Durio zibenthinus Linn.

Aphrodisiac activity of petroleum ether extract and isolated compound 3-β-hydroxyl-21-normethyl-19-vinylidenylursane of *Durio zibenthinus* Linn. Were screened for different dose level, and it was found that 400 mg/kg, p.o. was most active in the mice and have better aphrodisiac activity than all other treated dose[19].

5.14. Glycyrrhiza glabra

Glycyrrhiza glabra belongs to family Leguminocae. In the present study, aphrodisiac activity of aqueous extract of *Glycyrrhiza glabra* (Leguminocae) roots & rhizomes was investigated. The extract (150 mg/kg & 300 mg/kg body wt./day) was administered orally by gavage for 28 days. Mount latency (ML), intromission latency (IL), mounting frequency (MF), intromission frequency (IF), and weight of animals (gm) were the parameters observed before and during the sexual behavior study at day 0, 7, 10, 14, 21, and 28. The extract reduced significantly ML & IL. The extract also increased significantly MF & IF. These effects were observed in sexually active male rats[20].

5.15. Hybanthus enneaspermus (L) F. Muell

Orally administered ethanol (300 mg/kg) and aqueous (300 mg/kg) extracts of *Hybanthus enneaspermus* (L) F. Muell were evaluated for its aphrodisiac activity in sexually inactive male rats both in a single dose regimen and in a chronic regimen as a daily dose for 28 days. Mount and intromission latency and number of mounts, intromissions and ejaculations were the parameters used for assessing sexual arousal and performance. Following a single dose administration, the aqueous extract produced a decrease in the mounting and intromission latency, with an increase in the ejaculatory and intromission frequency. In the chronic model, both the alcohol and aqueous extracts increased the number of mounts, ejaculations and intromissions with decrease in the mounting and intromission latency. Treatment with aqueous extract also elevated the testosterone levels in sexually inactive male rats[21].

5.16. Leptadenia reticulate Linn.

Leptadenia reticulate Linn. belongs to family Asclpiadaceae. Effect of chloroform extract of *Leptadenia reticulate* Linn. at 50, 100, 250 mg/kg, p.o. on male rats for a period of 28 days. Significantly increase in mount, intromission interval, number of ejaculations and decreased latency of first mount as well as the increase in post ejaculation time. Significant weight gain in testis, seminal vesicles, prostate gland, vasdeferences, epididymis[22].

5.17. Mimusa pudica Linn.

Mimusa pudica Linn. belongs to family Mimosae. Effect of etanolic extract of roots of *Mimusa pudica* Linn. at 100, 250 & 500 mg/kg p.o. for 7 days on mice significantly increase MF, IF, IL, erections as well as aggregate of penile reflexes and caused significant reduction in ML & PEI. Hormonal parameter like testosterone was evaluated. The most appreciable effect of the extract was observed at the dose of 500 mg/kg[23].

5.18. Mucuna pruriens Linn.

Mucuna pruriens Linn. belongs to family Papilionaceae. Ethanolic extract of *Mucuna pruriens* Linn. showed significant increase in the MF, IF, EL & decrease the mount latency, IL, PEI & Intromission interval at 150, 200, 250 mg/kg, p.o. dose in wistar albino rats[24].

5.19. Myristica fragrans Houtt

Myristica fragrans Houtt. belongs to family Myristicaceae. Effect of 50% etanolic extract of dry kernel of *Myristica fragrans* Houtt.. at 100, 250 & 500 mg/kg p.o. for 7 days on male rat significantly increase MF, IF, IL, erections as well as aggregate of penile reflexes and caused significant reduction in ML & PEI[25].

5.20. Nymphaea stellata Willd

Nymphaea stellata Willd. belongs to family Nymphaeceae. The extract (150, 250 and 500 mg/kg) was administered orally once a day for 7 days. Mating behaviour test, orientational activities, test for libido and test for potency were assessed in male rats. Results and Discussion: There was an overall increase in sexual behaviour as evidenced by an increase in MF (Mounting frequency), IF (Intromission frequency), EL (Ejaculatory latency) and a decrease in ML (Mounting latency), IL (Intromission latency) and PEI (Post ejaculatory interval). Increase in orientational activities, weight of primary and accessory sex organs, libido and potency were also observed. These results were statistically significant. The study showed that the extract certainly has aphrodisiac activity particularly at the dose level 500 mg/kg[26].

5.21. Ocimum gratissimum

Ocimum gratissimum belongs to family Lamiaceae. Effect of etanolic extract of leaves of *Ocimum gratissimum* at 100, 250 & 500 mg/kg p.o. for 7 days on mice significantly increase MF, IF, IL, erections as well as aggregate of penile reflexes and caused significant reduction in ML & PEI. A dose of 500 mg/kg showed maximum effect without any conspicuous gastric ulceration and adverse effect[27].

5.22. Paederia foetida Linn.

Paederia foetida Linn. belongs to family Rubiaceae. Ethanolic extract of the leaves (50, 100 and 200 mg/kg body weight) was studied for their effect on body and secondary sexual organ weight, sexual behavior, spermatogenesis and serum testosterone level in male albino rats. Oral administration of the extract in albino rats showed pronounced anabolic and spermatogenic effects in animals in the treated groups. The extract significantly increased both mount and intromission frequency[28].

5.23. Passiflora incarnate Linn.

Passiflora incarnate Linn. belong to family Passifloraceae. Effect of methanolic extract of *Passiflora incarnate* Linn. on male mice exhibited significant aphrodisiac behavior at 75, 100 & 150 mg/kg, p.o. among these, the highest activity was observed with the 100 mg/kg p.o dose. When the mounting were calculated about 95 min after the administration of test extract[29].

5.24. Pedalium murex Linn.

Pedalium murex Linn. belongs to family Pedaliaceae. Fruits and roots of *Pedalium murex* Linn. were reported for its aphrodisiac activity. Ethanolic extract of *P. murex* fruits possesses aphrodisiac property. Petroleum ether extracts of *P. murex* roots possesses aphrodisiac property.

Petroleum ether extract of *Pedalium murex*, family Pedaliaceae. Doses of 200 and 400 mg/kg of PEPM showed a significant increase in mating and mounting behaviour. The effect on fertility factors such as total body weight, percentage of pregnancy, litter size were also significantly increased in comparison with the ethanol-treated group. Significant increases in sperm motility and count were observed in PEPM treated groups in a dose-dependent manner as compared with the ethanol-treated group. Similarly, reductions in the percentage of abnormal sperm were noted in animals treated with PEPM

400 mg/kg. The effects of PEPM on total protein, total cholesterol and testosterone were satisfactory, the levels being increased significantly for protein, cholesterol and testosterone by 400 mg/kg PEPM. Microtome sections of the testes of animals treated with 400 mg/kg PEPM exhibited restoration and recovery of germinal cells and the luminal spermatozoa and were comparable with the control group animals[1,30].

5.25. Piper guineense

Piper guineense belongs to family Piperaceae. Aqueous extract of dry fruits of *Piper guineense* two doses (122.5 & 245 mg/kg p.o. for 8 days and 122.5 mg/kg p.o. for 55 days) Significant increase in the level of testosterone in the serum & testes, Cholesterol in testes, α–glucosidase in the epididymis in the seminal vesicles after 8 days of treatment, while 55 day treatment the levels of cholesterol in the testes increases by 75%. Aqueous extract of *Piper guineense* at both doses had a positive effect on the male reproductive function[31].

5.26. Polygonatum verticillatum

Polygonatum verticillatum belongs to family Liliaceae. Aqueous extract of *Polygonatum verticillatum* leaf dose (500 mg/kg body weight/day) and L–dopa (100 mg/kg body weight/day) were administered orally by gavages for 28 days. Mount latency (ML), intromission latency (IL), ejaculation latency (EL), mounting frequency (MF), intromission frequency (IF), ejaculation frequency (EF) and post ejaculatory interval (PEI) were the parameters observed before and during the sexual behavior study at day 0, 7, 14, 21 and 28. Polygonatum verticillatum leaf aqueous extract reduced significantly ML, IL, EL and PEI. The extract also increased significantly MF, IF and EF[32].

5.27. Spilanthes acmella (L.) Murr.

Spilanthes acmella (L.) Murr. belongs to family Asteraceae. Ethanolic extracts of the *Spilanthes acmella* flower and its effects on general mating pattern, penile erection and serum hormone levels of normal male Wistar albino rats were investigated and compared with sildenafil citrate. The animals were evaluated on various parameters of sexual behavior, anabolic effects, testosterone level and *in–vitro* sperm counts. The aphrodisiac potential of an ethanolic *Spilanthes acmella* extract was demonstrated *in vitro* and *in vivo*[33].

5.28. Syzygium aromaticum (L) Merr. & Perry

Syzygium aromaticum (L) Merr. & Perry belongs to family Myrtaceae. *Syzygium aromaticum* (L) Merr. & Perry. (clove) in three doses (15, 30 & 60 mg/kg body weight p.o) in male mice significantly increase MF, IF, IL, erections as well as aggregate of penile reflexes. Hexane extract of *Syzygium aromaticum* (L) flower bud as an aphrodisiac[34].

5.29. Tinospora cordifolia

Tinospora cordifolia belongs to family Menispermaceae. In this study, the total extracts were tested for their constituents and tested for aphrodisiac activity in experimental rats. Hydroalcoholic extract of *Tinospora cordifolia* stem at higher concentration (400 mg/kg body weight) showed significant aphrodisiac activity on male wistar albino rats as evidenced by an increase in number of mounts and mating performance. On the other hand, hydroalcoholic extract at lower dose (200 mg/kg body weight) and aqueous extract (400 mg/kg body weight) showed moderate aphrodisiac property[35].

5.30. Tribulus terrestris Linn.

Tribulus terrestris Linn. is a flowering plant belongs to the family of Zygophyllaceae. It is commonly known as "Ghokhru". The lyophilized powder of the dried fruits of *Tribulus terrestris* was studied for sexual behavior effects of acute and subchronic administration in male albino rats, and comparison has been made with standard sexual stimulant drug, sildenafil citrate. The animals were evaluated on various parameters of sexual behavior, anabolic effects, testosterone level and *in–vitro* sperm counts. Oral administration of 100 mg/kg of test drug has proven anabolic effect as evidenced by body weight gain in the body and reproductive organs. Improvement in sexual behavior of male rats was characterized by increased amount and intromission frequency. Penile erection index (PEI) was also considerably enhanced without any noticeable toxicity, and the testosterone level and sperm count also significantly increased, and the results are comparable to that of standard drug, sildenafil citrate[36].

5.31. Trichopus zeylanicus Gaerton.

Trichopus zeylanicus Gaerton. belongs to family Trichopodaceae. Administration of ethanolic extract of *Trichopus zeylanicus* Gaerton. leaves to male mice increased the number of mounts & mating performance. The pups fathered by the extract treated mice were normal with regard to fetal growth, litter size and sex ratio. Although oral administration of a single dose (200 mg/kg p.o.) was effective, daily administration of the extract were for 6 days was more effective. The aqueous as well as *n*–hexane extracts of the leaves were found to be inactive[37].

5.32. Turnera aphrodisiaca Ward

Turnera aphrodisiaca Ward belongs to family Turneraceae. Chloroform extract exhibited significant activity at a dose of 200 mg/kg, p.o. while methanol extract showed aphrodisiac activity at a lower dose, i.e., 50 mg/kg, p.o.. Volatile oil of *T. aphrodisiaca* was found to be devoid of aphrodisiac activity. Qualitative phytochemical screening showed the presence of alkaloids in chloroform and methanol extracts. Therefore, the alkaloidal fraction was isolated from aerial parts of *T. aphrodisiaca*, and tested for aphrodisiac activity at dose levels of 25, 50, 75, or 100 mg/kg, p.o.[38].

5.33. Vanda tessellate (ROXB.) HOOK.EX DON

Vanda tessellate (ROXB.) belongs to family Orchidaceae. Alcholic extract of flowers of *V. tessellata* at doses of 50 and 200 mg/kg, p.o. were found to increase mating performance, and tend to increase the male/female ratio resulting offspring. The alcohol extract was devoid of any conspicuous general toxicity[39].

6. Indian medicinal plants having aphrodisiac potentials

Indian medicinal plants used to treat sexual dysfunction as well as ones that give sexual strength, stamina,

Table 1
Various Indian medicinal plants used to treat sexual dysfunction as well as ones that give sexual strength, stamina, increased libido, vitality and sexual energy.

No.	Plant name	Family	Part used	Extract	Type of studies	Reference
1	*Abelmoschus manihot* (L.)	Malvaceae	Seeds	Ethanolic extract	Animal studies (7 days)	[8]
2	*Anacyclus pyrethrum* DC.	Compositae	Roots	Petroleum ether extract	Animal studies (28 days)	[9]
3	*Argyreia nervosa*	Convolvu aceae	Root, flower	Alcoholic extract	Animal studies (6 days)	[10]
4	*Asparagus racemosus*	Liliaceae	Roots	Hydro-alcholic extract	Animal studies (8 days)	[11]
5	*Asteracanta longifolia*	Acanthaceae	Seeds	Ethanolic extract	Animal studies (28 days)	[12]
6	*Blepharis edulis* Linn.	Acanthaceae	Seeds	Ethanolic extract	Animal studies (7 days)	[13]
7	*Butea frondosa* Koen.ex Roxb.	Papilionaceae	Bark	Aqueous extract	Animal studies (28 days)	[5]
8	*Chenopodium album*	Chenopodiaceae	Seeds	Ethanolic extract	Animal studies (7 days)	[14]
9	*Chlorophytum borivilianum*	Liliaceae	Root	Aqueous extract	Animal studies (28 days)	[15]
10	*Crossandra infundibuliformis* Linn.	Acanthaceae	Leaves	Petroleum ether extact	Animal studies (30 days)	[16]
11	*Curculigo orchioides* Gaertn.	Amaryllidaceae	Rhizomes	Ethanolic extract	Animal studies (30 days)	[4,17]
12	*Dactylorhiza hatagirea* (D.Don) Soo	Orchidaceae	Roots	Aqueous extract	Animal studies (28 days)	[18]
13	*Durio zibenthinus* Linn.	Bombacaceae	Fruit	Petroleum ether extact	Animal studies (14 days)	[19]
14	*Glycyrrhiza glabra*	Leguminoaceae	Roots & Rhizomes	Aqueous extract	Animal studies (28 days	[20]
15	*Hybanthus enneaspermus* (L) F.Muell	Violaceae	Entire plant	Aqueous extract	Animal studies (28 days)	[21]
16	*Leptadenia reticulate* Linn.	Asclpiadaceae	Seed	Chloroform extract	Animal studies (14 days	[22]
17	*Mimosa pudica* Linn.	Mimosae	Roots	Ethanolic extract	Animal studies (7 days)	[23]
18	*Mucuna pruriens* Linn.	Papilionaceae	Seed	Ethanolic extract	Animal studies (45 days)	[24]
19	*Myrisita fragrans* Houtt.	Myristicaceae	Kernel	Ethanolic extract	Animal studies (7 days	[25]
20	*Nymphaea stellata*	Nymphaeceae	Leaves	Ethanolic extract	Animal studies (7 days)	[26]
21	*Ocimum gratissimum*	Lamiaceae	Leaves	Ethanolic extract	Animal studies (7 days	[27]
22	*Paederia foetida* Linn.	Rubiaceae	Leaves	ethanolic extract	Animal studies (28 days)	[28]
23	*Passiflora incarnate* Linn.	Passifloraceae	Leaves	Methanolic extract	Animal studies	[29]
24	*Pedalium murex* (L.)	Pedaliaceae	Fruits, Roots	Ethanolic extact, Petroleum ether extact	Animal studies (1 & 28 days)	[1,30]
25	*Piper guineense*	Piperaceae	Fruit	Aqueous extract	Animal studies (8 days)	[31]
26	*Polygonatum verticillatum*	Liliaceae	Leaf	Aqueous extract	Animal studies (28 days)	[32]
27	*Spilanthes acmella*	Asteraceae	Flower	Ethanolic extract	Animal studies (28 days	[33]
28	*Syzygium aromaticum*	Myrtaceae	Flower bud	Hexane extract	Animal studies (35 days)	[34]
29	*Tinospora cordifolia*	Menispermaceae	Stem	Hydro-alcholic extract	Animal studies (10 days)	[35]
30	*Tribulus terrestris* Linn.	Zygophyllaceae	Fruit	Lyophilized powder of dried fruits	Animal studies (1 day)	[36]
31	*Trichopus zeylanicus* Gaerton.	Trichopodaceae	Leaf	Ethanolic extract	Animal studies	[37]
32	*Turnera aphrodisiaca*	Turneraceae	Aerial parts	Chloroform extract	Animal studies	[38]
33	*Vanda tessellate* (ROXB.) HOOK.EX DON	Orchidaceae	Root, flower	Aqueous suspension	Animal studies	[39]

increased libido, vitality and sexual energy are represented in Table 1.

7. Other herbal plants with aphrodisiac potential

Other herbal plants with aphrodisiac activity are *Artocarpus heterophyllus* Linn., *Bombax ceiba* Linn., *Boesenbergia rotunda* L., *Amaranthus spinosus* L., *Bryonia laciniosa* Linn., *Bussea occidentalis*, *Carica papaya* L., *Cannabis indica* L., *Celastrus paniculatus* Willd., *Dalbergia sissoo* Roxb., *Daucus carota* L., *Emblica officinalis* Gaertn., *Eriodendron anfractuosum* DC., *Ficus arnottiana* Miq., *Flueggea virosa* Roxb., *Garcinia afzelii* Engl., *Gmelina arborea* Roxb., *Hibiscus rosa-sinesis*, *Hygrophila auriculata* Schum., *Ipomoea mauritiana* Jacq., *Jatropha curcas* L., *Linum usitatissimum* L., *Mallotus philippensis* Lam., *Mangifera indica* L., *Mezoneuron benthamianum*., *Morinda lucida*., *Orchis latifolia* Linn., *Papaver somniferum* L., *Punica granatum* L., *Rauvolfia vomitoria*., *Saccharum spontaneum* Linn., *Santalum album* Linn., *Scindapsus officinalis* Schtt., *Sida cordifolia* Linn., *Solanum nigrum* Linn., *Tamarindus indica* L., *Terminalia arjuna* Roxb., *Turrea heterophylla* Sm., *Valeriana jatamansi* Wall., *Wrightia tinctoria* (Roxb.), and *Zingiber officinale*[40].

8. Conclusion

In India, various types of traditional herbal medicines are used to improve the general well-being and, consequently, the male sexual satisfaction. These traditional herbal remedies are accepted among men and they provide them with an easy alternative to legitimize medical treatment for their sexual problem. In the males study, about 50% of the respondents claimed that the reasons for not using phosphodiesterase type 5 (PDE5) were it was risky and they were looking for natural therapies. Other important characteristics of the SD therapies that are sought by sufferers include safety, containing natural aphrodisiac agent.

The herbal drugs discussed in review have shown potent aphrodisiac activity. The synthetic formulation available in market, though they are showing excellent clinical and pharmacological activity in sexual dysfunction but they have significant adverse effect hence herbal drugs are preferred over synthetic drug to avoid serious side effects and adverse effects. One has to be extremely cautious about the use of traditional herbal medicines due to the fact that in India, quality control regulations are non-existent or they are too flexible. Further investigation on the plants can increase the isolation of the newer molecules which will be helpful for the treatment of Sexual dysfunction.

Conflict of interest statement

We declare that we have no conflict of interest.

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