

# Some Medicinal Plants with Anti-Fertility Potential: A Current Status

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## Abstract

The increase in population is becoming a comprehensive dilemma, causing much pressure on economic, social and natural assets. Oral contraceptive agents have improved the rate of infertility but their unusual side effects limit the use. Current anti-fertility therapy lacks satisfactory success due to this adverse effect; hence, patients are seeking complementary and alternative medicine for anti-fertility action. Ayurveda and other Indian literature mention the use of plants in various human ailments. India has about more than 45000 plant species and among them several thousand are claimed to possess medicinal properties. Researchers conducted in the last few decades on the plants mentioned in ancient literature or used traditionally for anti-fertility action. This review reveals that some plants and their part used having anti-fertility action, which are helpful for researcher to develop new herbal anti-fertility formulations. In the recent years, interest in drugs of plant origin has been progressively increased.

## Key words

Anti-fertility, Contraceptives, Review

## Abbreviation

AP:(All Parts); BR:(Bark); BU:(Bulb); EX:(Exudates); FJ:(Fruit Juice); FL (Flower); FB (Flower Buds); FR:(Fruit); FS:(Flower Stem); GU:(gum); HU:(Husk); IF:(Inflorescence); K:(Kernels); LA:(Latex); LF:(Leaf); P:(Petiol); PC:(Pericarp); PE:(Peduncle); PL:(Whole Plant); PT:(Petals); PX:(Plant Without Root); RB:(Root Bark); RE:(Resin), RH:(Rhizome); RT (Root); SB:(Stem Bark); SD:(Seed); SP:(Sapadix); ST:(Stem); TH:(Thallus); TU:(Tuber); WD (Wood); YS (Young Stem).

## Introduction

The population explosion is a leading cause of poverty and pollution in developing countries [1]. Exponentially growing population has been adversely affecting the social, economic and technological development of human race [2]. Therefore to reduce/control our number has to be the first on a priority list. A good number of synthetic contraceptives are available in market, each one with either a limited success or side effects [2]. It created a population control programme, which includes studies of traditional medical practices [1]. Since ancient times, plants have been a source of drugs, but scientific

medicines tend to ignore the importance of herbal medicine [3]. The World Health Organization suggested that effective, locally available plants can be used as substitutes for drugs [1].

Medicinal plants in India have been screened for contraceptive potential and anti-fertility effects, since the country has always been concerned about population explosion [1]. Exploration of drugs having anti-fertility activity is the need of current time, and many time plant extracts have been investigated for their anti-fertility effect in animals [4]. Since herbal drugs are easily available and with no side effects, the current study was undertaken [2].

## Some Medicinal Plants with Anti-Fertility Potential

Some medicinal plants have proven to possess a traditional as well as scientifically proven anti-fertility action. A brief report of plants has been tested for anti-fertility potential are documented.

### *Adiantum lunulatum* (Pteridaceae)

Effects of crude extract, both alcoholic and decoction of whole plant of *Adiantum lunulatum* Burm was observed on the reproductive structures of male albino rat after the oral administration of 100 mg/kg, 250 mg/kg;

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and 500 mg/kg b.w. for 30, 60, 90 days respectively. A dose and duration dependent effects on testis, epididymis, vas deferens and accessory reproductive organs of the rats were observed. The treatment resulted in deformation in the germ cells of testis Leydig's cell were atrophied. No spermatozoa could be seen in the seminiferous tubules and were filled either with edematous fluid or degenerated cellular debris [5].

#### *Balanites roxburghii* (Balanitaceae)

*Balanites Roxburghii* is a small evergreen thorny tree found in drier parts of India. Aqueous suspension of dried fruits of this plant is being used as abortifacient by local herbal healers. Petroleum ether, chloroform, ethanol, and distilled water extracts of the fruits of the plant *Balanites roxburghii* (Balanitaceae) were tested for antifertility activity in female albino rats at a dose of 300 and 600 mg/kg body weight orally. Among these, the ethanol extract was found to be most effective in causing significant abortifacient activity. The antifertility activity was found to be dose dependent and reversible on withdrawal of the treatment [6].

#### *Cannabis sativan* (Cannabinaceae)

According to folklore medicine, the plant *Cannabis sativa* (Cannabinaceae) possesses antifertility activity. Aqueous, alcoholic and chloroform extract of *Cannabis sativa* exhibited significant abortifacient activity (9% to 42%). The alcoholic extract at a dose of 400 mg/kg body weight was found to be most effective in causing strong abortifacient activity. The extract also showed estrogenic activity and prolonged the estrous cycle in experimental animal. The extract of *Cannabis sativa* caused a significant decrease in the ovarian and uterine weight, while a non-significant increase in the body weight. There was a slight decrease in the serum estrogen level and an increase in serum progesterone level, while the level of LH and FSH were found to be significantly reduced [1].

#### *Carica papaya* (Caricaceae) and *Capparis aphylla* (Capparidaceae)

Anti-fertility activity of herbal oral contraceptive suspension containing methanol extracts of plants *Carica papaya* leaves and *Capparis aphylla* aerial part, known to be potent contraceptive activity in folklore/ancient Indian literature. The method mainly involves the administration of different doses namely 200, 300 & 400 mg/kg of HOCS (herbal oral contraceptive suspension) to rats in group II, III & IV respectively, along with control dose. Finding of this study revealed a significant ( $p < 0.05$ ) reduction in the weights of reproductive organs like testis, epididymis and seminal vesicle in HOCS treated rats when compared with control. The sperm concentration in the epididymis and sperm motility decreased, whereas sperm abnormalities increased and also the duration of sperm motility reduced with respect to different doses of HOCS. Thus the results indicate disruption of the spermatogenic as well as androgenic properties [7].

#### *Cordia dichotoma* (Boraginaceae)

Hydroalcoholic extract of *Cordia dichotoma* G Forst. (*C. dichotoma*) leaves, used to produce sterility among the tribal women through its abortifacient activity. The extract was found to be safe up to dose of 2000 mg/kg body weight when administered orally. A good Anti-implantation (81.22%) activity in female rats was observed at the tested dose levels (200 and 400 mg/kg, orally). The extract further showed more significant ( $P < 0.01$ ) increase in uterine weight and significant change in biochemical parameters in immature rats. Simultaneous administration of extract along with ethinyl estradiol showed significant estrogenic activity [8].

#### *Curcuma longa* (Zingiberaceae) and *Andrographis paniculata* (Acanthaceae)

The antifertility effect of curcumin and andrographolide was evaluated by measuring their effect on implantation and estrus cycle of rats. The combination significantly reduced the number of implants and the size of the litters in rats compared to the normal control group. The combination also significantly altered the durations of each phase of estrus cycle and synergized the effect to decrease the number of ovarian follicles [9].

#### *Dactyloctenium aegyptium* (Poaceae)

Ethanol extract of *D. aegyptium* extract at a dose of 200, 400, and 600 mg/kg body weight were administered, respectively for a period of 30 days. A non-significant increase in the bodyweight and a significant decrease in weight of testes, accessory sex organs, and reduction in sperm count, increase motility and abnormality were observed. Some serum biochemical parameters showed significant variations and were as the serum hormonal levels are significantly decreased [10].

#### *Dodonea viscosa* (Sapindaceae)

*Dodonea viscosa* Linn (Sapindaceae) is an erect perennial shrub found throughout the hotter parts of India and Nepal. The methanolic extract of the leaves of this plant were investigated for their anti-fertility activity in female rats. The identification of the secondary metabolites showed that the leaves of the plant contained alkaloids, phytosterols and polyphenols. It was found that the extract reduced significantly ( $p < 0.01$ ) the number of litters and administered through oral route. It also produced ant fertility effect in a dose dependent manner and the contraceptive effect was manifested for a definite period of time [11].

#### *Enicostemma axillare* (Gentianaceae) and *Urena lobata* (Malvaceae)

Six groups of rats were treated with ethanolic (70% v/v) extracts of *E. axillare* (375 and 750 mg/kg body weight) and *U. lobata* root (300 and 600 mg/kg body weight) once daily for 55 days. The *E. axillare* and *U. lobata* tested doses did not decrease body weight, whereas the weight

of testes, epididymides and seminal vesicles were significantly ( $P < 0.01$ ) reduced. Significantly ( $P < 0.01$ ) more reduction in sperm motility viability and counts, epididymal and testicular protein contents were noted in the rats treated with the higher doses of plants. Both the plants at higher dose caused a marked increase ( $P < 0.01$ ) in sperm morphological abnormalities, testicular cholesterol and ascorbic acid contents were remarkably increased ( $P < 0.01$ ), while, the activities of testicular glucose-6-phosphate dehydrogenase (G-6-PDH) and  $\Delta 5$ - $\beta$ -hydroxy steroid dehydrogenase ( $\Delta 5$ - $\beta$ -HSD) were significantly reduce [12].

#### *Ficus racemosa* (Moraceae)

Swiss male mice were orally administered hydroalcoholic extract of *Ficus racemosa* bark (50 mg/kg for 30 d and 100 mg/kg body weight for next 30 d), and the effect of the treatment on body weight, reproductive organs weight, sperm, biochemical profile (sialic acid in epididymis and fructose in seminal vesicle), fertility and vaginal contraceptive efficacy was investigated. Extract reduced fertility to 70% within 60 d. Suppression of cauda epididymis sperm count, motility, viability and abnormal morphology was observed. Marked reduction was noted in the weight of reproductive organs and the level of sialic acid in epididymis and fructose in seminal vesicle. Vaginal application of bark extract exhibited 80% vaginal contraceptive efficacy. After cessation of plant extract treatment, the altered parameters recovered after 60 d [13].

#### *Jatropha gossypifolia* (Euphorbiaceae)

*Jatropha gossypifolia* leaf extract, when administered orally, altered the estrous cycle pattern in female mice, prolong the length of estrous cycle with significant increase in the duration of diestrus stage and reduced significantly the number of litters in albino mice. Treatment of mice with extract of 250 and 450 mg/kg body weight/day for 21 days caused a prolonged estrous cycle with significant increase in the duration of diestrus phase and elongation of estrus stage in treatment with higher dose (450 mg/kg body weight/day) [14].

#### *Madhuca latifolia* (Sapotaceae)

*Madhuca latifolia* (Roxb.) Macbride a tall tree commonly known as "Mahuwa" belong to family Sapotaceae. When the aqueous powdered drug (2 gm/body weight) was administered to male albino rats has proved to be an effective antifertility drug. The activity was confirmed by significant decrease in sperm count, biochemical assays so also through histopathological investigations. Hence seeds of *Madhuca latifolia* can be a reliable herbal option after the necessary clinical trials [3].

#### *Michelia champaca* (Magnoliaceae)

*Michelia champaca* L. (family: Magnoliaceae), commonly known as Champa [Hindi], is traditionally used for fertility regulation by the women of Chhattisgarh

state in India. The antifertility activity of the extract administered at dose levels (100 and 200 mg/kg body weight,  $p_o$ ) was evaluated in two experimental animal models i.e. anti-implantation activity in female wistar rats and estrogenic/antiestrogenic activity in ovariectomized female rats. The extract showed significant ( $p_o 0.01$ ) 49.95% and 71.03% anti-implantation activities at 100 and 200 mg/kg doses respectively. The extract also exhibited significant ( $p_o 0.01$ ) estrogenic activity as evidenced by increase in body weight, uterine weight, increased thickness and height of endometrium, vaginal cornification and significant ( $p_o 0.01$ ) increase in estrogen, cholesterol, alkaline phosphate and triglycerides levels at higher dose when administered alone as well as along with ethinyl estradiol [15].

#### *Nelumbo nucifera* (Nymphaeaceae)

*Nelumbo nucifera* has been used as antifertility agent in females by the local tribals of Rajasthan especially of Udaipur district India. Ethanolic extract at dose of 800 mg/kg b.wt. for investigating the nature of the drug and antifertility effect Data revealed that oral administration of *Nelumbo nucifera* extract brought about a significant decline in the weight of Ovary; Control ( $43 \pm 4.75$ mg), Nelumbo extract treated ( $25 \pm 3.86$ mg), Uterus; Control ( $236 \pm 0.004$ mg), Nelumbo extract treated ( $214 \pm 0.007$ mg) and Vagina; Control ( $221 \pm 0.002$ mg), Nelumbo extract treated ( $178 \pm 0.003$ mg) as well as protein and glycogen level, however cholesterol level increased significantly. In addition, the diestrous phase of the estrous cycle was found to be prolonged; Control ( $1.81 \pm 0.21$ ) days, Nelumbo extract treated ( $3.62 \pm 0.42$ ) days [16,40-65].

#### *Piper nigrum* (Piperaceae)

*Piper nigrum* is commonly known as black pepper. Effect of oral administration (25 and 100mg/kg body wt/day for 20 and 90 days) of fruit powder of *Piper nigrum* on the male reproductive organs of mice was investigated. Treated groups show degenerative changes in the seminiferous tubules. Percentage of affected tubules in testes of piper treated mice was dose and duration related. Further, *Piper nigrum* treatment for 20 days did not cause appreciable alterations in the histological appearance of the epididymis, while the treatment for 90 days caused detectable alterations in the duct [17,65-74].

#### *Ruta graveolens* (Rutaceae)

Different preparations of *Ruta graveolens* were administered orally to female rats (Days 1–10 post coition) and female hamsters (Days 1-6 post coition). The powdered root (CDR), aerial parts (CDA) and the aerial parts aqueous extract (AEA) all showed potential anticonceptive activity in rats. Limited administration on selected days of CDA showed uniformly lesser activity than with 10-day treatment. Sequentially prepared petroleum ether and methanol extracts of CDA were as

active as CDA itself. The benzene and chloroform extracts were toxic and inactive. Rutin, a known chemical constituent of the plant, was found to be inactive. None of the above preparations showed activity in hamster [18].

#### *Striga orobanchoides* (Scrophulariaceae)

The two flavones, apigenin and luteolin, isolated from *Striga orobanchoides*, were investigated for endocrine and contraceptive properties. Graded doses of these compounds (5-25 mg/kg body weight/day) when administered from day 1 to day 4 of pregnancy showed dose-dependent and significant anti-implantation activity. The mean effective Dose 100% (MED(100)) for both compounds was found to be 25 mg/kg body weight. Oral administration of these compounds caused a significant increase in uterine weight in immature ovariectomised rats. It also caused a significant increase in uterine diameter, thickness of the endometrium and its epithelial cell height when compared with those of control rats [19].

#### *Terminalia chebula* (Combretaceae)

Aqueous-ethanolic (1:1) extract of fruit of *T. chebula* was administered orally at a dose of 60 mg/0.5 mL distilled water/day for 28 days. The treated group showed a significant diminution in spermatogenic profile. On the other hand testicular cholesterol showed a significant

elevation in *T. chebula* treated group and plasma testosterone was decreased significantly in comparison to control. The above said androgenic key enzymes were exerted a significant diminution in extract treated group. Anti-oxidative enzymes such as catalase and superoxide dismutase showed a significant reduction and a significant elevation in conjugated diene and Thiobarbituric acid reactive substance was noted in treated group. GOT and GPT study of liver and kidney showed a non-significant change which confirmed the non-toxic nature of *T. chebula*. Histological study of testis of treated group exhibited significant reduction in seminiferous tubular diameter [20]. (Table 1).

#### *Trachyspermum ammi* (Umbelliferae)

*Trachyspermum ammi* (Linn) Sprague, well known member of the *Umbelliferae* family was found to be throughout India. Ethanolic extract of *Trachyspermum ammi* at four different doses such as 100mg/kg, 200mg/kg and 400mg/kg for a period of 60 days with the recovery group animals for 120 days at the dose of 400mg/kg. Parameters such as testes weight, sperm count, sperm motility, sperm morphology and histopathological examination of the testis are carried out. The study revealed that the drug possess significant male anti-fertility effect dose dependently [21-30].

S. no.	Plant name	Family	Common name	Part used	References
1.	<i>Abroma angusta</i> Linn.	Sterculaceae	Ulat kambal	RT	[22]
2.	<i>Abrus precatorius</i> Linn.	Fabaceae	Ghungchi	RT, SD	[22]
3.	<i>Acacia leucophloea</i> (Roxb.) Willd.	Fabaceae	Renjhua, Safed	BR, LF, GU	[23]
4.	<i>Achyranthes aspera</i> Linn.	Amaranthaceae	kikar	LF	[24]
5.	<i>Achyranthes bidentata</i> Blume.	Amaranthaceae	-	LF, RT	[25]
6.	<i>Aconitum heterophyllum</i> Wall.	Ranunculaceae	Atis	RT	[26]
7.	<i>Acorus calamus</i> Linn.	Araceae	Bach	RT	[27]
8.	<i>Adhatoda vasica</i> Nees	Acanthaceae	Adhusa	PL	[22]
9.	<i>Adiantum lunulatum</i>	Pteridaceae	-	AP	[5]
10.	<i>Aerva lantana</i> (L.) Juss. ex. Shult	Amaranthaceae	Chaya	RT	[28]
11.	<i>Agave americana</i> Linn.	Agavaceae	Rambans	RT Sap	[22]
12.	<i>Ailanthus excelsa</i> Roxb.	Simaroubaceae	Ghar Karnana	SB	[29]
13.	<i>Alangium salvifolium</i> (L. f.) Wang.	Alangiaceae	Aankol	RT	[30]
14.	<i>Allium cepa</i> Linn.	Liliaceae	Pyaj	BU	[22]
15.	<i>Allium sativum</i> Linn.	Liliaceae	Lahsun	SD, BU	[22]
16.	<i>Aloe barbadensis</i> Mill.	Liliaceae	Ghikwar	LF	[22]
17.	<i>Alternanthera philoxeroides</i> Griseb.	Amaranthaceae	Jaisachi-ara	PL	[28]
18.	<i>Alysicarpus vaginalis</i>	Fabaceae	Davai	RT	[23]
19.	<i>Amaranthus spinosus</i> Linn.	Amaranthaceae	Katailichaula	-	[29]

20.	<i>Ananas comosus</i> Merr.Syn. A. <i>sativus</i>	<i>Bromeliaceae</i>	Anannas	FR	[31]
21.	<i>Anastatica hierochuntica</i> Linn.	<i>Brassicaceae</i>	Garvaphul	–	[22]
22.	<i>Andrographis paniculata</i>	<i>Acanthaceae</i>	-	-	[9]
23.	<i>Aneilema conspicuum</i> Kunth.	<i>Commelinaceae</i>	–	RT	[32]
24.	<i>Anethum sowa</i> Kurz.	<i>Apiaceae</i>	Soya	FR	[26]
25.	<i>Annona reticulata</i> Linn.	<i>Annonaceae</i>	Ramphal	SD	[28]
26.	<i>Annona squamosa</i> Linn.	<i>Annonaceae</i>	Sharifa, Sitaphalam	SD,RT	[31]
27.	<i>Anthemis nobilis</i> Linn.	<i>Asteraceae</i>	Babuni-ka-phul	Oil	[33]
28.	<i>Anthocephalus cadamba</i> Miq.	<i>Rubiaceae</i>	Kadamba	RT, FL	[32]
29.	<i>Anthriscus nemerosa</i> (M. Bieb.) Spreng.	<i>Apiaceae</i>	Cow parsley	PL	[34]
30.	<i>Antidesma ghaesaembilla</i> Gaertn.	<i>Euphorbiaceae</i>	Square leaf China laurel	WD	[34]
31.	<i>Apium graveolens</i> Linn.	<i>Apiaceae</i>	Ajmud	SD	[22]
32.	<i>Areca catechu</i> Linn.	<i>Arecaceae</i>	Supari	FR	[35]
33.	<i>Argyrea speciosa</i> Sweet.	<i>Convolvulaceae</i>	Takoria alu	TU	[36]
34.	<i>Arisaema leschenaultia</i>	<i>Araceae</i>	-	TU, SP	[25]
35.	<i>Aristolochia bracteata</i> Retz.	<i>Aristolochiaceae</i>	Kirama	RT	[22]
36.	<i>Artemisia siversiana</i> Willd.	<i>Asteraceae</i>	Charmara	LF	[37]
37.	<i>Artemisia vulgaris</i> Linn.	<i>Asteraceae</i>	Nagadouna	LF, RT	[38]
38.	<i>Aristolochia indica</i> Linn.	<i>Aristolochiaceae</i>	Isharmul	RT	[22]
39.	<i>Asplenium adiantum-nigrum</i> Linn.	<i>Polypodiaceae</i>	Black Spleen.	PL	[33]
40.	<i>Avicennia marina</i> Forssk. Vierch.	<i>Avicenniaceae</i>	Pyara ban	LF	[28]
41.	<i>Azadirachta indica</i> A. Juss.	<i>Meliaceae</i>	Neem	GU	[22]
42.	<i>Balanites roxburghii</i>	<i>Zygophyllaceae</i>	Desert date	FR	[6]
43.	<i>Bambusa arundinacea</i> (Retz.) Willd.	<i>Poaceae</i>	Bans	RT, LF	[26]
44.	<i>Barleria crista</i> Linn.	<i>Acanthaceae</i>	Jhinti	RT	[28]
45.	<i>Basella alba</i> Linn.	<i>Basellaceae</i>	Lalbachlu, Poya	RT	[26]
46.	<i>Bauhinia racemosa</i> Lam.	<i>Fabaceae</i>	Apta	SB	[39]
47.	<i>Bauhinia retusa</i> Ham.	<i>Fabaceae</i>	Semla	RE	[22]
48.	<i>Berberis aristata</i> DC.	<i>Berberidaceae</i>	Dar-hald	EX	[22]
49.	<i>Beta vulgaris</i> Linn.	<i>Chenopodiaceae</i>	Chukandar	LF,RT,SD	[22]
50.	<i>Betula bhojpatra</i> Wall.	<i>Betulaceae</i>	Bhojpatra	SB	[26]
51.	<i>Blumea balsamifera</i> L. DC.	<i>Asteraceae</i>	Kakaronda	LF	[22]
52.	<i>Bombax ceiba</i> L.	<i>Bombacaceae</i>	Buruga	SD	[31]
53.	<i>Borassus flabellifer</i> Linn.	<i>Arecaceae</i>	Tad	RT	[30]
54.	<i>Boswellia glabra</i> Roxb.	<i>Burseraceae</i>	Lobhan	RE	[22]
55.	<i>Brassica indica</i>	<i>Brassicaceae</i>	Kadugu	SD	[40]
56.	<i>Brassica juncea</i> Coss	<i>Brassicaceae</i>	Rai	Oil	[22]



57.	<i>Brassica nigra</i> Linn. & Koch.	Brassicaceae	Banarsi rai	SD	[26]
58.	<i>Bridelia retusa</i> (L.) Spreng.	Euphorbiaceae	Lankpana	BR	[30]
59.	<i>Buddleja asiatica</i> Lour.	Buddlejaceae	Bana	RT	[26]
60.	<i>Butea monosperma</i> (Lam.) Kuntze	Fabaceae	Palas	FL,LF, SD	[33]
61.	<i>Caesalpinia bonducella</i> Linn	Fabaceae	Kat-karanj	SD	[22]
62.	<i>Caesalpinia pulchrrima</i> (Linn.) Swartz.	Fabaceae	Krishna chura	LF	[41]
63.	<i>Caesalpinia sappan</i> Linn.	Fabaceae	Patang	WD, LF	[22]
64.	<i>Calendula officinalis</i> Linn.	Asteraceae	Calandula	FL	[22]
65.	<i>Callicarpa macrophylla</i> Vahl.	Verbenaceae	Daya	-	[32]
66.	<i>Calotropis gigantea</i> (Linn.) R. Br.	Asclepiadaceae	AK	RB	[22]
67.	<i>Calotropis procera</i> (Ait.) R. Br.	Asclepiadaceae	Akada madar	LA, PL, RT	[42]
68.	<i>Cananga odorata</i>	Annonaceae	Ylang	FR	[43]
69.	<i>Cannabis sativa</i> Linn.	Moraceae	Bhang	-	[1]
70.	<i>Capparis aphylla</i>	Capparidaceae	Wild caper	AP	[7]
71.	<i>Cardiospermum helicacabum</i>	Spindaceae	Kanphuti	PL	[2]
72.	<i>Careya arborea</i> Roxb.	Lecythidaceae	Pizh	FB	[40]
73.	<i>Carica papaya</i> Linn.	Caricaceae	Papaya	LF	[7]
74.	<i>Carum carvi</i> Linn.	Apiaceae	Shia Jira	FR	[26]
75.	<i>Cascabela thevetia</i> (Linn.) Lippold	Apocynaceae	Pacha Ganneru	SD	[31]
76.	<i>Cassia fistula</i> Linn.	Fabaceae	Rela	FR	[31]
77.	<i>Cassia lanceolata</i> Linn. & Forsk	Fabaceae	Sana	LF	[22]
78.	<i>Cassia occidentalis</i> Linn.	Fabaceae	Kasondi	RT	[44]
79.	<i>Cedrela toona</i> Roxb.	Meliaceae	Tun	FL	[22]
80.	<i>Celastrus paniculata</i> Willd.	Celastraceae	Malkangni	SD	[22]
81.	<i>Celosia argentea</i> Linn.	Amaranthaceae	Kurdu	RT	[39]
82.	<i>Cenchrus biflorus</i> Roxb.	Poaceae	Kutta ghash	ST, SD	[45]
83.	<i>Cerbera manghas</i> Linn.	Apocynaceae	Dabur	FR	[32]
84.	<i>Cerbera odollam</i> Gaertn.	Apocynaceae	Dhakur	SD, LF	[33]
85.	<i>Cicer arietinum</i> Linn.	Fabaceae	Chana	-	[22]
86.	<i>Cichorium intybus</i> Linn.	Asteraceae	Kasini	SD	[22]
87.	<i>Cinchona calisaya</i> Wedd.	Rubiaceae	Cinchona	BR	[22]
88.	<i>Cinnamomum camphora</i> Nees & Eberm.	Lauraceae	Kapoor	-	[22]
89.	<i>Cinnamomum cassia</i> Blume	Lauraceae	Tej	-	[22]
90.	<i>Cissampelos pareira</i> Linn.	Menispermaceae	Akanadi	RT	[26]
91.	<i>Citrullus colocynthis</i> Schrad.	Cucurbitaceae	Indrayan	RT	[22]
92.	<i>Citrus medica</i> Linn.	Rutaceae	Bara-Nimbu	FR	[26]
93.	<i>Clerodendrum phlomidis</i> Linn. f.	Verbenaceae	Arni	RT	[46]

94.	<i>Colebrookia oppositifolia</i>	Lamiaceae	Indian squirrel	LF	[47]
95.	<i>Commiphora mukul</i>	Burseraceae	Guggul	RE	[22]
96.	<i>Cordia dichotoma</i> Forst.	Boraginaceae	Lasora	LF	[8]
97.	<i>Cordia gharaf</i> Roxb.	Boraginaceae	Gundi	LF	[23]
98.	<i>Cordia rothii</i> Roem. & Schult	Boraginaceae	-	RT	[48]
99.	<i>Costus speciosus</i> Koeing	Zingiberaceae	Chengalva Kostu	RH	[31]
100.	<i>Crataeva nurvala</i> Buch.Ham.	Capparidaceae	Barun	SB	[49]
101.	<i>Crocus sativus</i> Linn.	Iridaceae	Kesar	FL	[22]
102.	<i>Crotalaria juncea</i> Linn.	Fabaceae	Sandi	LF	[22]
103.	<i>Croton roxburghii</i>	Euphorbiaceae	Bhutala	BR	[50]
104.	<i>Cuminum cyminum</i> Linn.	Apiaceae	Jira	FR	[22]
105.	<i>Curcuma longa</i> Linn.	Zingiberaceae	Haldi	RH	[9]
106.	<i>Curcuma zedoaria</i> Rosc.	Zingiberaceae	Kachura	RH	[22]
107.	<i>Cuscuta reflexa</i> Roxb.	Convolvulaceae	Amar bel	-	[22]
108.	<i>Cynodon dactylon</i> Pers.	Poaceae	Durva	PL	[39]
109.	<i>Cyperus rotundus</i> Linn.	Cyperaceae	Motha	TU	[22]
110.	<i>Dactyloctenium aegyptium</i>	Poaceae	-	PL	[10]
111.	<i>Datura metel</i> Linn.	Solanaceae	Sadahdhatura	LF, FR, RT	[40]
112.	<i>Daucus carota</i> Linn.	Apiaceae	Gajar	SD	[22]
113.	<i>Dendrophthoe falcata</i> (Linn. f.) Ettingshausen	Loranthaceae	Baramanda	ST	[28]
114.	<i>Dendrocalamus strictus</i> (Roxb.)	Poaceae	Sadana	LF	[31]
115.	<i>Derris brevipes</i> Baker.	Fabaceae	-	RT	[44]
116.	<i>Desmodium retroflexum</i> DC.	Fabaceae	-	RT	[33]
117.	<i>Dioscorea pentaphylla</i> Linn.	Dioscoreaceae	Lalvala vahrikand	TU	[35]
118.	<i>Diospyros cordifolia</i> Roxb.	Ebenaceae	Karatendu	FR,RT	[35]
119.	<i>Dodonea viscosa</i>	Sapindaceae	-	LF	[11]
120.	<i>Dolichandrone falcata</i> Seem.	Bignoniaceae	Hawar	-	[22]
121.	<i>Drosera burmannii</i> Vahl.	Droseraceae	Kavara mogga	PL	[31]
122.	<i>Dryopteris felix-mas</i> (Linn.) Schott	Polypodiaceae	Male fern	RT,SD	[33]
123.	<i>Echinochloa frumentacea</i> Linn.	Poaceae	Sanwa	SD	[32]
124.	<i>Echinops echinatus</i> Roxb.	Asteraceae	Utanti	PL	[51]
125.	<i>Embelia ribes</i> Burm. f.	Myrsinaceae	Baberang	RT	[22]
126.	<i>Enicostemma axillare</i>	Gentianaceae	-	LF	[12]
127.	<i>Erythrina indica</i> Lam.	Fabaceae	Dadap	LF, RT	[33]
128.	<i>Erythrina variegata</i> Linn. Var.	Fabaceae	-	E	[32]
129.	<i>Erythroxylum coca</i> Lam.	Erythroxylaceae	Koko	LF	[22]
130.	<i>Eupatoriun odoratum</i> Linn.	Asteraceae	-	PL	[33]
131.	<i>Euphorbia nerifolia</i> Linn.	Euphorbiaceae	Shehund	RT	[26]

132.	<i>Euphorbia resinifera</i> Berg.	Euphorbiaceae	-	-	[22]
133.	<i>Euphorbia tirucalli</i> Linn.	Euphorbiaceae	Konpal	PL	[52]
134.	<i>Excoecaria agallocha</i> Linn.	Euphorbiaceae	Gangawa	PL	[22]
135.	<i>Ferula assa-foetida</i> Linn.	Apiaceae	Heeng	RE	[22]
136.	<i>Ficus racemose</i>	Moraceae	-	BR	[13]
137.	<i>Foeniculum vulgare</i> Mill.	Apiaceae	Saunf	SD	[32]
138.	<i>Garcinia morella</i> Desr.	Clusiaceae	Tamel	RE	[22]
139.	<i>Gloriosa superba</i> Linn.	Liliaceae	Kaliari	TU	[22]
140.	<i>Glossocardia bosvallia</i> DC.	Asteraceae	Seri	PL	[33]
141.	<i>Glycyrrhiza glabra</i> Linn.	Fabaceae	Mulethi	RT	[22]
142.	<i>Gossypium herbaceum</i> Linn.	Malvaceae	Kapas	RT	[22]
143.	<i>Gossypium indicum</i> Lam.	Malvaceae	Kapas	SD	[22]
144.	<i>Grewia columnaris</i> Sm.	Tiliaceae	Gangchi	RT	[30]
145.	<i>Hagenia abyssinica</i> .	Rosaceae	Cusso	-	[22]
146.	<i>Hibiscus manihot</i> Linn.	Malvaceae	-	BR	[33]
147.	<i>Hibiscus rosa-sinensis</i> Linn.	Malvaceae	Gudhal	PT	[22]
148.	<i>Hydrocotyle asiatica</i> Linn.	Apiaceae	Brahmi	PL	[33]
149.	<i>Hyptis suaveolens</i> Poit.	Labiatae	Bilati Tulsi	LF	[53]
150.	<i>Indigofera linnaei</i> Ali	Fabaceae	Tejomala	RT	[30]
151.	<i>Jasminum multiflorum</i> (Burm. f.) Andrews	Oleaceae	Kundphu	-	[32]
152.	<i>Jatropha curcus</i>	Euphorbiaceae	Jangli-arandi	FR	[54]
153.	<i>Jatropha gossypifolia</i>	Euphorbiaceae		LF	[14]
154.	<i>Juniperus communis</i> Linn.	Cupressaceae	Aaraar	PX, ST, FR	[22]
155.	<i>Justicia simplex</i> D. Don.	Acanthaceae	-	RT	[44]
156.	<i>Lagenaria siceraria</i> Standl.	Cucurbitaceae	Kashiphal	FR, SD	[26]
157.	<i>Laurus nobilis</i> Linn.	Lauraceae	Hab-el Ghar	LF	[22]
158.	<i>Lawsonia inermis</i> Linn.	Lythraceae	Hina	LF	[22]
159.	<i>Lepidium sativum</i> Linn.	Brassicaceae	-	SD	[22]
160.	<i>Lobelia nicotianifolia</i> Heyne	Campanulaceae	Nala	PL	[53]
161.	<i>Luffa acutangula</i> (Linn.) Roxb.	Cucurbitaceae	Karvitori	RB	[33]
162.	<i>Luffa echinata</i> Roxb.	Cucurbitaceae	Ghagarabela	-	[22]
163.	<i>Lycopodium clavatum</i> Linn	Lycopodiaceae	Bendarli	PL	[33]
164.	<i>Madhuca latifolia</i>	Sapotaceae	Mahuwa		[3]
165.	<i>Mallotus philippinensis</i> Muell. Arg.	Euphorbiaceae	Kamila	FR	[26]
166.	<i>Marsdenia tenacissima</i> (Wright & Arn.)	Asclepiadaceae	-	RT	[26]
167.	<i>Martynia annua</i>	Pedaliaceae	Devils claws	RT	[55]
168.	<i>Melia azadirachta</i> Linn.	Malvaceae	Bakain	FL, LF, RE	[33]



169.	<i>Memecylon amplexicaule</i> Roxb	Melastomataceae	Perungacha	-	[32]
170.	<i>Mentha arvensis</i> Linn.	Labiatae	Pudina	LF	[33]
171.	<i>Mesua ferrea</i> Linn.	Clusiaceae	Nagkesar	LF	[33]
172.	<i>Meyna spinosa</i> Roxb.ex. Link	Rubiaceae	Meyna	FR, SD	[28]
173.	<i>Michelia champaca</i> Linn.	Magnoliaceae	Champa	LF	[15]
174.	<i>Mitragyna parvifolia</i> (Roxb.) Korth.	Rubiaceae	Kadam	BR	[56]
175.	<i>Mollugo cerviana</i> Ser.	Ficoideae	-	FL	[53]
176.	<i>Mollugo pentaphylla</i> Linn.	Ficoideae	Jalpapa	PL	[53]
177.	<i>Momordica charantia</i> Linn.	Cucurbitaceae	Karela	RT	[22]
178.	<i>Morinda citrifolia</i> Linn.	Rubiaceae	Ach	LF, FR	[22]
179.	<i>Momordica tuberosa</i> Cogn.	Cucurbitaceae	Kadavanchi	RT	[32]
180.	<i>Moringa concanensis</i> Nimmo ex Dalz. And Gibs.	Moringaceae	Ranshevga	SB	[57]
181.	<i>Moringa oleifera</i> Lam..	Moringaceae	Sehjan	SB	[22]
182.	<i>Musa sapientum</i> L.	Musaceae	Banana	ST, FL	[58]
183.	<i>Myristica fragrans</i> Houtt	Myristicaceae	Jaiphal	SD	[59]
184.	<i>Nardostachys gradiflora</i> DC.	Valerianaceae	Masi	ST	[60]
185.	<i>Nardostachys jatamansi</i> DC.	Valerianaceae	Jatamanasi	RT	[22]
186.	<i>Nelumbo nucifera</i>	Nymphaeaceae	Lotus	SD	[16]
187.	<i>Nerium indicum</i> Mill.	Apocynaceae	Kaner	PL	[29]
188.	<i>Nerium odorum</i> Soland.	Apocynaceae	Lal-kaner	PL	[33]
189.	<i>Nigella sativa</i> Linn.	Ranunculaceae	Kalaunji	SD	[33]
190.	<i>Ocimum sanctum</i> Linn	Labiatae	Tulsi	LF	[61]
191.	<i>Origanum vulgare</i> Linn.	Labiatae	Sathra, Baslughas	-	[62]
192.	<i>Pandanus odoratissimus</i> L.f.	Pandanaceae	Kevera	RT, IF	[56]
193.	<i>Pandanus tectorius</i> Soland.	Pandanaceae	Keora	-	[32]
194.	<i>Pedilanthus tithymaloides</i> (L.) Poit.	Euphorbiaceae	-	ST	[35]
195.	<i>Peganum harmala</i> Linn.	Zygophyllaceae	Gandhya/Harmal	PL	[57]
196.	<i>Picrorhiza kurrooa</i> Benth.	Scrophulariaceae	Kutki	RH	[22]
197.	<i>Piper betel</i>	Pedaliaceae	Betel pepper	P	[58]
198.	<i>Piper longum</i> Linn.	Piperaceae	Pippal	FR	[22]
199.	<i>Piper nigrum</i>		Black pepper		[17]
200.	<i>Pisum sativum</i> Linn.	Fabaceae	Mattar	SD	[32]
201.	<i>Plumbago indica</i> Linn.	Plumbaginaceae	Lal-chitrak	RT	[32]
202.	<i>Plumbago zeylanica</i> Linn.	Plumbaginaceae	Chitrak	RT	[33]
203.	<i>Plumeria acuminata</i> Ait.	Apocynaceae	Gobarchampa	RT	[22]
204.	<i>Polygonum hydropiper</i>	Polygonaceae	Knot weed	RT	[59]
205.	<i>Prangos pabularia</i> Lindl.	Apiaceae	Komal	RT	[22]
206.	<i>Prosopis cinearia</i> (Linn.) Druce	Fabaceae	Sangri, Khejda	BR, FL RT, FR	[23]

207.	<i>Prunus armeniaca</i>	Rosaceae	Apricot	K	[54]
208.	<i>Punica granatum</i> Linn.	Punicaceae	Anar	PC	[22]
209.	<i>Pyrethrum indicum</i> DC.	Asteraceae	Guldaudi	RT	[22]
210.	<i>Pyrethrum umbelliferum</i> Boiss.	Asteraceae	Mithaakarkara	RT	[22]
211.	<i>Randia dumetorum</i> Lamk.	Rubiaceae	Mainphal	SD	[33]
212.	<i>Randia spinosa</i> (Poir.)	Rubiaceae	-	FR	[26]
213.	<i>Ranunculus sceleratus</i> Linn.	Ranunculaceae	Jaldhania	PL	[22]
214.	<i>Raphanus sativus</i> Linn.	Brassicaceae	Muli	SD	[22]
215.	<i>Rauwolfia serpentina</i> Benth.	Apocynaceae	Chotachand	RT	[22]
216.	<i>Rhynchosia minima</i> DC.	Fabaceae	Nelaalumu	LF	[22]
217.	<i>Rivea hypocrateriformis</i> Choisy.	Convolvulaceae	-	PX	[63]
218.	<i>Rubia cordifolia</i> Linn.	Rubiaceae	Majitha	RT	[22]
219.	<i>Rubus moluccanus</i> Linn	Rosaceae	Katsol	LF	[22]
220.	<i>Ruta angustifolia</i> Linn.	Rutaceae	Sadab	LF	[22]
221.	<i>Ruta graveolens</i> Linn.	Rutaceae	Salab	RT,AP	[18]
222.	<i>Saccharum bengalense</i> Retz.	Poaceae	Munj	LF	[30]
223.	<i>Salvia plebeia</i> R. Br.	Labiatae	Sej	SD	[22]
224.	<i>Santalum album</i> Linn.	Santalaceae	Chandan	PL	[22]
225.	<i>Sapindus trifoliatus</i> Auct.	Sapindaceae	Ritha	SD	[22]
226.	<i>Scilla indica</i> (Baker)	Liliaceae	Jangli Pyaz	BU	[64]
227.	<i>Semecarpus anacardium</i> Linn.	Anacardiaceae	Bhilawa	RT	[22]
228.	<i>Sesamum indicum</i> DC.	Pedaliaceae	Til	SD	[22]
229.	<i>Sesbania aegyptiaca</i> Pers.	Fabaceae	Jayant	LF, SD	[22]
230.	<i>Sesbania sesban</i>	Fabaceae	Common sesban	SD	[65]
231.	<i>Stephania japonica</i> (Thumb.) Miers.	Menispermaceae	Annad-ne- muka	RT	[28]
232.	<i>Striga orobanchiodes</i>	Scrophulariaceae	Witches weed	PL	[19]
233.	<i>Semecarpus stellata</i> Linn.	Anacardiaceae	-	RT	[66]
234.	<i>Smithia conferta</i> J.E. Sm.	Fabaceae	Bhaji	LF	[39]
235.	<i>Solanum virginianum</i> Linn.	Solanaceae	Rigni	RT	[67]
236.	<i>Soymida febrifuga</i> A. Juss	Meliaceae	Rohan	SB	[68]
237.	<i>Stachytarpheta jamaicensis</i> Vahl Enum.	Verbenaceae	Kata punuttu	-	[32]
238.	<i>Stephania japonica</i> (Thumb.) Miers.	Menispermaceae	Annad-ne- muka	RT	[28]
239.	<i>Strychnos potatorum</i>	loganiaceae	Nirmali	SD	[69]
240.	<i>Tabernaemontana heyneana</i> Wall.	Apocynaceae	Kundalam	LA	[70]
241.	<i>Taxus baccata</i> Linn.	Taxaceae	Kash	FR	[22]
242.	<i>Tephrosia purpurea</i> Linn. Pers.	Fabaceae	Unhali	LF	
243.	<i>Terminalia chebula</i>	Combretaceae	-	FR	[20]

244.	<i>Thevetia peruviana</i> (Pers.) K. Schum.	Apocynaceae	Kalke	SD	
245.	<i>Thysanolaena</i> (Roxb.) O. Kuntze	Poaceae	Kutcho	FL	[71]
246.	<i>Trachylobium hornemannianum</i> Heyne.	Fabaceae	Sandarus	RE	[33]
247.	<i>Trachyspermum ammi</i>	Umbelliferae			[21]
248.	<i>Trachyspermum roxburghianum</i> (DC.) Sprague	Apiaceae	Ajmud	-	[32]
249.	<i>Trianthema pentandra</i> Linn.	Aizoaceae	Itsit	PL	[22]
250.	<i>Trianthema portulacastrum</i> Linn.	Aizoaceae	Lalsabuni	RT	[22]
251.	<i>Trichosanthes bracteata</i> (Lam.) Voigt	Cucurbitaceae	Kaki-kado	SD	[30]
252.	<i>Trichosanthes cucumerina</i> Linn.	Cucurbitaceae	Jangli chichonda	-	[32]
253.	<i>Trifolium subterraneum</i> Linn.	Fabaceae	-	-	[32]
254.	<i>Trichosanthes tricuspidata</i> Lour.	Cucurbitaceae	Kaundal	SD	[72]
255.	<i>Trigonella foenumgraecum</i> Linn.		Methi	SD	[22]
		Fabaceae			
256.	<i>Triumfetta bartramia</i> Linn.	Tiliaceae	Chikti	RT	[32]
257.	<i>Tussilago farfara</i> Linn.	Asteraceae	Fanjuim	LF, RT	[22]
258.	<i>Uraria lagopoides</i> DC	Fabaceae	Pithavana	PL	[32]
259.	<i>Uraria lagopodioides</i> Desv.	Fabaceae	Chintamoni	PL	[28]
260.	<i>Urena lobata</i> Linn.	Malvaceae	Bachata	LF	[22]
261.	<i>Urginea indica</i> Kunth.	Liliaceae	Jangli-pyaz	BU	[22]
262.	<i>Urtica dioica</i> Linn.	Urticaceae	Bichu	-	[22]
263.	<i>Viburnum foetidum</i> Wall.	Caprifoliaceae	Narvel	LF	[66]
264.	<i>Vicoa indica</i> (L.) DC.	Asteraceae	Banjhauri	RT	[73]
265.	<i>Viscum articulatum</i> Burm.f.	Viscaceae	Chettubadanika	ST	[33]
266.	<i>Vitex negundo</i> Linn.	Verbenaceae	Nirgundi	RT,ST	[33]
267.	<i>Vitex trifolia</i> Linn.	Verbenaceae	Pani-ki- sambhalu	FR	[22]
268.	<i>Withania somnifera</i> Dunal	Solanaceae	Asvgandh	PL	[33]
269.	<i>Ziziphora tenuior</i> Linn.	Labiatae	Mishkataramasha	SD	[22]
270.	<i>Zizyphus xylopyrus</i> (Retz.) Willd.	Rhamnaceae	Ghatoor	FR	[30]

Table 1: Herbal plants available in India as contraceptives

## Conclusion

Current interest in traditional medicine has led to the rapid development and studies of many herbal remedies employed for anti-fertility action. Novel information gathered from the current data is important in preserving folk indigenous knowledge as well as in the discovery of novel potential compounds with promising anti-fertility potential. Therefore, this review has been prepared to provide a new compilation of plants with specific use as anti-fertility agents. Moreover, this review has

incorporated latest data on new plant species which are not covered in previous reviews on anti-fertility agents.

## Future needs for this Area of Research

Majority of plants used as anti-fertility agents, have not been thoroughly experimentally studied on humans. Present data also lacks information on exact mechanism of action and toxic effects of tested extracts. However, this is clearly one area that needs further investigation as findings in animals need to be translated to humans in

order for a natural extract to be recommended for traditional use as anti-fertility agents. Therefore, significant research into the chemical and biological properties of such less explored plants is still needed to determine their anti-fertility efficacy and also will possibly define their exact mechanism of actions.

## Declare of Interest Statement

We declare that we have no conflict of interest. The authors alone are responsible for the content and writing of the paper.

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